STUDY ON MAINTENANCE PRACTICES CARRIED OUT IN THE SPINNING INDUSTRIES OF BANGLADESH.

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Study on Maintenance Practices Carried out in the Spinning Industries of Bangladesh

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APPROVAL

I hereby declare that the work which is being presented in this thesis entitled,

"Study on Maintenance Practices Carried out in the Spinning Industries of Bangladesh" is

Original work of my own has not been presented for a degree of any other university and all the resource of materials uses for this thesis has been acknowledged.

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DECLARATION

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ACKOWLEDGDEMENT

At the beginning, I praise the almighty Allah and his blessing who gave me enabling grace to opportunity to complete my Thesis work **"Study on Maintenance Practices Carried out in the Spinning Industries of Bangladesh"**

With sincerity I would like to Express deepest gratitude to my course teacher Prof.Dr.Md.Mahbubul Hague Head, Department of Textile Engineering, for his guidance, encouragement, and help during my thesis work at DIU.

Giving practical exposure to theoretical knowledge is important as it enhances ones concepts and that's the reason, why engineering student are advised to visit industries and relate their theoretical knowledge with industrial practices. As per Instruction I worked a good numbers of Textile spinning mills i.e. Akota composite mills Ltd, Joba Textile mills Ltd and Delta spinners Ltd. Mozaffar spinning mills Ltd etc.

This report covers following major topics:

a) Introduction to spinning operation.
b) Detailed maintenance strategy of spinning mill machinery.
c) Quality report on maintenance work of spinning machinery.

With sincerity, I extend my warm and deep appreciation also gratitude to my Supervisor Prof.Dr. Mahbubul Haque and co- Supervisor Md. Mashud Raihan Senior lecturer Department of Textile engineering Diu for their unreserved guidance and support to come up with this research work. The author deeply thanks to my family members Misses Shamim Ara & Sadir they will help me composing and supply desirable tea. Without their help it would not possible to complete the work. This report helped me a lot to boost my knowledge about plant maintenance. I cordially give thanks to Engr. Md. Aminul Islam (GM, Akota composite mills Ltd) and SK. Reza Mahmud Manager (Tech.) Joba textile mills Ltd. help me a lot by arranging an informative visit and sharing their valuable knowledge with me. And last, but not least, I thank to Md. Sadiur Rahman student of B.sc in FDT for typing various portion of this work, editorial input, proofreading & tolerance.

-The Author.

Abstract

Now-a- days the world is striving for achieving higher productivity with optimum quality assurance. Low material cost, Low manpower involvement, less time duration in the process, optimum utilization of resources increase productivity.

This study presents and over view for the implementing approach of different maintenance in spinning industries of Bangladesh. I have studied valuable Journals, books, booklets, and uploading relevant data in the websites for enrich my research work. The implementation of different maintenance program is suggested for improvement in the availability, performance efficiency and the quality rate, results improvement of the overall equipment effectiveness of the equipment's. The aim of this study is to suggest and implementation of different maintenance program in the Spinning industry.

In this project work, shown the case study on Carding engine, Simplex & Ring frame by changing setting & speed finding results. After implementation of Total Productive Maintenance (TPM) on model machine, both direct and indirect benefits such as less inventory, fewer break down and increase productivity. It can be obtained for equipment and employees respectively. This project work will be useful to senior level undergraduate and graduate students in Textile, mechanical and industrial engineering; maintenance and operations engineers.

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Chapter-1: INTRODUCTION

1.1 Research background

In the contemporary dynamic globalization world economy, manufacturing organizations are faced with stiff cut-throat competition. The global competition characterized by the rapid technological innovations and ever-changing market demands is putting enormous pressure on manufacturing organizations across the globe. The contemporary manufacturing organizations endeavor to achieve world-class performance through continuous improvement in the production system and development of world-class products and services, to satisfy the particular and rapidly changing customer requirements. The manufacturing sector globally has witnessed drastic changes in the later part of the twentieth century.

So Maintenance of machinery is a vital part of quality and production. Now what is maintenance and why is it performed? Past and current maintenance practices in both private and government sectors would imply that maintenance is the actions associated with equipment repair after it is broken. The dictionary defines maintenance as follows "the work of keeping something in proper condition; up keep'' this would imply that maintenance should be actions taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order. The effective integration of maintenance function with engineering and other manufacturing functions in the organization can help to save huge amounts of time, money and other useful resources.

1.2 Aims

The objective of this thesis is to study the effectiveness and implementation of the routine maintenance and Total productive Maintenance (TPM) program on cotton spinning mills and high light the contribution made by the strategies TPM initiatives in a typical Bangladesh Textile cotton spinning industry. [ref: Journal of quality in Maintenance Engineering-14]

Chapter- 2. LITERATURE REVIEW

2.1 Evolution of maintenance

Maintenance of spinning machineries:

In a spinning mill, the performance of the plant depends on the rehabilitee availability and maintainability of the plant, all of which are of primary importance for ensuring an excellent and affordable product. The concept of maintenance has changed substantially over the years; its main function is to prevent mechanical and quality breakdowns, does not mean that the quality of whole lot is low; but it means the lot is rejected due to poor quality of yarn on few bobbins or cones. Therefore to maintain excellent quality, plant engineers are capable of judging spindle to Spindle variations in ring frames, speed frames and winding and machine to machine variations in preparatory .But in order to discuss maintenance strategy of a spinning mills machineries it is important to define the processes and equipment's involved in execution of spinning first.[ref: maintenance management in spipping-1]

2.2. Descriptions Spinning Process

In textile product processing, fibers from bales of cotton or manmade fiber are converted into finished cloths. First step of textile product processing is spinning. Spinning is a process in which fibers from bales are drawn out and are twisted to form yarn. However this process commercially is defined in 3 steps:

- Drawing out Fibers.
- Twisting fibers to form yarns.
- Winding yarns onto bobbins.

2.2.1 Process Flow chart in spinning Operation:

A Typical spinning process involves a number of operations in different sections. Therefore

Basic process flow diagram of spinning mill with respect to sections is given below:

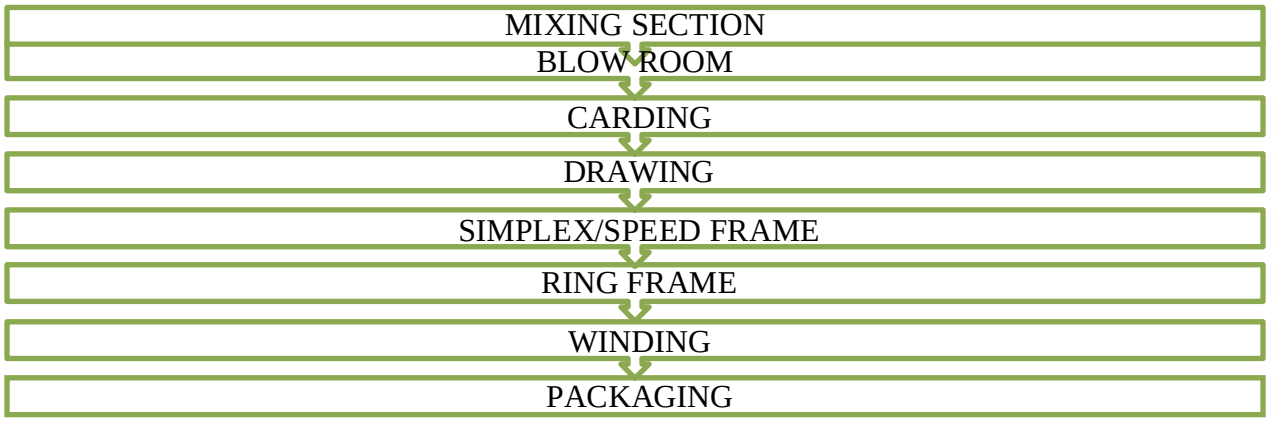


FIG.2.1. Process Flow Chart of Spinning

2.2.2 Mixing Section:

Mixing section is basically designed for the purpose of mixing different lots, because these lots are purchased from different regions and areas and contain different colors, shades and brightness ranges due to moisture, weather, packing condition and treatment during transportation. Mixing section serves as a cotton opener, cotton mixer and remover of any foreign particles like jute and pieces of cloth from cotton.

Fig: 2.2. Mixing Section

In case of bale lay down system it is not require to open the bales and make stack. In that case bales are to be arranged according to bale management system as per instructed by QC department. Following figure shows the bale lay down as per arrangement by quality of individual bales fiber:

Fig: 2.3. Bale lay down Mixing.

2.2.3. BLOW ROOM:

Blow room is the first step of yarn production process in spinning mills. In this step compressed bales are opened, cleaned and blending or mixing. The cleaning efficiency of blow room line is 40 to 70%.

Working Function of Blow room:

- Opening the compressed bales of fiber and making the cotton tuft a small size as far as possible.
- Detecting the metal objects and fire in fiber.
- Mixing and blending of different classes or grades of fibers.
- Cleaning the fiber by removing the dust, dirt, broken seeds etc. and other foreign materials from the fiber.
- Removing foreign fibers and plastic contaminations.
- Uniform feeding to the next step.

Basic Parameters for Blow room Line:

- Fiber type and micron are value.
- No of Opening Machine.
- Types of Beater.
- Beater Speed.
- Production Rate of Individual Machine.
- Size of the flocks in the feed.
- Type of grid and grid setting.
- Position of the machine in the sequence.
- Amount of Trash in the material.
- Relative Humidity and Temperature in the room.[ref: Manual of Cotton Spinning-17]

Machine used in a Blow room Line:

For Reiter	For Trutzschler	For Conventional
• Unifloc • Metal and Fire Detector • Uniclean • Unimix • Uniflex • Loptex	• BDT (Blendomat) • SP-EM • CL-P • MX-U • CL-C3 • SP-FP	• Automatic Bale Opener • Automatic Blender • Step Cleaner • AXI Flow Opener • Porcupine Opener • Hopper Feeder • Scutcher/chute card

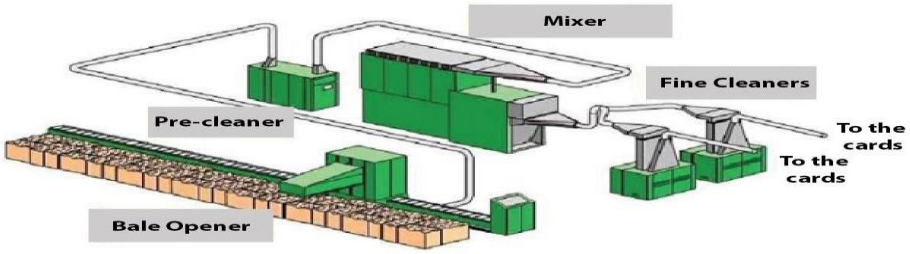
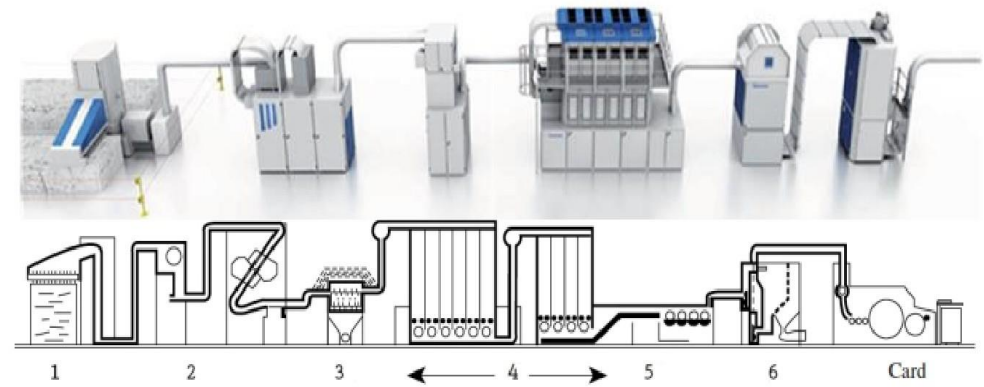


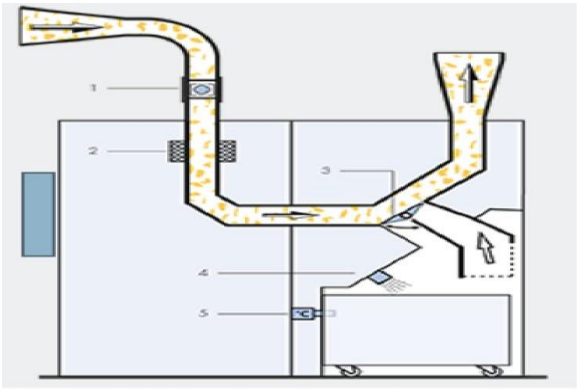
Fig1:2.4. Blow room line for Reiter



(1) automatic bale opener (2) condenser drum (3) beater/grid-bar -airflow system (4) multi-stack continious blender (5) multi-beater cleaner for intensive opening & cleaning (6) final dedusting step

Fig2:5. Blow room Line for Trutzschler

Working diagram of Blow room Machineries:



1) The rectangular dust is monitored by two spark detectors 2) The metal detector defects all types of metals 3) The extraction flap does not work with pre-tensioned springs, but is actively opened and closed 4) An extinguishing nozzle is installed at this point 5) A heat detector monitors the waste container

Fig: 2.5. Electronic Metal Separator (SP-EM)

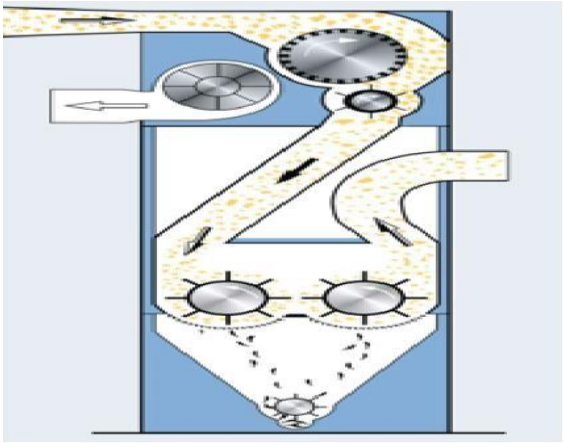


Fig: Pre-cleaner CL-P (Courtesy of Trützschler)

Fig: 2.6

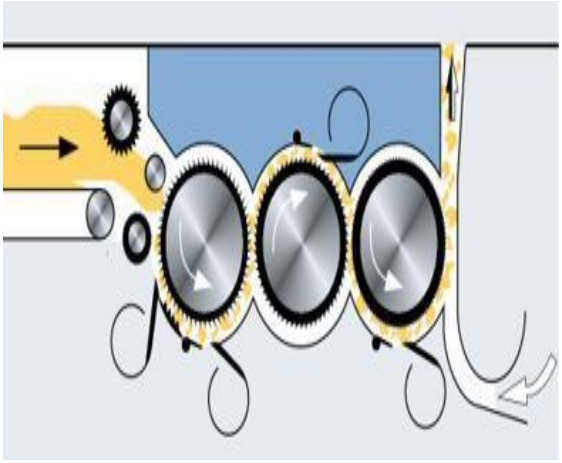


Fig: 2.7. Universal Mixer (MX-U)

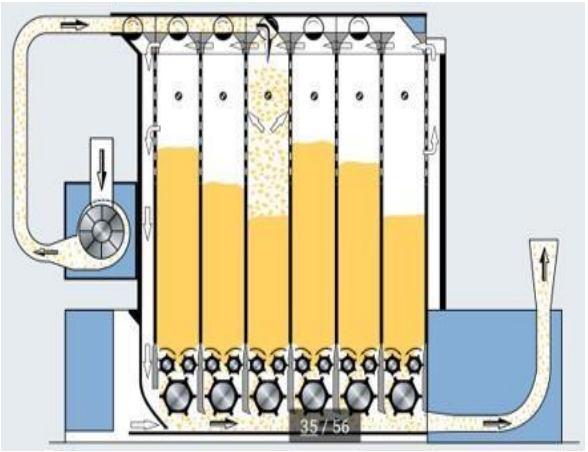


Fig: 2.8. Cleaner CL-C3

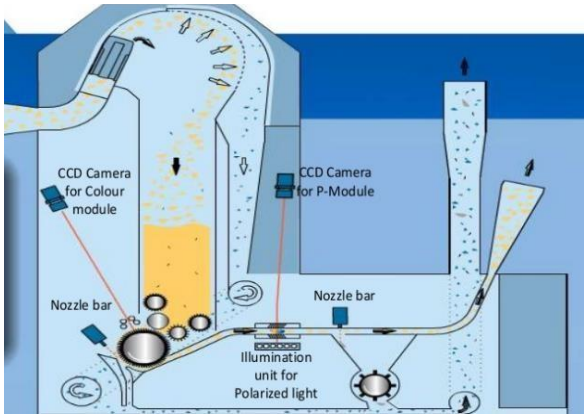


Fig: 2.9. Basic Variant SP-FP

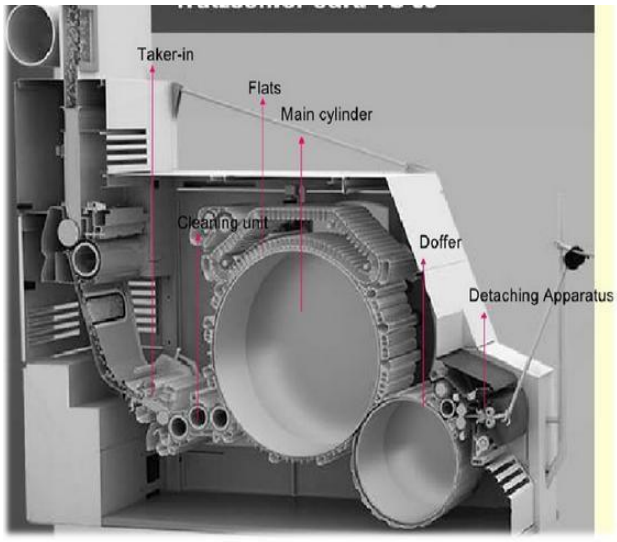
2.2.4. CARDING:

Carding is a process of spun yarns where the staple fiber is opened, aligned and formed into a continuous, untwisted strand.

Function of Carding Machine:

- Opening to individual fibers.
- Elimination of impurities.
- Elimination of dust and short fiber.
- Fiber blending, orientation and make parallel.
- Sliver formation.

Different Machine parts of Carding Machine:



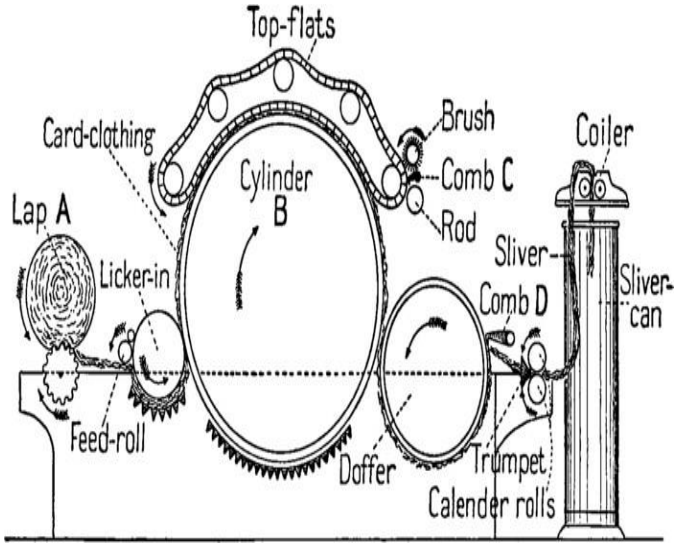


Fig: 2.10 Carding Machine parts of Lap feed.**Fig: 2.11** Carding Machine parts of Chute Feed.

Action in Carding Machine:

- **Combing action**: Combing action occurred between feed roller and taker in. Here the pin directions of two surfaces are the same. Combing is the straitening & paralleling of fibers & removal the short fiber, impurities by using a comb or combs which is assisted by roller & brushed.
- **Carding action**: Carding action takes place between flat and cylinder. Here direction of wire in two surfaces is opposite and moving direction are also opposite but flat moves slower and cylinder moves faster.
- **Stripping action**: Stripping action occurred between i) Taker in – Cylinder and ii) Doffer-Stripper. Here wire direction will be the same and roller moving direction also will be the same. One roller will be faster than another.
- **Doffing action**: This action happened between Cylinder & Doffer. In this place fiber is transferred from cylinder to doffer. Doffer speed is lower than cylinder and the lower speed doffer collect the fiber from cylinder & makes condensed web for formation of sliver.

Working principle of Carding Machine:

- Raw material supply through ducting pipe.
- Chute feed evenly compressed the fiber.
- Transport roller forwards the fiber to feed plate.
- Feed arrangement consists of feed roller & feed plate.
- Taker in opens the material to small flocks and passes to main cylinder.
- Mote knives, grid bars and carding segments eliminate a great portion of waste during material passes through the cylinder.
- Suction ducts carry away the waste.
- The main carding operation occurs between main cylinder and flats. Total 80 to 116 flats are moving attached with carding bars and 30 to 40 flats are always in action with cylinder.
- The Doffer combines the fiber into a web.
- The calendar roller calendars the web and forward to coiler of sliver form and finally the sliver accumulates in a can from coiler by moving of coiler as coiled form.

Fig: 2.12 Carding Machine

Model: Crosrol MK6, England

Fig: 2.13 Carding Machine

Model: Reiter C60, Switzerland

2.2.5 Drawing:

Drawing is a process in which different slivers from carding machines are combined together to produce single sliver by giving a particular draft. Normally 5 to 8 slivers are fed behind one drawing machine and get an end product in form of single sliver in cans or boxes. It is the process of increasing length per unit weight of sliver. It is mainly due to peripheral speed of the rollers. The draw frame's influence on quality, especially evenness, is highly important in yarn formation. If the draw frame is not properly adjusted, there are effects on yarn strength and elongation. Secondly a defect arising at the draw frame itself can exert an effect of significant proportions on the overall yarn formation process.

Fig:2.14 Draw frame Machine. (Breaker) SB D22, Switzerland

Fig:2.15 Draw frame (Finisher) Model: Reiter Model: Toyota DX 8, Japan

Function of Draw frame:

- Drafting.
- Equalizing.
- Parallelizing.
- Blending.
- Dust removal.

Objectives of Draw frame:

- Straightening of crimped and hooked fibers.
- Paralleling of fibers.
- To produce more uniform of sliver of definite wt. /yd.
- To reduce wt. /yd. of materials fed.
- To make perfect blending/mixing of the component fibers.

2.2.6 Simplex/Speed frame:

Simplex Machine for spinning process is individual machinery used for spinning process of Textile technology to transform the drawn sliver into roving. The main function of simplex machine is the attenuation of drawn sliver and insert small amount of twist to give required strength of roving. Finally, the twisted roving is wound on to bobbin. Simplex machine is used to the carded and combed yarn process but for the rotor spinning system this process can be eliminated.

Function of Simplex Machine:

- Drafting: The main task of the spinning machines to attenuation of the sliver to required count of the roving.
- Twisting: To hold it together, small amount of twist is inserted. The numbers of twist is very low.
- Winding: To easily transport the twisted roving, it winds onto the bobbin developed by textile machine manufacturers.

Main Parts of Simplex Machine and their function:

Following are the various parts and their functions of the Simplex Frame

Bottom steel fluted rollers:

The bottom rollers are made of steel and are mounted on a roller stand. These are positively driven by the main gear transmission. For better carrying of the material in a forward direction, these rollers are fluted into

1. Axial fluted
2. Spiral/inclined fluted
3. knurled fluted

Nowadays axial flutes are replaced by inclined flutes which result in better gripping of fibers as well as fewer wears of top rollers. Knurled flutings are on those rollers on which apron revolves.

Top rollers:

There are two parts of top rollers

1. Arber (top rollers without rubber cot)
2. Rubber cot

These are actually twin rollers having rubber cots for better gripping of fibers during drafting. Hardness of top rollers depends upon the type of material. Normally for cotton, less hardness is recommended as compared to polyester fiber. For polyester more hardness is better to avoid wear of the top rollers. Rollers are replaced after 15-20 years but rubber cots are replaced within 2 years. For better gripping, these rollers are ground after a certain period. So with the passage of time, the diameter of these rollers will be reduced and behind the limits, these can't be used. Hence old cots are replaced by new cots with the result of the reduction of top roller diameter, arm pressure will be reduced which will result in less/undrafted material. With the result of grinding, a surface of top rollers becomes rough. Hence on the processing of sensory fibers, rough roller surface result in wrapping effect. To overcome this problem a chemical treatment is required which will smooth the surface.

Aprons:

The upper aprons are short and made of synthetic rubber. The thickness of apron is about 1mm.Lower aprons are larger and made of same material as that of uppers. Aprons are used to support the material which is being drafted and ultimately to reduce the variation in the material i.e. material will be uneven. When a drafting force is applied, there is a chance of variation. So to reduce this variation, aprons are provided. In the main drafting, zone aprons are used for further control of the drawing sliver. In the zone, the number of fibers is less and they are given draft so that any floating fiber content would occur fabric defects and it has to be avoided.

Pressure Arm:

Pressure is implemented on main drafting roller to improve the nip contact and higher nip. Since a high drafting is taken place, the possibility to make slippages is somewhat high. This is avoided and prevented to avoid long-term variations in subsequent processes. The top rollers are well pressed on bottom rollers by applying pressure through pressure arm.

Cradle assembly:

Consists of

- Cradle
- Top apron
- Steal roller
- Spacer
- Cradle spring

It supports the material during drafting and reduces the variation due to drafting force. Spacer size changes the distance between the aprons (bottom &top). For coarse material, bigger size spacer is used. Change of spacer size affects the U%.

Flyer:

A flyer is used to wind up the roving on a bobbin and to impart twist into the roving revolving around the bobbin at a speed 700-1600 rpm. Flyer inserts twist. Each flyer rotation creates one turn in the roving. Twist per unit length of roving depends upon the delivery rate:

Dynamic flyers ensure excellent yarn quality and free of fluff accumulation and fiber chocking.

- Flyers are made from quality aluminum alloy, polished stainless steel tubes, and steel parts.
- Computer generated aerodynamic profile ensures minimum air turbulence and noise.
- To facilitate well twisted roving false twisters are specially designed and manufactured.
- Minimum vibrations in the flyer are kept by high precision balancing at all rated speeds.
- To maintain constant pressure, Pressers are made of heat treated special grade steel.
- Higher return on investment on flyers.

Condenser:

In Simplex machine two condensers are used in the drafting arrangement. The purpose of these condensers is to bring the fiber strands together. It is difficult to control, Spread fiber masses in the drafting zone and they cause unevenness. In Addition, a widely spread strands leaving the drafting arrangement leads to high fly levels and to high hairiness in the roving. The size of condensers should be selected according to the volume of the fiber sliver.

Top & bottom clearer:

Cleaning is one another important aspect of drafting zone. Since the high draft is given to the sliver, short fibers can immune from the main flow of fibers and then may wind on rollers it self If this process keeps happening the drafting capability of the rollers are effected through contact area and lose grip. Hence tow aprons are used to clean each and every roller during drafting. In this machine, two top and bottom clearers are also used for the cleaning purpose.

Bobbin Rail: The bobbin rail is moving up and down continuously so that the coils must be wound closely and parallel to one another to ensure that as much as a material is wound on the bobbin. Since the diameter of the packages increases with each layer, the length of the roving per coil also will increase. Therefore the speed of movement of bobbin rail must be reduced by a small amount after each completed layer

Fig:2.16. Simplex Machine. **Model:** TJFA458A, China

2.2.7 Ring Machine:

The Ring Spinning is the most widely used form of the spinning machine due to significant advantages in comparison with the new spinning processes. The ring spinning machine is used in the textile industry to simultaneously twist staple fibers into yarn and then wind it onto bobbins for storage. The yarn loop rotating rapidly about a fixed axis generates a surface referred to as “balloon”. Ring frame settings are chosen to reduce yarn hairiness and the risk of glazing or melting the fiber.

Fig: 2.17. Ring frame, Reiter

Fig: 2.18 Ring Frame, China

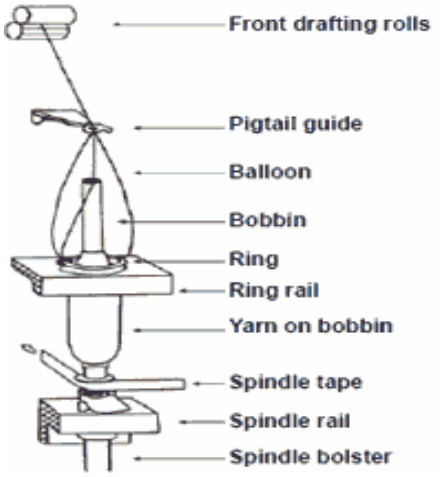


Fig: 2.19. Working feature of Ring Frame.

Basic Principles of Ring Machine:

Some basic principles of Ring Machine are as follows:-

- **Drafting Mechanism**

  To attenuate roving until the desired fineness is reached.

- **Consolidation (strength) Mechanism**

  To impart strength to the fiber by twisting it.

- **Winding and Package forming Mechanism**

  To wind up the resulting yarn in a package suitable for storage, transportation, and further processing.

Objectives of Ring Machine:

Following are the core objectives of Ring Machine:

- To draft the roving fed to the Ring spinning frame i.e. to convert roving into very fine strand called yarn.
- To impart strength to the yarn by inserting the necessary amount of twist.
- To collect twisted strand called yarn onto handy and transportable package by winding the twisted thread on a cylindrical bobbin or tube.

2.2.8 Winding Machine:

In Spinning process winding is the last step. After winding yarn packages are used for making woven or knitted fabrics. Winding process can be defined as the transfer of spinning yarn from one package to another large package (Cone, Cheese, Spool etc.)

On the other hand it can be defined as the transfer of yarn from Ring bobbin, hanks etc. into a convenient form of package containing considerable long length of yarn. A process of accumulating yarn on a package to facilitate the next process is called as winding.

Fig: 2.20. Manual winding machine

Fig: 2.21 Auto winding Machine Murata, Japan

Function of Winding Machine:

Winding process has some objectives which are given as below:

- To transfer yarn from spinning bobbin package to a convenient yarn package.
- To improve the quality of yarn
- To get suitable yarn package.
- To get better warp yarn.
- To empty the spinner's bobbin so that it can be used again.
- To remove dust and clean the yarn.
- To store the yarn
- To improve the efficiency of yarn for next process

2.2.9 Packaging:

Yarn packaging is a process, where the cone or cheese form yarn are packed by PP oven bag, Cartoon or any other suitable form for yarn marketing requirement. Packaging area has a conditioning system; this conditioning system is especially designed. Specially designed duct are used for conditioning of yarn. The yarn is conditioned up to 24 hours before packing. Enhanced conditioning of yarn increases the strength of yarn. The result is a product which is not only conditioned exceptionally but additionally it helps to decrease the wastage as well. [ref: Maintenance strategy of spinning mill-3]

Fig: 2.22. Yarn packaging of Cone form.

Chapter-3: METHODOLOGY

3.1 Aims of Maintenance program

An effective maintenance program has the following aims:

- ✓ To maintain equipment at the maximum operating speed and production efficiency.
- ✓ To ensure the best possible level of quality of the product.
- ✓ To minimize the idle time resulting from machinery breakdowns.
- ✓ To reduce to a minimum the cost of maintenance consistent with the above objectives.
- ✓ To introduce higher productivity of machines.
- ✓ To reduce and control wastages of several machines.
- ✓ To Economization of the process.[ref; maintenance engineering -12]

3.2 Proper Maintenance improves the quality and production:

Whether it is old or modern machine, maintenance has to be planned and directed in a systematic manner for its efficient functioning. There are also ever increasing economic pressures which compel a mill to use its high capital equipment to the fullest extent so that it can survive in the intensely competitive conditions of today. For this a proper maintenance is essential.

Not only good maintenance contributes to high productivity but it can also be considered to be at the heart of quality product. Neglect of maintenance and of timely replacement of components will prove several times expensive compared with the costs which a proper maintenance program entails, particularly, since, in some cases a very small amount of wear can cause a disproportionate effect .For example, to replace a worn top roller cot on a Ring frame will need about 15 taka .As against this, allowing it to run would cost the mill anywhere between Tk. 100 to Tk. 200 a month because of the deterioration in yarn quality.

The examples mentioned above are not merely hypothetical. They indeed, represent the extent of the scope indicated in some units. SITRA'S inter firm comparison studies on productivity and quality place the potential improvement attainable through proper maintenance as follows: [ref: maintenance management -1]

Productivity per spindle	**: 10%**
Yarn strength	**: 5%**
Machine utilization	**: 2%**

3.3 System of Maintenance:

There are two basic systems are involved in machinery maintenance:

1) Unplanned Maintenance.

2) Planned Maintenance.

3.3.1. Unplanned Maintenance: It means that people wait until equipment or machinery fails and repair it. In other way we can say "run it till breaks". It is sub divided into two types:

- **Emergency maintenance**: It is carried out as fast as possible in order to bring a failed machine or facility to a safe and operation efficient condition.
- **Break down Maintenance**: In this system, attention is given to a machine only when it breaks down.

Advantages of Unplanned maintenance:

- Low cost for the process.
- Less staff required.

3.3.2 Disadvantages of Unplanned maintenance:

- Increased cost due to unplanned downtime of equipment.
- Increased labor cost, especially if overtime is needed.
- Cost involved with repair or replacement of equipment.
- Possible secondary equipment or process damage from equipment failure.
- Inefficient use of staff resources.
- Equipment durability reduces.
- Quality of output degraded.

3.3.3 Planned Maintenance: The salient features of planned maintenance system may be stated below:

- Various maintenance operations are carried out according to a previously fixed plan.
- Attention is focused, not on major repairs, but on minor as well as periodical and conservation repairs aimed at controlling the condition of machine to prescribed standards.
- Primary emphasis is given to the prevention and retardation of wear and tear.

Planned maintenance confers many benefits such as longer machine life, fewer breakdowns, improved quality and higher productivity.

3.4. Different type of planned maintenance:

- Routine maintenance.
- Preventive maintenance.
- Predictive maintenance.
- Remedial maintenance.
- Restorative maintenance.
- Emergency maintenance.

3.4.1 Routine maintenance

Routine maintenance usually denotes those activities of maintenance which are bare minimum to ensure efficient working of machines. These activities have to be performed according to predetermined frequencies which are based on technical and quality consideration

Operations:-

Through cleaning of all points of a machine, minor adjustments and settings, wherever applicable; card grinding and setting; spindle and lappet gauging in spinning; buffing and re-covering of top roller cots and Maintenance of pneumatic and electrical equipment.

3.4.2. Preventive maintenance:

The preventive maintenance demands regular and systematic inspection of machines by skilled technicians and these inspections are made in accordance with planned schedules. The causes of wear to machine parts and assemblies are determined. In addition, all the key machine settings are checked for conformity to prescribed standards. Preventive maintenance is the area in which maintenance can affect the greatest savings in the overall manufacturing or operating costs.

Operations:- Machinery inspections and diagnostic checks at predetermined intervals of those parts which have a greater bearing on quality and production. e.g. Sensitivity of feed regulation unit in blow room ; licker-in and cylinder under casing contours; bite of comber nippers; rollers eccentricity; differential gearbox alignment; checking the tensions; alignments and profiles of top-arm drafting assembles, Apron-cots, ring and spindle-bolster replacement, card clothing replacement etc.

3.4.3. Predictive maintenance:

Routine maintenance and preventive maintenance need fact – finding activities to help in their planning. It is necessary and also useful to know what is happening to different parts of equipment under actual working conditions. Predictive maintenance helps in assessing the effectiveness of the routine and preventive maintenance program as reflected in actual machine performance.

Operations:-

Tests made while the machine is in operation; bearing failure tests with the aid of stethoscope or by feel or by noise levels; eccentricity measurements by dial gauge; roller slip by R.S.Meter and machine vibration by vibration Meter.

3.4.4 Remedial maintenance:

Remedial maintenance is not the rectification of minor defects considered under routine and preventive maintenance. It is mainly covers the study of failures and changing designs, materials or working conditions to avoid the repetition of these failures, increasing the capability of machines by changing or improving the designs so that they become fit to withstand increased loads and speeds.

Operations:-

Alterations (not of a major nature) to machinery design either to simplify maintenance or to improve working conditions .Provision of self-oil circulating systems; change of bush bearings to ball bearings; change of cast iron spur gears to steel helical gears; provision of positively driven top clearers to speed frames, draw frames etc.

3.4.5. Restorative Maintenance:

This type of maintenance calls for drastic changes in a machine such as replacement of major parts involving considerable amount of expense and time. The machine is completely dismantled and re- erected after replacing all worn parts and assemblies. As a result the efficiency and precision of the machine goes to almost to their original levels. Taking advantages of this general overhaul, the machines may also be modernized.

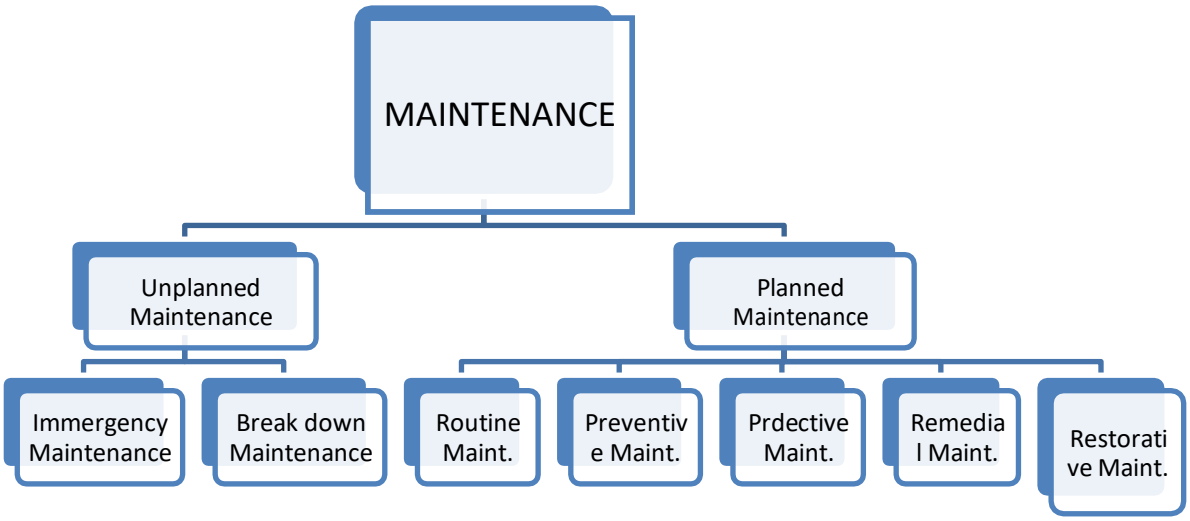
Operations: Overhauling and modernization.

3.4.6. Emergency Maintenance:

In a running machine breakdown may always occur unexpectedly and handling of such breakdowns is called emergency maintenance. The reporting of breakdowns, the rapid diagnosis of the failure, the speedy allocation of the task to specialized maintenance stuff, more particularly ensuring immediate availability of spare parts and quick attendance to the failure, all should be organized and planned to the greatest possible extent.

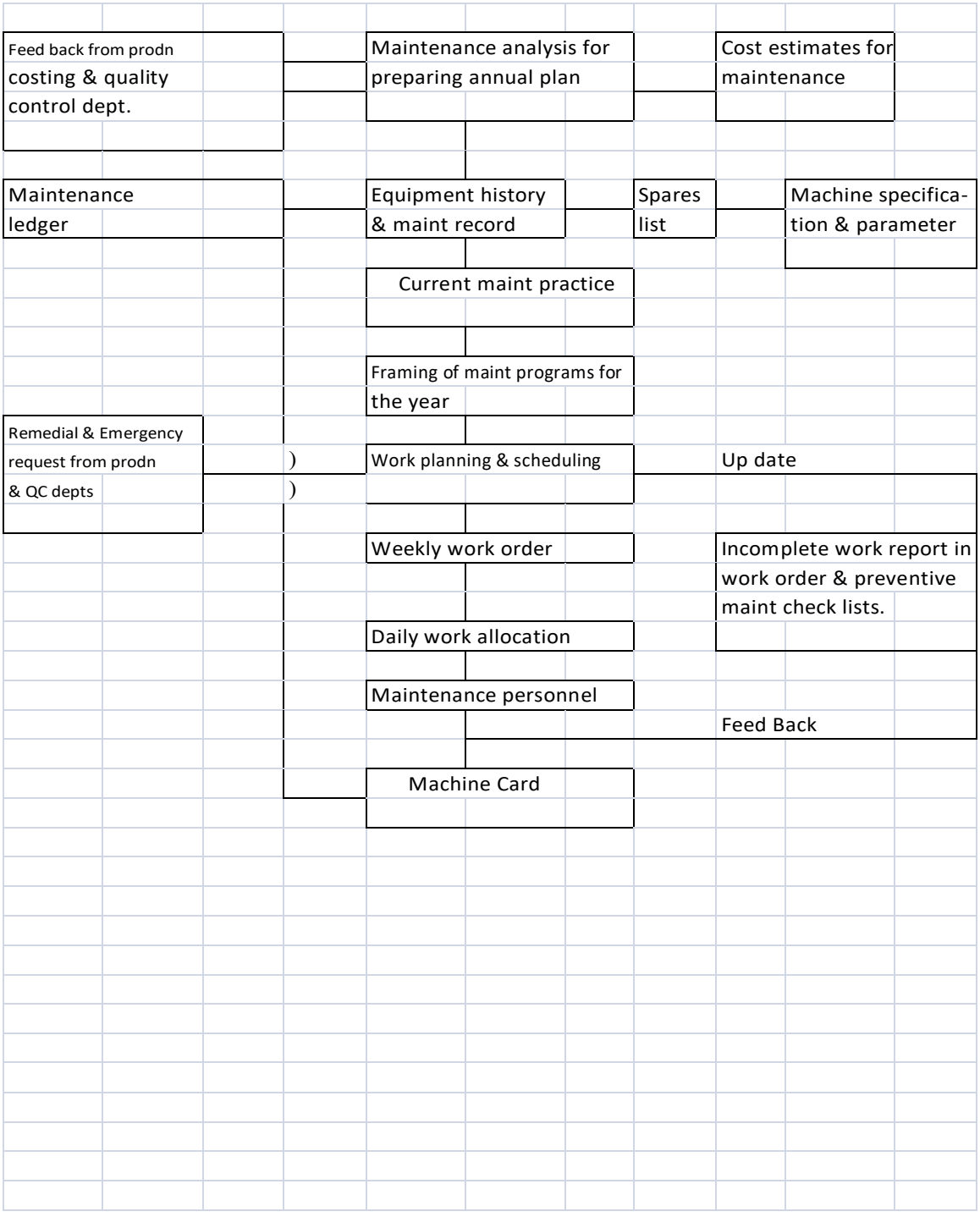
3.5 Operations: Attending to unforeseen breakdowns.

It will be noted that the majority of activities in a spinning mill belong to the first two categories, i.e. Routine and preventive maintenance. Restorative maintenance can be divided in two parts, i.e. overhauling and modernization. Overhauling of machinery is being done in a routine manner by almost of the mills, provided the routine and preventive maintenance, operations are performed systematically, the need for emergency maintenance will rarely arise.



[Different Type of Maintenance in Spinning Machineries. [Ref: Engineering Maintenance-12]

3.5.1. Operation Flow chart of Maintenance Program in Spinning Mill:



[Ref: maintenance management of spinning -1]

3.5.2. Minimization the Maintenance time and loss of production:

To minimize the maintenance period and loss of production by proper maintenance it is

Essential to follow the following system:

1. **Planning**
2. **Scheduling**
3. **Controlling**

1) Planning :

This exercise consists of the following steps:

- ✓ To make a list of all the points to which attention should be directed to keep them in order.
- ✓ To establish frequencies of various maintenance functions involved and review their adequacy periodically.
- ✓ To Lay-out the frequencies of the various operations over the plan period in such a manner as can be implemented with the available men and facilities.

2) Scheduling:

Whilst planning has defined the various maintenance tasks to be carried out on-each machine during the course of a year, scheduling is to get the right men and facilities at the right place and at the right time.

A well-devised and well operating planning and scheduling system will:

- ✓ Minimize delays arising from lack of co- ordination between production and maintenance schedules.
- ✓ Reduce loss of useful man-hours because of unnecessary walking time for procuring materials and tools.
- ✓ Co-ordinate multi-skilled jobs to optimize skill utilization consistent with minimum machine down-time.
- ✓ Reduce waiting time between jobs, so that operative idle time is minimized.
- ✓ Co-ordinate with SQC to ascertain the effectiveness of the maintenance operation and their adequacy.

3) Controlling:

All planning and scheduling, without effective controls and the means of enforcing them, would be useless and waste of time and effort. Whereas planning and scheduling are connected, respectively, with how a job is to be done.[ref: maintenance management-1]

The aim of maintenance control:

- To provide management with a tool that will disclose deviations from plans and schedules so that backlogs can be dealt with.
- To provide feedback information from preventive maintenance checklists and diagnostic reports signaling the need not only for remedial action, but also for reviewing the various schedules established in the annual plan.
- Information from quality control and costing departments will also form the supplementary sources of feedback.

3.6. Records and Forms of Maintenance Control:

- Maintenance ledger.
- Machine card.
- Job incomplete report.
- Breakdown record.
- Overtime engagement record.
- Monthly consumption of spares and lubricants record.
- Lubrication control chart.
- Overtime requisition form.
- Weekly work order form.
- Maintenance chart.

3.7 Maintenance Ledger:

Maintenance department is suggested that a maintenance ledger has to be kept, with a separate leaf opened for each machine. Upon finalization of the annual plan and work distribution tables for different weeks or months, details must be recorded in the ledger to show for each machine.

3.7.1. Model sheet for maintenance ledger:

Table 1: Model sheet for maintenance ledger.

Department	operation	Page no

- Ring Frame
  05 — i. General Cleaning
  10 — ii. Top Arm Pressure Checking
  15 — iii. Spindle & Lappet Gauge
  25 — iv. Cot Buffing
- Simplex …….. ……

3.7.2. Machine cards:

Machine card is a card where displayed the details of maintenance work to be carried out on it each week of the year. This procedure will bring any maintenance lapses to the direct attention of the maintenance in charge when he makes his routine rounds inside the department.

3.7.3. Model sheet: Machine Card for Speed Frame:

Machine No: 5 Next overhauling Due on…….

Make and year…….

Operation	Frequency	Done on	Due on
▪ Top roller cots buffing/greasing	6 month	5.12.2016	5.5.2017
▪ Top arm pressure checking	6 month	5.12.2016	5.5.2017
▪ Cots replacements	2 years	11.11.2016	11.11.2018
▪ Apron replacements	1 ½ year		
▪ Building motion setting			

Table 2: Model sheet: Machine card for Speed Frame.[ref:source,tex.mill-6]

3.7.4 Job Incomplete Report from work order forms:

A report on job incomplete may be prepared from the entries in the work order forms.

3.7.5. Break Down Record:

The Mills should maintain a machinery breakdown record to note down the break down in each department. This helps "the maintenance –in charge" to have close follow up on the performance of machines and to forecast the needs of spares in each department. This record should be submitted to the Manager on a periodical basis.

3.7.6. Overtime Engagement Record:

The management should be informed periodically by maintenance-in charge the man-hours engaged in each department as overtime with reasons thereof. This is possible only when a separate register is maintained by maintenance-in charge for recording the overtime engagement.

3.7.7. Spares and Lubricants Consumption record:

To maintain a control over the consumption of spares and lubricants, a record of the same should be maintained.

3.8. Maintenance Chart:

For each department, a chart may be prepared for a period ranging from 1 –12 month to cover the various maintenance operations based on planned schedule. By displaying the chart in the room of maintenance-in charge, it will be easy to follow up and execute the program as per schedule. [ref: maintenance management of spinning-1]

3.8.1 Model sheet: <u>Maintenance Chart of Ring Section</u>:

(**Table3:** Maintenance Chart of Ring Frame)

	x		0		*		#		x		0		*		#		x		0		
#		x		0		*		#		x		0		*		#		x		0	
	#		x		0		*		#		x		0		*		#		x		0
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*		#		@		x		0		*		#		x		0		*		#	
4	8	12		16	20		24		28		32		36		40		44		48		

* Top Arm Pressure Checking.[maintenance management-1]

\# Spindle and lappet gauging.
@ Spindle Oil Topping.
X Spindle Oil Replacement.
0 Cot Buffing

3.8.2 Mechanical down Time Report:

Mechanical Down time report is to be prepared and forwarded to manager after completion of the job on any breakdown. The report should contain all necessary particulars such as causes for breakdown, action taken, machine hours lost, spare parts used and cost etc.

3.8.2.1 Model sheet: - Mechanical down time report:

Department: Ring Shift fitter: Rahim

Machine No: 32 Supervisor: Jobber

Operator Card No: 1208 Man hour lost: 2 hrs.

Date	Time		Nature & Cause of repair	Spare Used	Qty	Cost
	Stopped	started				
03.02.2017	8:30 AM	10:30AM	Front Roller Needle Bearing LZ 2822 fault	Needle Bearing LZ2822	01 pc	Tk. 150

Table 4: Mechanical down time report.

Remarks: Should take more care of front roller needle bearing during routine maintenance checking period.

Date: 04.02.2017 Attended: Fitter Checked: Mr. Robin

Manager: Mr. Asad

[ref: Source of textile mill-6]

3.9. Basic Practice of Routine Maintenance of Spinning Machinery:

Department	Nature of Operations	Frequency (Days)		Remarks
		Min	Max	
Blow room	▪ General Cleaning with Oiling, Greasing	07	10	
Carding	▪ General Cleaning. ▪ Half setting. ▪ Full setting. ▪ Grinding-cylinder - doffer - Flat tops	07 10 30 - - -	10 15 45 180 180 180	
Draw frame	▪ General Cleaning, greasing with oiling. ▪ Top roller cot buffing. ▪ Top Roller Pressure checking.	07 30 60	10 60 90	
Speed Frame	▪ General Cleaning, greasing, oiling. ▪ Top roller cot buffing. ▪ Top Arm Pressure checking.	10 90 60	15 180 90	
Ring Frame	▪ General Cleaning, greasing, oiling. ▪ Top roller cot buffing. ▪ Top Arm Pressure checking. ▪ Spindle lappet gauge.	10 60 60 60 90	15 120 90 90 120	

Table.5: Basic of Routine Maintenance of Spinning Machinery.[maintenance management in spinning-1]

3.9.1 Routine Maintenance program – Blow Room Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	General Cleaning with greasing & Oiling.	01	Assistant. Fitter & Cleaner
02	Condition of beaters, inspection of gears, belts, bearing, shaft of machines involved.	15	Fitter, Assistant. Fitter, helper
03	Cleaning & Checking of dust filter fan, Motor, net etc.	01	Assistant .fitter, Cleaner

Table 6: Routine Maintenance program – Blow Room Machine.

3.9.2 Routine Maintenance program – Carding Machine (Semi High speed card):

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	General Cleaning with greasing & Oiling (Half setting)	1-2	Assistant. Fitter & Cleaner
02	Full Setting	4-6	Fitter , Assistant fitter, helper
03	Cleaning & Checking of dust filter fan, Motor, net etc.	01	Assistant. Fitter, Cleaner
04	Grinding- ▪ Cylinder & Doffer wire ▪ Flat Tops "Off" Machine	 24 (as required) 24 (as required)	 Fitter & Assistant. Fitter Do
05	Wire Replacement- ▪ Cylinder & Doffer ▪ Flat tops ▪ Taker in	2 ½ year (400-500 ton mtl processed) Do 1 ½ year (150-200 ton mtl processed)	 Fitter & Assistant. Fitter Do Do

Table 7: Routine Maintenance program – Carding Engine.

3.9.3 Routine Maintenance program – Comber Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ General Cleaning with greasing & Oiling.	02	Assistant. Fitter & Cleaner
02	▪ Detaching Roller & Top roller Cot Buffing.	12	Roller coverer
03	▪ Re needling of Top Combs.	24	Assistant. Fitter
04	▪ Over hauling.	5 years	Fitter, Assistant. Fitter, helpers

Table-8: Routine Maintenance program- Comber Machine

3.9.4 Routine Maintenance program – Drawing Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ General Cleaning with greasing & Oiling.	1-2	Assistant. Fitter & Cleaner
02	▪ Scanning Roller, T&G gauge checking	3-4	Fitter.
03	▪ Top roller Cot Buffing.	4-6	Roller coverer
04	▪ Top Roller cot replacement.	50 (as reqd.)	Do
05	▪ Top roller end bush replacement.	50 (as reqd.)	Fitter/Assistant. Fitter
06	▪ Over hauling.	2-3 years	Fitter, Assistant. Fitter, helpers

Table- 9: Routine Maintenance program- Drafting

3.9.5 Routine Maintenance program – Speed frame/Simplex Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ General Cleaning with greasing & Oiling.	2	Assistant. Fitter & Cleaner
02	▪ Top roller Cot Buffing & greasing.	12-15	Roller coverer
03	▪ Top Roller cot replacement.	2 years (as reqd.)	Do
04	▪ Top Arm pressure checking.	12	Fitter/Assistant. Fitter
05	▪ Top Apron replacement	1- 1.5 year	Do
06	▪ Bottom Apron replacement.	1.5 – 2 years	Do
07	▪ Over hauling.	4-5 years	Fitter, Assistant. Fitter, helpers

Table- 10: Routine Maintenance program- Simplex machine

3.9.6 Routine Maintenance program – Ring Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ General Cleaning with greasing & Oiling, Ring traveler change.	2	Assistant. Fitter & Cleaner
02	▪ Spindle & Lappet gauge.	12	Assistant. Fitter, Helpers
03	▪ Top roller Cot Buffing & greasing.	12-15	Roller coverer
04	▪ Top Roller cot replacement.	2 years (as reqd.)	Do
05	▪ Top Arm pressure checking.	12	Fitter/Assistant. Fitter
06	▪ Top Apron replacement	1- 1.5 year	Do
07	▪ Bottom Apron replacement.	1.5 – 2 years	Do
08	▪ Jockey pulley greasing.	24	Assistant. Fitter/Helper
09	▪ Spindle oil topping.	12	Do
10	▪ Spindle Oil replacement	24	Do
11	▪ Over hauling.	4-5 years	Fitter, Assistant Fitter, helpers

Table- 11: Routine maintenance program – Ring Frame.

3.9.7 Routine Maintenance program – Auto cone Machine:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ General Cleaning & greasing, opening of all m/c covers, cleaning with compressed air and washing with corium or Jet powder water as required.	1-2	Assistant. Fitter & Cleaner
02	Checking of- ✓ Condition of driving end of drum. ✓ Drum shaft bearing. ✓ Package adaptor alignment. ✓ Bobbin change mechanism etc.	15-24	Fitter, Assistant. Fitter
03	▪ Over hauling.	4-5 years	Fitter, Assistant Fitter, helpers

Table-12: Routine Maintenance program – Auto cone machine.

3.9.8 Routine Maintenance program – Electrical department:

Mills should take particular care for the proper maintenance of electrical parts of spinning machineries in order to ensure continuous working of electrical parts without breakdown at the rated speed and lower power consumption. A specimen system is as follows:

Sl. No	Name of Operation	Frequency in weeks	Category of Operatives
01	▪ Cleaning exterior parts of Motor, Terminal contacts and houses.	2-3 days	Electricians and helpers
02	▪ Cleaning of exterior parts of switches and switch gears.	1 weeks	Assistant. electrician, Helper
03	▪ Checking earth connection and Motor terminal.	1 week	Electrician, winder, helper
04	▪ Checking over heating of Bearings	1 week	Do
05	▪ Renewal of Oil or Grease.	12-18 weeks	Electrician, Helpers
06	▪ Greasing of Motor Bearings.	6 month-1 year	Motor winder.

Table- 13: Routine maintenance program - Electrical department.

3.9.9 Maintenance program of Humidification Plant in Spinning Mill:

Humidification plants have become a very essential part of a spinning unit. In order to obtain the ambient conditions in the department to get better operations of different machineries and better-quality yarn, it is essential to operate a humidification plant in a very efficient manner. Some of the necessary checks of Humidification plants which are done by Maintenance personnel are listed below: [ref;NASF,2000-13]

- Ensure whether rated air changes are achieved.
- Adjust the discharge air depending on the departmental requirement.
- Check air filter for its condition in order to avoid pressure loss.
- Keep air washers working at maximum efficiency by periodical cleaning of spray nozzles and eliminators plates.
- Avoid accumulation of dirt, lint, fluff and trash at air filters.
- Clean periodically dampers and ventilators.

3.10 Concept of Productive Maintenance and modern development of Spinning Machineries.

Now a day's market is very much competitive and for that reason – to maintain more better quality with increasing production and to reduce man-power cost, Hi-tech machines are using in most of the spinning mill and these Hi-tech machinery- parts in Blow room, Cards, Comber, Draw frame, Speed frame, Ring frame, Auto cone etc. are generally designed in a way different from the point of view of sophistication. Design features of these machineries are such that they are capable of producing yarns meeting international quality requirements with imported or indigenous raw material at higher level of productivity. Maintenance of these machineries is to be carried out based on "Selective Maintenance Program (SMP)."

3.11. "Selective Maintenance Program (SMP)":

The selective maintenance program (SMP) is to be formulated based on the specific needs of the machinery under consideration and also on the recommendation of the machinery manufacturers. Some of the design feature of modern spinning machines, which necessities the use of "SMP" are listed below:

i) Bearings are preheated and assembled with very close tolerances to have vibration free revolutions.

ii) Inverters and AC servomotors are used to control the speeds of machines with a finite number of steps.

iii) Microprocessors are used to-

- ✓ Set the machinery parts.
- ✓ Change the speeds.
- ✓ Clear the yarn to meet customers' requirements.
- ✓ Maintain humidity levels in department automatically &
- ✓ Monitor the quality of products.

iv) Lubrication of machinery is entrusted with automatic and centralized systems.

v) Droppings, micro dust and noel from the machines are collected with the help of automatic waste evacuation systems with preset timings for each function.

In case of modern or Hi-tech machinery the manufacturer normally supply instruction/technical manuals along with the machinery. These manuals contain all the relevant information pertaining to erection, operation and maintenance of machinery. This information could be used for guidance for framing "SMP". Most of the modern spinning machines have microprocessor controls, precisely designed/ set machinery parts and special drives like vireo speed, inverters etc. Maintenance of these machines calls for technical expertise of the persons involved. Almost all machinery manufacturers provide technical training to the mill personnel. These programs could be well utilized by the mills. On acquiring the necessary skills, the trained personnel would be able to chalk out a suitable maintenance program for the machine. [ref: application of TPM spinning mills-8]

3.12. Application of Total Productive Maintenance (TPM) in the Spinning Mill:

The concept of Total Productive Maintenance (TPM) has been introduced and developed by Japanese in 1971. This came in response to the maintenance and support problems in commercial factory. Textile industry is the second largest industry in the world next to agriculture. The effective utilization of manpower and resources in the manufacturing sector leads to low manufacturing cost, which is necessary for survival in present scenario. Total Productive Maintenance (TPM) is also a cost reduction tool used in industry particularly in spinning mills, where maintenance activities are key to the smooth running of the textile mill.

Practice of Maintenance function:

The industrial statistics shows the maintenance activities are carried out by conventional maintenance system. Six major loss areas in any plant are:

- Planned downtime loss.
- Unplanned downtime loss.
- Idling and minor stoppage.
- Slow down.
- Process non conformities.
- Scrap. .[ref: application of TPM spinning mills -8]

Maintenance Activity				
	Operator	Maintenance Dept.	Project	Sub Contractor
Routine Inspection	38%	62%		
Periodic inspection	5%	93%		2%
Minor Repair	1%	85%	4%	10%
Shutdown	2%	83%	4%	11%

Table 14: Traditional practice of maintenance functions:

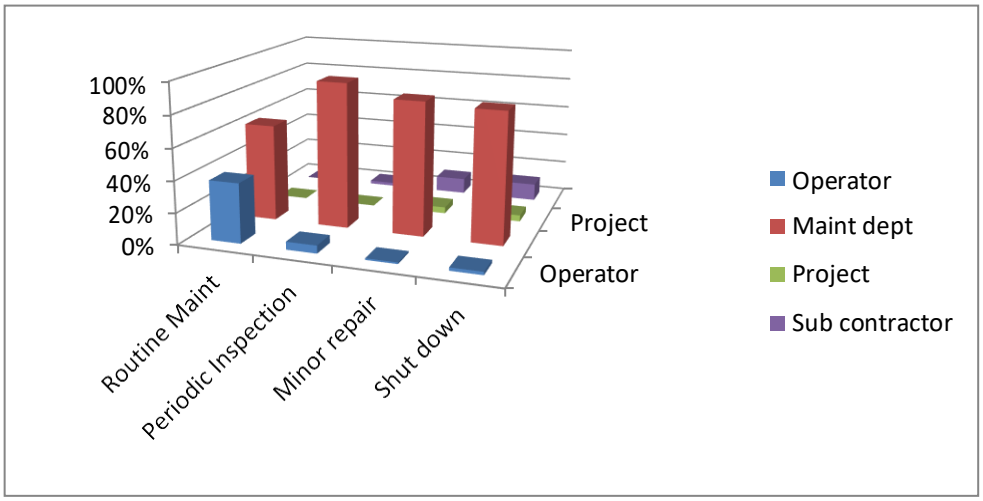


Fig: 3.2: Traditional practice of maintenance functions (related to table 14)

In traditional maintenance system, the loss will be more in the above aspects due to non-involvement of production people in basic maintenance activities, leading to frequent machine breakdown, efficiency and utilization loss. This ultimately results production loss and increases the manufacturing cost of the product. TPM – Total Productive Maintenance is a tool used to overcome all the above said difficulties in a cost-effective manner in any manufacturing process.

3.12.1 **TPM** – Definition:

TPM is a low-cost people intensive system for maximizing equipment effectiveness by involving entire company in a preventive maintenance program**.**

- **Total** –All-encompassing by maintenance, production individuals working together.
- **Productive** – Production of goods, services that meet or exceed customer's expectations.
- **Maintenance** – Keeping equipment, plant in a as good as or better than the original conditions at all times.

3.12.2 Objectives of TPM:

- Avoid wastage in a quickly changing economic environment.
- Producing goods without compromising product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods sent to the customers should be without defects.

3.12.3 Steps of TPM implementation:

Step 1 - Announcement by Management to all about TPM introduction in the organization.
Step 2 – Initial education and propaganda for TPM.
Step 3 – Setting up TPM and department committees.
Step 4 – Establishing the TPM working system and target.
Step 5 – A master plan for institutionalizing.

3.12.4. Barriers to implementing TPM in spinning industry:

Though Total Productive Maintenance is successfully implemented in more professionally managed engineering industries, the benefit of this concept is yet to be exploited in most of the spinning industry. There are some obvious barriers in this regard:

- Unskilled labor.
- Inadequate training facility.
- Lack of commitment.
- Heterogeneous stock of inventory.
- Lack of co -ordination between production and maintenance department.

3.13 : LUBRICATION ON SPINNING MACHINERY PARTS:

Lubrication is a major item of expenditure in the maintenance of machinery, and it also represents the most important factor in protection of machinery from wear, corrosion and possible failure.

Proper lubrication of machinery is of immense importance as majority of the problems stem out due to under lubrication of parts or wrong selection of lubricants. Though the lubrication is considered as one of the regular activities in the department, many times it is observed that there is no control on the details of this operation. In many instances, the oilers who are not instructed in detail regarding the parts which are to be lubricated, the frequency to be adopted and type of lubricants to be applied. Every machine manufacturer furnishes these instructions which should be displayed in proper form in local languages for day to day reference of oilers.

3.13.1 : Basic useable Lubricants of different section in Spinning Mill:

Sl No	Machines	Parts to be Lubricated	Nomenclature	Particulars of Lubricants	
				Viscosity in centistokes at 40^0c	Viscosity Index (VI)
01	Blow room & Combers	Gear box & PIV Units.	Heavy E.P.Oil	220±22	VI>90
02	Carding & Draw frame	Gear boxes	Light E.P.Oil	150±15	VI>90
03	Carding	Flat drive unit gear box	E.P. grease	(of the Oil base) 75 – 190	-
04	Draw frame & Combers	Top Roller end Bushes	Grease	(of the Oil base) 65 – 160	-
05	Speed Frame	Differential Gear box	Heavy Gear oil	100±10	VI>90
06	Blow room to Ring frames	Gear & Chains	Adhesive Oil	Minimum 110	VI>80
Sl No	Machines	Parts to be Lubricated	Nomenclature	Particular of Lubricants	
07	Draw frame to Ring Frame	Bottom roller Bearings	Grease	(of the Oil base) 65 – 160	-
08	Ring frame	Spindle bolster	Light spindle oil	10±1.0	VI>85
09	Cone winder	Drum shaft bearing	E.P. grease	(of the Oil base) 75 – 190	-
10	Auto cone	Tension assembly, Splicing, tail end Cutter. All greasing point	Dry Lubricant E.P. grease	 (of the Oil base) 75 – 190	- -

Table-15: Basic useable Lubricants of different Section in Spinning Mills. [Ref: source of Textile mills -6]

3.14. Maintenance Organization:

The systems and procedures of machine maintenance are described above, but a maintenance organization is essential for an effective maintenance program in a spinning mill. The organization chart shows the number of maintenance personnel required under various categories for mills of different sizes.

The maintenance in charge is fully responsible for all routine and preventive maintenance programs. The various maintenance staff in different departments such as M.O (Maintenance Officer), Engineer, Asst. engineer, Foreman, Head Fitter, Fitters, Asst. Fitters, and Cleaners etc. would be under his control. Visit of a Maintenance organization of 34,000 spindle modern spinning mill named "ABC Composite Mills Ltd. (Producing all carded cotton warp yarns.) Machineries of "ABC composite mills ltd." are as follows:

- Blow room & Card: Two line – one is Crosrol chute feed with 07 no's Crosrol card and another one is Lap feed with 12 no's Chinese card.
- Draw frame: Breaker – Reiter (02 sets of double delivery) and Finisher-Toyota Hara Dx8 (02 sets of double delivery.)
- Simplex: 07 no's (120 spindle each) of Jingwei, Chinese Make.
- Ring frame: 66 no's (516 spindle each) of Jingwei, Chinese make.
- Auto cone: 06 no's (60 drum each) of QPRO-Murata, Japan make.
- Humidification Plant: one is Chinese and another 04 no's Indian make
  Generator: 02 no's (900 KW each) of Waukesha, USA make.

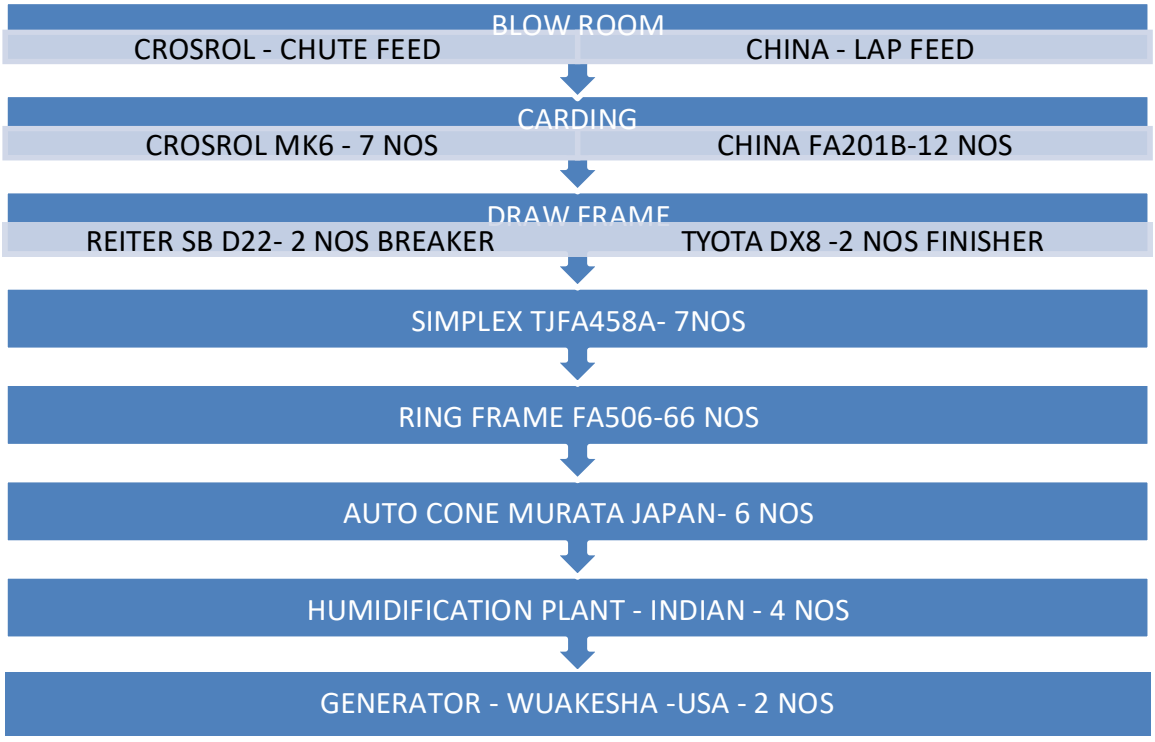
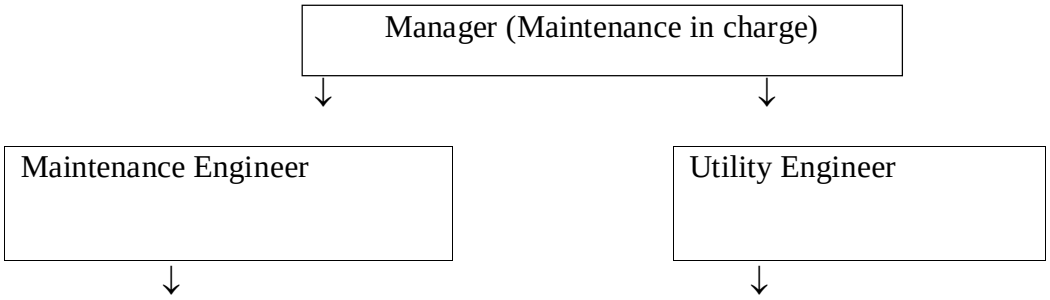


Fig: 3.3. Maintenance Organization of ABC Composite Mills Ltd.

3.14.1 Maintenance Manpower of "ABC Composite Mills Ltd":



B/R & Card: Foreman 01 Head fitter 01 Fitter 03 Asst. Fitter 02 Shift Fitter 03 Helper/Cleaner 03 **D/F & Simplex:** Foreman- 01 Head fitter – 01 Fitter- 01 Asst. Fitter – 02 Shift Fitter- 03 Helper/Cleaner- 03 **Ring Frame:** AMO/ Foreman- 01 Head fitter – 01 Sr. fitter - 01 Fitter- 02 Asst. Fitter – 03 Shift Fitter- 03 Helper/Cleaner- 15 **Auto cone:** AMO/ Foreman- 01 Fitter – 01 Asst. Fitter – 2 Shift Fitter- 03 Helper/Cleaner- 03	**Electrical dep't:** Foreman: 01 Head/ Sr. Electrician: 01 Electrician/ Asst. Electrician: 02 Motor Winder: 01 Electric Helper: 04 Shift attended: 03 **Humidification Plant:** Head fitter/ Sr. Fitter: 01 Shift operator: 03 Helper: 03 **Generator shift Operator**: 04

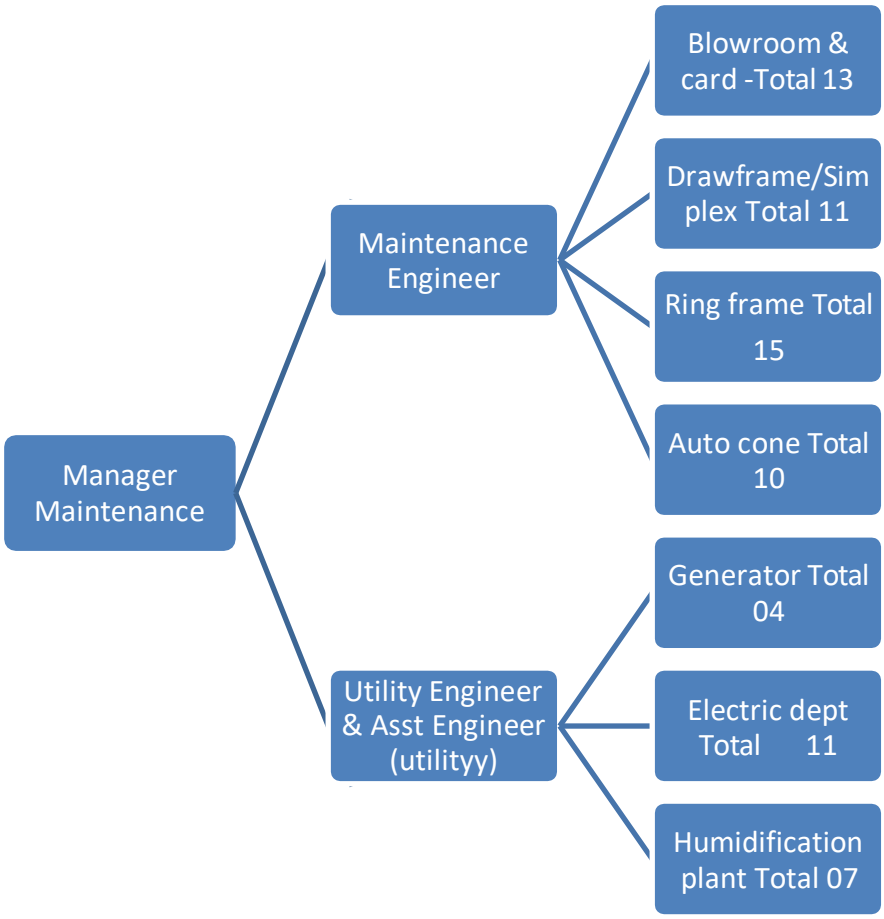


Fig: 3.4: Maintenance Manpower of ABC Composite Mills Limited:[ref.-6]

14.1.1 The ABC Composite mills ltd is following routine and preventive maintenance as per maintaining their monthly and yearly schedule.

To follow the proper maintenance schedule and done accordingly, the mentioned spinning mill is operating above ten years old machineries along with new machineries and obtaining satisfactory target production:

Following roles are served by maintenance department of ABC Composite Mills Limited in spinning machineries:

3.14.2 : Roles of Maintenance Department of ABC Composite Mills Limited:

- Objectives, based on the organizational objectives and preparation of standard maintenance procedures, maintenance schedules, lubrication charts etc.
- Preparation of maintenance charts for individual equipment and to train the maintenance personnel for their implementation.
- Coordination with the production department staff to ensure that a regular maintenance will be implemented without affecting important production schedules.

- Maintenance department carry out the scheduled preventive maintenance programs and ensure that plant is available for production for the maximum duration.
- Carry out the overhauling of the machinery at the scheduled time without fail.
- Calibration of various instruments installed at various points in the plants.
- Record keeping of maintenance activities.
- Keeping a watch on critical parts in inventory that could be required for any breakdown.
- To prepare maintenance budget in the start of each fiscal year.
- To adjust the different machines in the process according to the fiber processed.
- Preparation of policy statement for the maintenance department, which explains basic

3.14.3 Spinning Machinery Audit by Maintenance Personnel:

The job of "Machinery Audit" in different departments could be assigned to a group of a well experienced senior person in maintenance department. They are expected to give a searching look to the mechanical condition of the machinery. After machinery inspection, the Audit personnel are expected to submit a report to the Management on the various corrective actions to be taken in different departments with a view to improve the overall mechanical condition of the process machinery.

3.14.4 Advantages of the Machinery auditing system:

Introduction of "Machinery Auditing system" as a routine program with a frequency of once in a year results in the following advantages:

- ✓ Determination of the adequacy and the quality of regular maintenance carried out in the mills.
- ✓ Detection and correction of mechanical faults at the earliest opportunity.
- ✓ Identification of "rogue" machines both in terms of quality and production.
- ✓ Formulation of guidelines to determination the budgets on capital expenditure and programmed replacements.

3.14. Tools for Machinery Audit: In order to conduct the machinery audit in a systematic manner in a mill, the following tools are necessary:

- Maintenance records.
- Reports from QC departments.
- Production records.
- Preventive maintenance checklists.

3.14.6. Required Tools and Gauges in Spinning Machinery Maintenance work:

Department	Nature of Operation	Tools & Gauge required
Carding	✓ Cylinder & Doffer wire grinding. ✓ Setting between various points of card. ✓ Wire point sharpness inspection. ✓ Licker in setting.	✓ Travers wheel grinder. ✓ Leaf gauge. ✓ Microscope of card wire inspection. ✓ Pendulum gauge.
Draw frame	✓ Setting of draft Roller. ✓ Top roller pressure setting. ✓ Top roller eccentricity. ✓ Shore hardness of top roller cot.	✓ Flat solid gauge. ✓ Nanometer. ✓ Dial gauge. ✓ Shore hardness meter.
Department	Nature of Operation	Tools & Gauge required
Ring Frame	✓ Spindle centering. ✓ Cots shore hardness test. ✓ Top arm Pressure checking gauge. ✓ Lappet eye centering. ✓ Main draft zone setting. ✓ Lifting the spindle. ✓ Speed checking. ✓ Traveler clearer setting. ✓ Frame level checking.	✓ Fiber disc gauge. ✓ Hardness tester. ✓ Dial Indicator for top arm pressure check. ✓ Plum bob. ✓ Slide gauge, Calipers. ✓ Spindle wrench. ✓ Tachometer. ✓ Traveler clearer setting gauge ✓ Spirit level.
Auto Cones	✓ Setting the package weight compensation, yarn guide drum, package cradle, bobbing peg alignment, mechanical Slub catcher etc.	✓ Special gauge and tools supplied by machine manufacturer.
Electrical Department	✓ Servicing of Motor. • PLC and others circuit repairing.	✓ Micrometer (In and outside) ✓ Dial indicator. ✓ Volt-amp-ohm meter. ✓ Thermometer and level ammeter. • Heat gun.

Table-16: Required Tools& gauges in Spinning Machines maintenance work. [ref: source of textile mill-6]

3.14.7. Following Tools & Instrument are used in Maintenance & Quality Testing

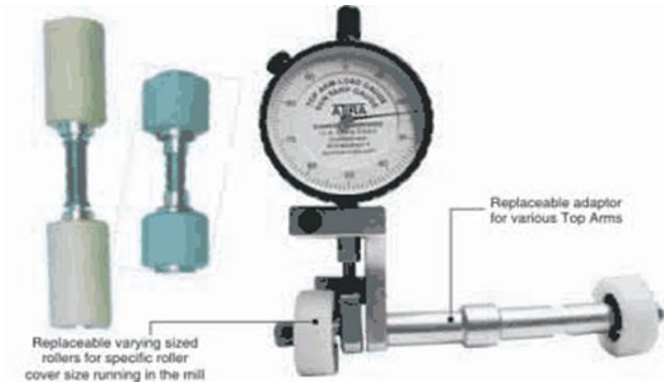


Fig: 3.5. Dial indicator for Top Arm pressure

Fig: 3.6. Top Roller cots shore hardness

tester. Measurement.

Fig: 3.7. Tachometer for speed/RPM measurement.

Fig: 3.8. Spirit level for leveling check.

Fig: 3.9. Leaf gauge for Card setting.

Fig: 3.10. Volt-amp-ohm meter.

Besides of above it is necessary in each department the following common tools:

Fig: 3.11. Common useable tools of spinning Machinery maintenance work.

Fig: 3.12.(Combination Tools (Spanners): Tightening and loosening of nuts & bolts.

Adjustable spanner/wrench: Tightening and loosening of Nuts and bolts. **Pliers:** Tightening and Loosening of Nuts and bolts

Fig: 3.13. Adjustable Spanner/wrench**.**

Fig: 3.14. Pliers.

File: For smoothing the surface of metal item.

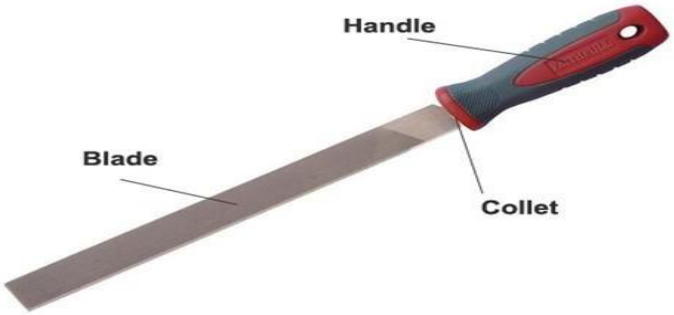


Fig: 3.15. File for smoothing the metal surf

Pipe wrench: Tightening and loosening of pipe joint.

Fig: 3.16. Pipe wrench.

- **Socket Ratchet**: Tightening of Nuts and bolts.

Fig: 3.17. Socket Ratchet.

- **Bearing puller:** To assist the opening of bearing from shaft.

Fig:3.18. Bearing Puller.

[ref: source of textile mill-6]

3.15 Synchronization of quality Control activities with Maintenance activities:

It is necessary to synchronies the activities of quality department with maintenance activities, so that the results of QC studies carried out on a particular machine are made available to the maintenance staff at the time when it is attended by them for various maintenance operations. This will enable the maintenance staff to take necessary corrective action on the machine in the light of the QC results available with them. The following general scheme is suggested to the mills which will enable them to get the necessary Co-ordination between QC and maintenance activities. It is noted that the following scheme does not cover all the activities of Quality control department but includes only those which need to be tied –up with maintenance activities:

Table-17: Synchronization of quality control activities with Maintenance activities:

Department	QC activities	Maintenance activities
▪ Blow room	1. Waste extraction and cleaning efficiency. 2. CV of one meter wrapping in case of lap feed line.	1. Before checking the basic settings. 2. Before periodic cleaning & alignment of condensers, cage, distribution etc.
▪ Carding	1. Full lap waste study in lap feed card. 2. Nep level in card sliver.	1. Before full setting of card. 2. Before and after grinding.
▪ Draw frame	1.Uster u% on all finisher deliveries 2. Sliver breakage rate. 3. CV of one meter wrapping.	1. Before periodic cleaning. 2. Before cot buffing. 3. Before checking the suction pressure.
▪ Speed frame	1. Roving evenness. 2. End breaks. 3. Eccentricity of fluted rollers	1. Before periodic cleaning and before checking the drafting system. 2. Before setting. 3. Before Over hauling.
▪ Ring frame	1. Yarn evenness with spectrogram. 2. End breaks. 3. Hairiness. 4. Classmate faults & Count variation.	1. Before drafting zone checking and before & after over hauling. 2. Before periodic cleaning with traveler change and before spindle gauge. 3. Before and after spindle gauging and Ring change. 4. Before Overhauling & resetting the machine.

3.16 Use of Computer for Maintenance of spinning machineries:

Now computers are being essentially used all over the world to control the various activities in business/industrial enterprises with the main activities of:

- Cost Control and
- Efficient time management.

Most of the modern spinning mills in Bangladesh are using computers for the activities connected with maintenance of machinery.
The major areas where computers can effectively use for machinery maintenance are as follows:

- To maintain record and schedule of:-

- ✓ Routine Maintenance and Lubrication of Machinery.
- ✓ Preventive Maintenance of machinery.
- ✓ Equipment History record.
- ✓ Machinery Audit.
- ✓ Inventory control.
- ✓ Calibration of instruments and devices
  And
- ✓ Work instructions.
- ✓ Budgetary control etc.

3.17. Cotton Quality Based Maintenance follows in ABC Composite Mills Limited:

Maintenance plan of ABC Composite Mills Limited also includes setting and adjustment of the machine depending upon the fiber to be processed. A cotton fiber is a peculiar object and has not truly fixed length, width, thickness, shape and cross-section. Such variations exist because of the large number of varieties in cultivation which not only differ widely in several key properties but also grown under divergent agro-climatic conditions. Besides inter-seasonal variations, the same variety displays variation at different locations and even in the same season. This is due to the fact that, apart from the genetic constitution of variety, the quality of cotton is influenced by various factors such as soil, climate, moisture levels of soil and atmosphere during crop growth, nutrient supply, pests, disease infestation, picking time and method, post-harvest handling. Hence, it is a known fact that cotton fiber characteristics vary from bale to bale. In order to process the cotton fiber in a spinning mill, the machines need adjustments like roller settings, gauge and speed settings in draw frames, speed frames and cards from time to time in order to optimize the process with respect to fiber.

3.17.1 Preventive/Routine Maintenance activity of ABC Composite Mills limited:

Preventive maintenance plan of ABC Composite Mills Limited defines type of maintenance, maintenance interval and expected down time for maintenance in form of charts for each department and machine. Following are department wise activity of preventive/Routine maintenance of ABC Composite Mills Limited spinning mill extracted from an internship report.

3.17.2. Routine Maintenance activity for Blow Room of ABC Composite mills Ltd:

Blow Room maintenance is stopped after 8 hours a day shift for maintenance, Maintenance is done by opening the covers and doors; a high velocity compressed air is blown into the machines. Air is blown in the waste zones and delivery zones like

- In bale opener/ pluckier - take up zone, fan zone, and ducts
- In mild opener - inlet zone, outlet zone and grid bar sections.
- In mixing machine - all cages for compartments, photocell regions, inlet zone, beater and grid bar zone, outlet zone.
- In fine cleaner - feed zone, beating zone, spikes of beater, photocell regions.

For good preventive maintenance, proper planning is developed, optimized plan for Blow room of ABC Composite Mills Ltd is:

Maintenance activity	Maintenance frequency	Require Time
▪ Cleaning by Compressed Air	Daily	Half hour.
▪ Schedule checking, repair and cleaning, lubricating	15 days	5-6 hour

Table-18: Routine Maintenance activity for Blow Room.

3.17.3. Routine Maintenance activity for Carding of ABC Composite Mills Ltd.

After the blow room in sequence is carding operation, following maintenance plan is followed for maintenance of equipment in carding department.

Maintenance Activity	Maintenance Frequency	Remarks
• General Cleaning by compressed air	Daily	1 hrs.
• Cleaning of Card (½ setting)	15 days	4-5 hrs.
• Doffer hand stripping	Daily	30 min
• Full cleaning with resetting	2 month	8 hrs.
• Flat hand stripping	As required	1 hrs.
• Taker in wire replacement	150 – 200 ton mtl processed	Done full cleaning
• Back stationary flat replaces.	Do	During Taker in wire replace
• Doffer, Cylinder & Flat wire replacement	400 ton mtl processed	
• Doffer, Cylinder and Flat wire grinding	As per requirement.	Condition based
• Front stationary Flat replace	400 ton	During cylinder wire replacement.
• Coiler Overhauling	3 month	During full setting
• Cleaning and bearing checking	3 month	Do

Table-19: Routine maintenance activity for Carding.

Fig:3.19. Cleaning work of Card

3.17.4 Routine Maintenance Activity of "ABC" Composite Mills Ltd.

The major areas of maintenance that are considered in draw frame machines are time to time oil change of the gear box, greasing activity of bearings at various drives in machine, setting points and calibrations. Following is maintenance plan for drawing in ABC Composite Mills Ltd:

Maintenance Activities	Frequency	Remarks
Cleaning by Compressed Air	8 hours	End of every shift
General cleaning & greasing	10 days	
Bottom Roller gauge checking	1 month	
Cot buffing & end bush greasing	1 month	
Top roller cot varnishing by thinner	Daily	As require
Maintenance Activities	Frequency	Remarks
All belt cleaning and tension checking	During cleaning	
All Stop motion checking	During cleaning	
Scanning Roller gauge checking	During general clg	
Bottom Roller bearing checking, greasing	2 month	
Gear box Oil change & Coiler cleaning	3 month	

Table-20: Routine maintenance activity for Drawing

Fig:3.20. Draw frame cleaning work

3.17.5. Routine Maintenance activity for Simplex.

Maintenance activity	Frequency	Remarks
General Cleaning, oiling & greasing: Bottom roller needle brg. grease, Top roller cleaning, Top bottom cone drum and belt setting, Greasing of Jack shaft, bobbin and spindle shaft, Flyer clg etc.	15 days	
Differential Gear box Oil Change	3 month	
.Top roller cot buffing & greasing	6 month	
Top & bottom apron change	1.5 year	
Top roller cot change	2 years	
Top bottom Apron washing	3 month	
Bottom roller setting & saddle gauge	6 month	
Over hauling	5 – 6 years	As require

Table- 21: Routine maintenance activity for Simplex

Fig: 3.21. General Cleaning of Simplex.

3.17.6. Routine Maintenance Activity for Ring frame of ABC Composite Mills Ltd:

Maintenance Activity	Frequency	Remarks
General cleaning, head stock greasing with Traveler change	15 days	
1st bottom roller needle bearing greasing	15 days	
2nd & 3rd bottom roller needle brg greasing	1 month	
Spindle & lappet, ring rail & height gauge checking	1 month	
Bottom apron centering	15 days	
Top & bottom apron washing	3 month	
Top roller cots buffing	3 month	
Top roller arbors greasing	6 month	
Main drive shaft bearing & jockey pulley greasing.	6 month	
Top bottom apron change	1.5 year	
Spindle oil topping	6 month	
Spindle oil replacement	6 month	
Head stock over hauling	6 month	
Ring change	2 years	
Spindle/bolster change	5-6 years	As require
Traveler clearer setting	3 month	
Over hauling	5 – 6 years	As require

Table- 22: Routine Maintenance activity for Ring frame.

Fig: 3.22. General Cleaning of Ring frame. **Fig: 3.23.** Ring frame over hauling & erection.

Fig: 3.24: Cot Buffing

Fig3.25: Cot mounting

Fig: 3.26. Fluted Roller Truing.

Fig: 3.27. Top Roller arbor greasing.

[Ref: Source of Different Textile Mills-6]

3.17.7 Routine Maintenance for Auto cone Machine of ABC Composite Mills Ltd:

Major Activity	Frequency	Remarks
▪ Unit Cleaning by compressed Air	Every 8 hrs	Each shift
▪ General Cleaning, checking & greasing-oiling of Cradle spring, Tension unit, splice unit,suction arm, BobbinMagazine, Bobbin peg of each unit.	1 month	
▪ Cradle bearing center, Air Damper greasing	6 month	
▪ Cradle spring – Silicon Oiling	1 month	
▪ Drum bearing greasing	2 years	As require
▪ Head stock blower box, Package conveyor, bobbin conveyor & over head cleaning, checking .	1 month	

Table- 23: Routinue Maintenance work for Auto Cone.

Fig: 3.28 Cleaning and maintenance work of Auto cone. [ref: source of textile mill-6]

While above charts show the type of maintenance and their frequency in general, below is the Schedule maintenance plan of ABC Composite Mills Limited developed for its spinning department for the month of November 2018. With strictly following the preventive & routine maintenance plan, Spinning Machineries efficiency of ABC Composite Mills limited are in satisfactory condition and to justify the matter shown below the yearly target and achieved production of mentioned spinning mill.

3.17.8. Target and achieved production report of "ABC Composite Mills Ltd" – year 2017:

Total No of Ring frame: **66** (each 516 spindles)

Total No of Spindle was in production: **34056 spindles.**

Count operated for the year 2017: 40s Ne & 50s Ne carded Cotton warp yarn

Month	Actual Count	Spindle allotted	Spindle RPM (Avg)	TPI	Target production (Ton)	Achieved production (Ton)	Achievement Percent %
Jan 17	41.5 51.5	10320 23736	15200 Do	27.24 32.00	212.056	203.211	95.80%
Feb 17	Do	Do	Do	Do	192.778	190.510	98.82%
March17	Do	Do	Do	Do	212.056	201.787	95.15%
April17	Do	Do	Do	Do	205.252	193.368	94.20%
May 17	Do	Do	Do	Do	205.252	197.459	96.20%
June17	Do	Do	Do	Do	205.252	204.436	99.60%
July17	Do	Do	Do	Do	177.810 'Eid holy 5	167.785	94.36%
Aug17	Do	Do	Do	Do	212.056	208.836	98.48%
Sep17	Do	Do	Do	Do	171.006 'Eid Holy 5	154.193	90.16%
Oct17	Do	Do	Do	Do	212.056	196.754	92.78%
Nov17	Do	Do	Do	Do	205.252	189.809	92.48%
Dec17	Do	Do	Do	Do	212.056	196.991	92.90%
Avg	-	-	-	-	-	-	**95.07%**

[ref: source of textile mill-6]

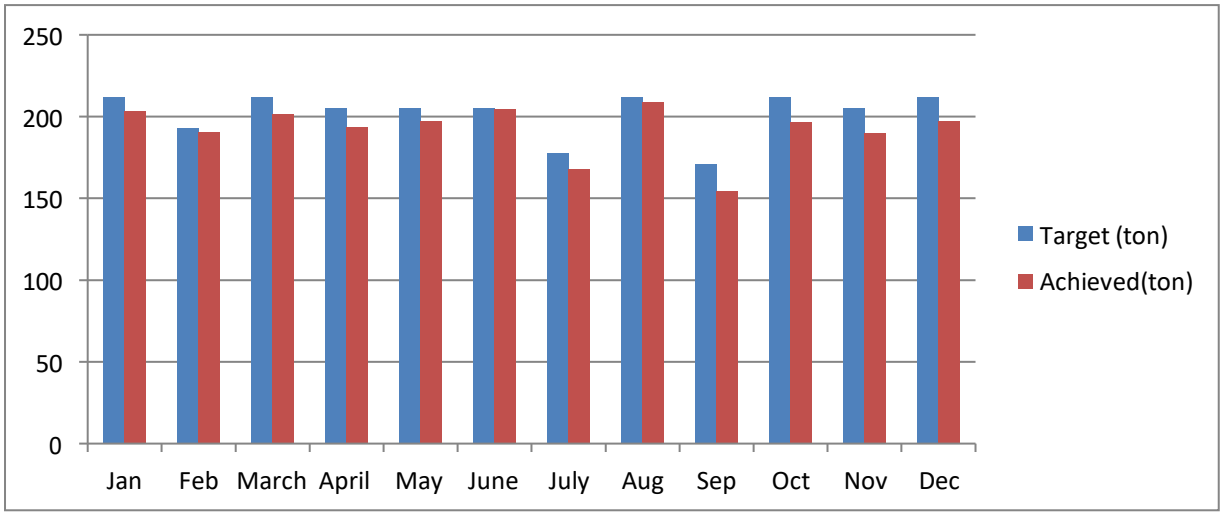


Fig: 3.29 Target and Achieved Production report of year 2017 (ABC Composite Mills.)

3.17.9 Views on Maintenance Plan of ABC Composite Mills Ltd:

ABC Composite Mills have a well-defined maintenance plan and maintenance activities associated with each component of each machinery and it helped me a lot to boost my practical knowledge of maintenance programs that are adapted by industries rather than just keeping our knowledge to books.

3.17.10 Recommendation for Maintenance development of ABC Composite Mills Ltd:

After observation the attached maintenance plan of ABC Composite Mills Ltd, which was developed for month of November 2018, it can be presumed that they have manual way of planning and executing maintenance activities, by using Microsoft Excel, despite of availability of advanced maintenance dedicated software knows as Computer-Managed Maintenance System (CMMS). Without CMMS, maintenance manager faces lots of problems regarding the analysis of feedback received from the maintenance department, and too much computer work burdens the maintenance manager and he gets little time to provide attention to the equipment and to the ongoing maintenance work. Likewise without an adequate information base, the manager is likely to take a wrong or a non-optimum decision, which may cost more to the company.

The primary objective of the maintenance management is to achieve the optimum balance between the plant availability and maintenance resource utilization. The effective matching of labor and material resources for maintenance planning and control is essential for industry to increase labor productivity, machine availability and overall equipment efficiency.

3.18. The following Testing equipment's are used in the project work for testing Sliver, Roving &Yarn:

1. Uster HVI 1000:

- Machine name-USTER HVI SPECTRUM
- Company-Zellweger USTER
- Country – Switzerland
- Software – USTER HVI 1000

Figure: 3.30. USTER HVI SPECTRUM

Functions of HVI:

The **USTER® HVI 1000** measures the most important cotton fiber properties for cotton classing purposes (and high-throughput requirements for spinning mills.) These are length, uniformity, short fiber index, micron ire, maturity index, strength, elongation, color and trash, and moisture content.

Main Equipment: Length/Strength, Moisture Content, micron ire and Color/Trash Instruments.

3.18.1 USTER AFIS PRO:

Machine no	02
Machine Name	USTER(R) AFIS PRO
Brand Name	Zellweger
Origin	USA
Model	Pro

Figure3.31: USTER(R) AFIS PRO

Function:

The function of this machine is to measure different information about cotton and sliver

Description:

The USTER(R) AFIS PRO comes with different modules e.g. NC module, L & M module and T module.

The NC module measures the following:

- Naps count per gram – nep Count/gram
- Nap size [micron] – nep size[µm]
- Seed coat nep count per gram – nep Count/gram
- Seed coat nep Size [micron] – SCN [µm]

The L & M module measures the following:

- Mean length by weight – L(w)
- Length variation by weight – L(w) CV%
- Upper Quartile length by weight – UQL(w)
- Short fiber content by weight – SFC(w)
- Mean length by number – L(n)
- Length variation by number – L(n) CV%
- 5%-Length by number – L(n) 5%
- Short fiber content by number – SFC(n)
- Fineness [militex] – FINE [mtex]
- Maturity ratio – MAT
- Immature fiber content [%] – IFC [%]

The T module measures the following:

- Dust count per gram – Dust Cnt/g
- Dust size [micron] – Dust size[µm]
- Trash count per gram – Trash Cnt/g
- Trash size [micron] – Trash [µm]
- Visible Foreign matter [%] – VFM [%]

3.18.2 USTER TESTER 5:

Machine no	03
Machine Name	USTER® TESTER 5
Company Name	USTER TECHNOLOGY AG
Origin	Switzerland
Model	S-400

Figure: 3.32.USTER® TESTER 5

Functions:

- Capacitive measurement of mass variations and imperfections in yarn, roving and
- Capacitive measurement of mass variations and imperfections in yarn, roving and sliver of staple fibers.
- Automatic check of all measured values, diagrams and spectrograms.
- Yarn classification based on the USTER
- **4. Lea strength tester:**

Machine no	04
Machine Name	Yarn Strength Tester(Lea)
Brand Name	Zweigle
Origin	Germany
Model	L-427

Figure: 3.33 Yarn Strength Tester (Lea)

Function: This machine is mainly used for measuring yarn strength.

3.18.3 Wrap reel:

Machine no		05
Machine Name		Wrap reel
Brand Name		Zweigle
Origin		Germany
Model	L-232	

Function: The main function of this machine is to prepare a lee for yarn count test

Figure: 3.34. Wrap reel

3.18.4 Wrap block:

Machine no	06
Machine Name	Wrap block
Brand Name	Zweigle
Origin	Germany
Model	L-202

Figure: 3.35. Wrap block

Function:

Use to measure the hank or count of preparatory process such as sliver, roving.

Ele. Wrap reel, Model MAG-Y0155, India

Figure: 3.36 ELe. Wrap reel XT

3.19: Effect of changing top arm pressure of drafting zone of speed frame on yarn quality

Keywords:

Roving, drafting zone, pressure arm, pressure disc, Speed Frame Toyota FL- 200

INTRODUCTION:

The action of reducing the thickness or linear density of the feed material by drawing is known as drafting. 4 over 4 drafting zone is very much popular in drafting arrangement of Speed Frame, where the draft ranges from 5 to 20, But, generally draft is around 8. Drafting zone is usually comprised of bottom fluted rollers and rubber coated pressure rollers. The top rollers must be pressed with relatively high force against the lower rollers to ensure guidance of fibers. (Klein, 1987) Practically, all manufacturers weigh the top rollers by spring pressure, 'Reiter' is an exception who prefer pneumatic weighting, and Platt Saco Lowell, who offer magnetic weighting in addition to spring weighting. In every weighting system, particular amount of load is applied on each top roller of drafting zone. There are some pressure disc which are colored with different color, Such as green, red, and Black. Each color represents particular amount of load.

MATERIALS AND METHODS

Fiber used

The property of the raw cotton determines the processing parameters of the spinning machinery and the quality of final yarn. However for the current experiment, we used the Shankar – 6 Indian fibers.

The HVI results for the fiber are given below:

Experimental Method:

Name of Fiber	Origin of Fiber	Test result On HVI	Remarks
Cotton (Shankar-6)	India	SCI-161 Mst(%) = 7.0 Mat = 0.87 UHML = 31.85 mm UI = 83.3% SF = 8.1% Strength = 35.7 g/tex Elongation = 4.5% Rd = 79.2 +b = 8.6 Tr. Area = 0.57% Tr. Cont. = 31	

Experimental Method:

During our experiment, we changed arm pressure and observed how the changes affect the quality of fibrous material.

Experimental setting of Pressure arm load:

Main specifications of Toyota FL – 200:

Number of spindles: maximum 144

Staff: 440 mm or 520 mm

Lift: 406 mm , Full-bobbin diameter: 152 mm

Draft system: 4-line, D-type, double apron (www.toyota-industries.com)

The top arm pressure and roller setting influence the yarn properties at all three drafting stages almost in similar way. With the increase of top arm pressure and roller setting the yarn tenacity increases initially up to a point and then decreases. Yarn unevenness, imperfections and hairiness shows an initial decrease up to a point with the increase of the above two parameters. In general, the moderate level of top arm pressure and roller setting gives better results. The roller weightings generally applied to the top rollers by weight hung below the roller beam are about 20 lbs. for a double boss front roller, 14 lbs. for middle roller and 10 lbs. for back roller, the middle and back rollers may be saddle weighted (spring weighted) and in this case the applied weight is about 20 lbs. Heavier weightings are helpful to deal with the occasional thick ends and piecing in the creeled material to make even material. (textileapex.blogspot.com).

Three types of pressures arm are available in Toyota FL – 200; they are Black, Green and Red. By changing pressure disc the pressures can be increased or decreased. Each color of pressure disc represents particular pressures which are shown below:

Pressure on the Rollers:

Roller	Black	Green	Red
Front r/r	9 Kg	12 Kg	15 Kg
2nd r/r	15 Kg	20 Kg	25 Kg
3rd r/r	10 Kg	15 Kg	20 kg
Back r/r	10 Kg	15 Kg	20 Kg

We did the experiment with three types of process setting:

Combination 1: Pressure Setting → B –B –B –B

Combination 2: Pressure Setting → G – G – G – G

Combination 3: Pressure Setting → R – R – R – R

Where

B = Black Pressure (Low Pressure)

G = Green Pressure (medium pressure)

R = Red Pressure (High Pressure)

Result of different setting:

B – B – B – B (low) pressure arm loads on drafting rollers (Combination 1).

Title	Cvm (%)	Thick (+50% km)	Thin (-40% km)	Sh	H	CSP
Front Row	16.02	345	370	1.64	6.65	1804.2
Back Row	16.38	397.5	467.5	1.73	6.75	1740.9

Table 24: Quality parameters of yarn obtained from front and back raw roving's by applying.

G – G – G – G (medium) pressure arm loads on drafting rollers (Combination 2).

Title	Cvm (%)	Thick (+50% km)	Thin (-40% km)	Sh	H	CSP
Front Row	15.64	337.50	260.00	1.68	6.75	2314.6
Back Row	15.64	327.5	212.5	1.78	7.19	2116.8

Table 25: Quality parameters of yarn obtained from front and back raw roving's by applying

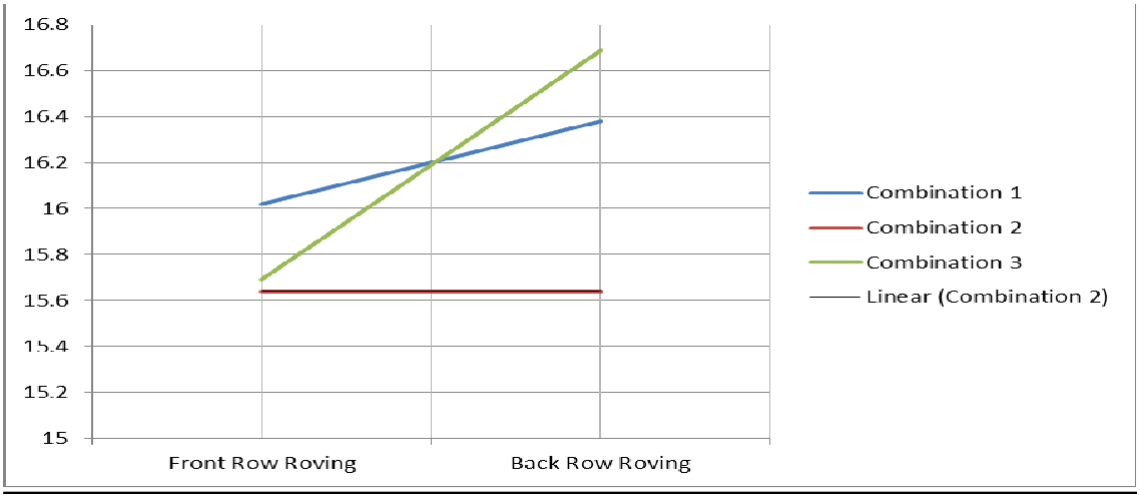
R – R – R – R (High) pressure arm loads on drafting rollers (Combination 3)

Title	Cvm (%)	Thick (+50% km)	Thin (-40% km)	Sh	H	CSP
Front Row	15.69	322.5	205	1.66	6.77	1894.2
Back Row	16.69	365.5	315	1.67	6.88	1764.2

Effect of pressure arm loads on yarn quality:

Graphical representation of results for different loads:

CVm%



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Chapter-4: DISCUSSION OF RESULTS.

Co- Ordination of 'Quality Control' with Maintenance department in Spinning Machineries.

The main objectives of a Systematic program of routine and preventive maintenance are to ensure a high quality of the products, free of defects and faults to achieve good working conditions

4. Case Study for improving quality by maintenance:

4.1 Case Study (i): Improvement of Sliver and yarn quality by setting card parameters.

The specification of the cotton which was used in the study is as follows:

Effective length (EL): 31 mm (MCU 5 – Indian cotton)

Bundle Strength (gm/tex): 29

Micron are: 4.2

Trash Content: 2.5%

Produced Sliver count (Finisher D/F): 0.13 (Ne)

Produced yarn Count: 30^{s}KW (Ne)

In this experiment, trial taken at carding by changing setting of Card delivery speed, and cylinder to flat gauge, respectively on Crosrol MK6.

Machine Parameters	Setting 1 (Existing)	Setting 2 (Trial setting)
Feed Roll Speed	9 rpm	9 rpm
Taker in speed	1000 rpm	1000 rpm
Cylinder speed	460 rpm	460 rpm
Flat Speed	254 mm/min	254 mm/min
Doffer speed	46 rpm	46 rpm
Draft	95	95
Delivery Speed	**130 m/min**	**120 m/min**

Table26: Card setting by increasing delivery speed.

Machine Parameters	Setting 1 (Existing)	Setting 2 (Trial setting)
Feed plate to feed Roller	0.15 mm	0.15 mm
Feed roller to Taker in	0.75 mm	0.75 mm
Taker in to mote knife	0.35 mm	0.35 mm
Taker in to under casing	1.00 mm	1.00 mm
Cylinder to taker in	0.2 mm	0.2 mm
Cylinder to bottom back plate	1.00 mm	1.00 mm
Cylinder to Flats	**0.35/0.25/0.25 mm**	**0.25/0.2/0.2 mm**
Cylinder to under casing	1.00 mm	1.00 mm
Cylinder to front top plate	1.00 mm	1.00 mm
Cylinder to doffer	0.15 mm	0.15 mm

Table 27: Card setting by changing cylinder to flat gauge.

Sliver Quality Improvement by card setting change:

Effect of sliver quality→		Naps (ct/gm)	Seed coat Naps (ct/gm)	Dust (ct/gm)	Trash (ct/gm)
3	Setting 1	114	22	106	14
4	Setting 2	82	10	58	10
5	% Improvement	28	54.5	45.2	28.42

Table28: Effect of card setting on sliver quality and improvement.

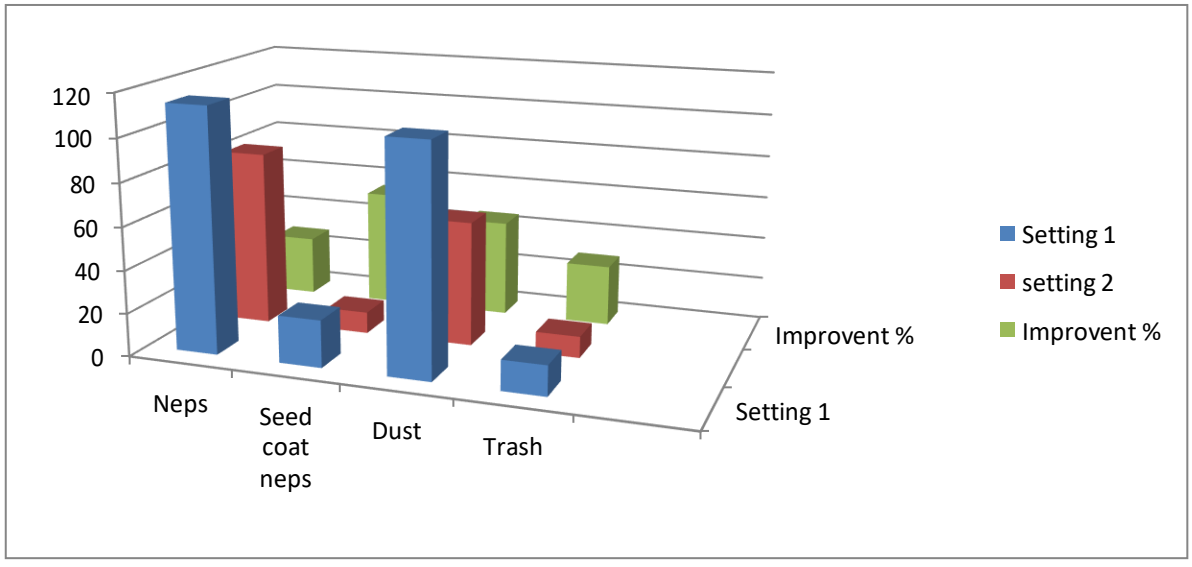

Fig: 4.1: Effect of card setting on sliver quality and improvement (Related to Table 28)

Yarn quality improvement by card setting change:

Yarn properties→		U%	Count CV%	Index	Thin (-50%)	Thick (+50%)	Neps (200%)	Total IPI	Hairiness
3	Setting 1	12.6	1.4	1.86	5	120	150	275	5.8
4	Setting 2	11.26	1.3	1.59	2	75	100	177	4.5
5	%Improvement	10.8	5.7	27.5				35.6	22.4

Table29: Effect of card setting on yarn quality and improvement.

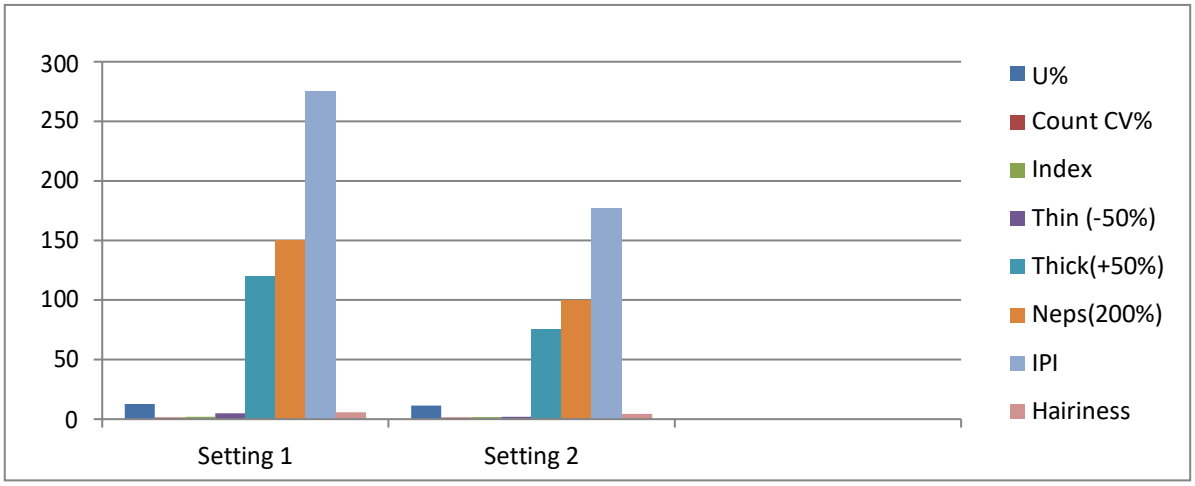

Fig: 4.2. Effect of card setting on yarn quality and improvement. (Related to Table 29)

4.1.2 A Chinese (Jingwei) Ring frame fitted with a top arm drafting system was found to produce 40^s count (Ne) carded cotton yarn with a following high level of unevenness and imperfections. Inspection the condition of the Ring frame revealed that –

i) The top arm pressure is insufficient than requirement.
ii) There is a gap more than required between spacer and nose bar.
iii) The distance between roller nip and the apron nip varies between in different arms.
iv) Incorrect positioning of the nose bar in different roller stands of the Ring frame.

After rectification of these defects by doing proper maintenance, the yarn samples were again tested and the yarn quality was found to improve significantly.

The yarn quality before and after corrective measures is given in below

Particulars	Before correction	After correction
Yarn evenness (U%)	16	13.80
Imperfections:		
✓ Neps (200%)	1000	500
✓ Thick (+50%)	500	250
✓ Thin (-50%)	250	100

Table 30: Improvement of yarn quality by maintenance work.

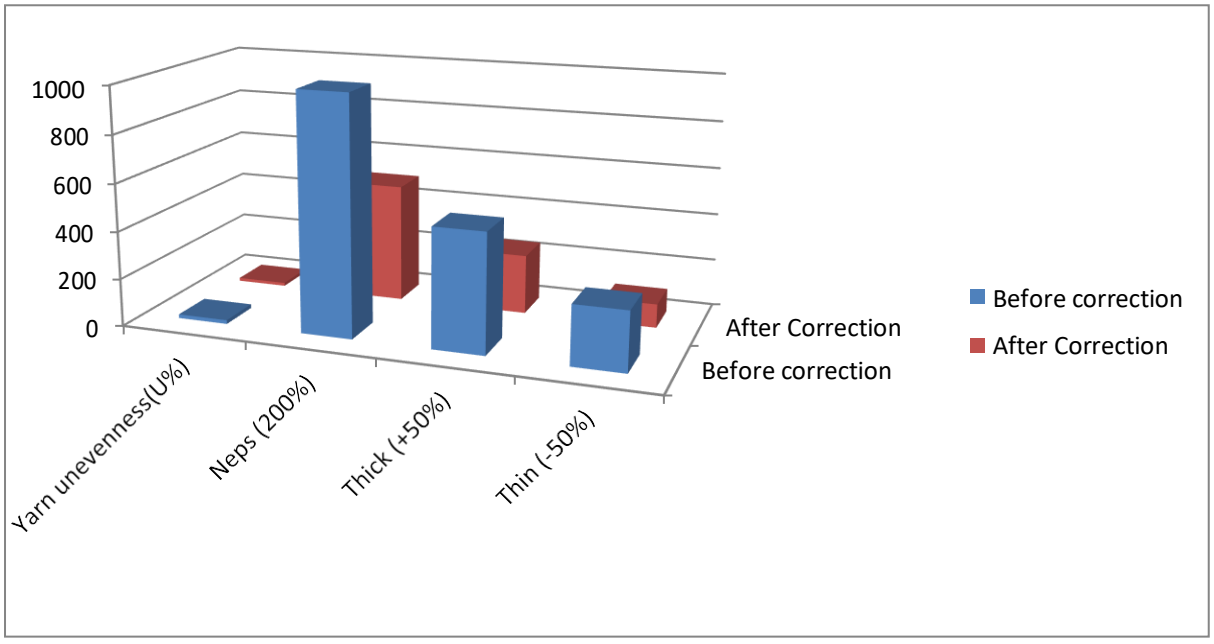

Fig: 4.3. Improvement of yarn quality by maintenance work [Related to Table 30]

4.2 LAB REPORT:

Testing Report of Carding, Drawing, Simplex & Ring Frame taken from

JABA TEXTILE MILLS LIMITED. Brahmondi- Narsingdi.

The Specification of Raw Cotton which was used in the study is as follows:

S-6 (Sankar-6) Indian Cotton.

Micron are=4.2(AVG)

Effective Length (EL) =29.58(M.M)

Bundle Strength (BS) = 31.5 (g/Tex)

Carding

Carding is the heart of spinning. There is Proverb' good carding good yarn'.

In This experiment, trial taken at carding before and after maintenance.
Ritter-C-60

M/C Model=C-60, Made in Switzerland **C/D=1**

Effect of Sliver quality	Before	After	Remarks
U% CVm% CV 1m% CV 3m%	2.49 3.13 1.25 0. 71	2.39 3.10 1.15 0.70	HK=0.925

Table: 31. Carding Sliver Test

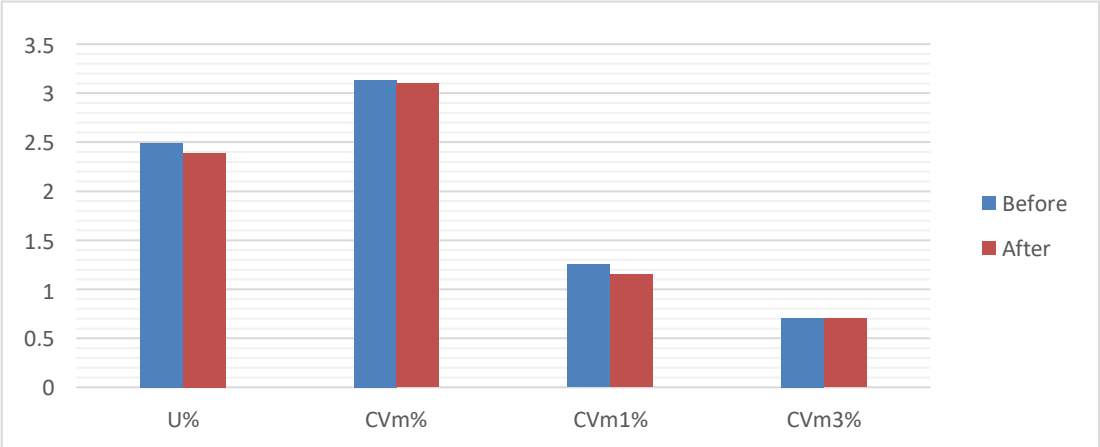

Fig: 4.2.1 Carding Sliver Test

Figure shown the improvement of card setting

Setting:

Feed Roller to Li-in=40 Thou

Li-in to Cylinder=10Thou Flat to cylinder

Front=10 [8] improve, Middle=11[8] improve, Back=12[9] improve

Cylinder to Doffer =10 Thou

Breaker Drawing

In This experiment, trial taken at Breaker Drawing before and after maintenance.

Ritter-B/D- 20

M/C Model=B/D-20, Made in Switzerland **B/D=1**

Effect of Sliver quality	Before	After	Remarks
U%	2.77	2.65	HK=0.104
CVm%	3.55	3.45	
CV 1m%	1.07	1.02	
CVm 3m%	0. 87	0.75	

Table: 32 Draw Sliver Test (i)

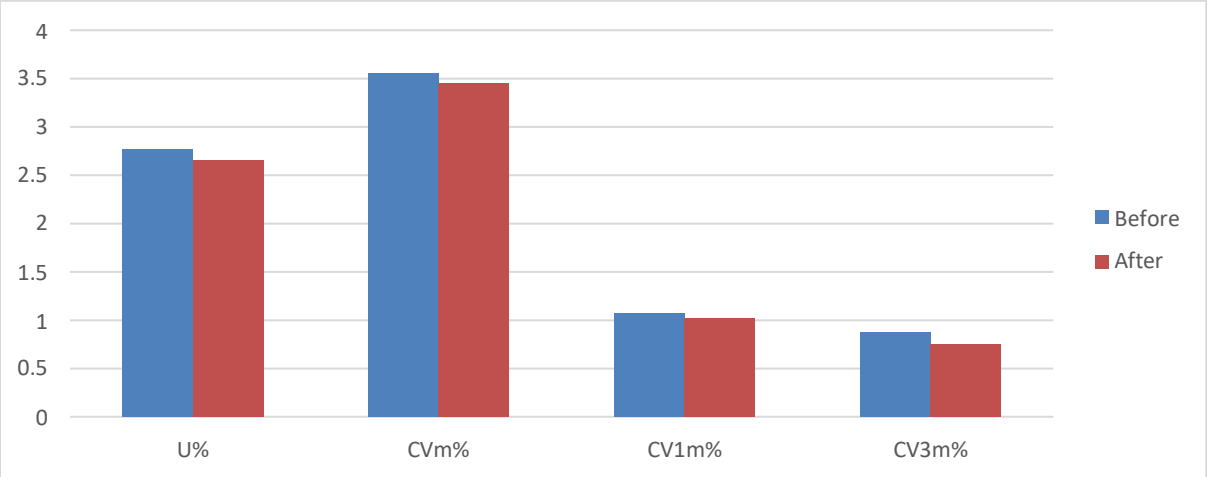

Fig: 4.2.2 Draw Sliver Test (i)

Finisher Drawing

In This experiment, trial taken at Finisher Drawing before and after maintenance Ritter -20

M/C Model=F/D-22, Made in Switzerland **F/D=1**

Effect of Sliver quality	Before	After	Remarks
U%	2.64	2.60	HK=0.104
CVm%	3.30	3.24	
CV 1m%	0.54	0.50	
CV 3m%	0.36	0.32	

Table: 33 Draw Sliver Test (ii)

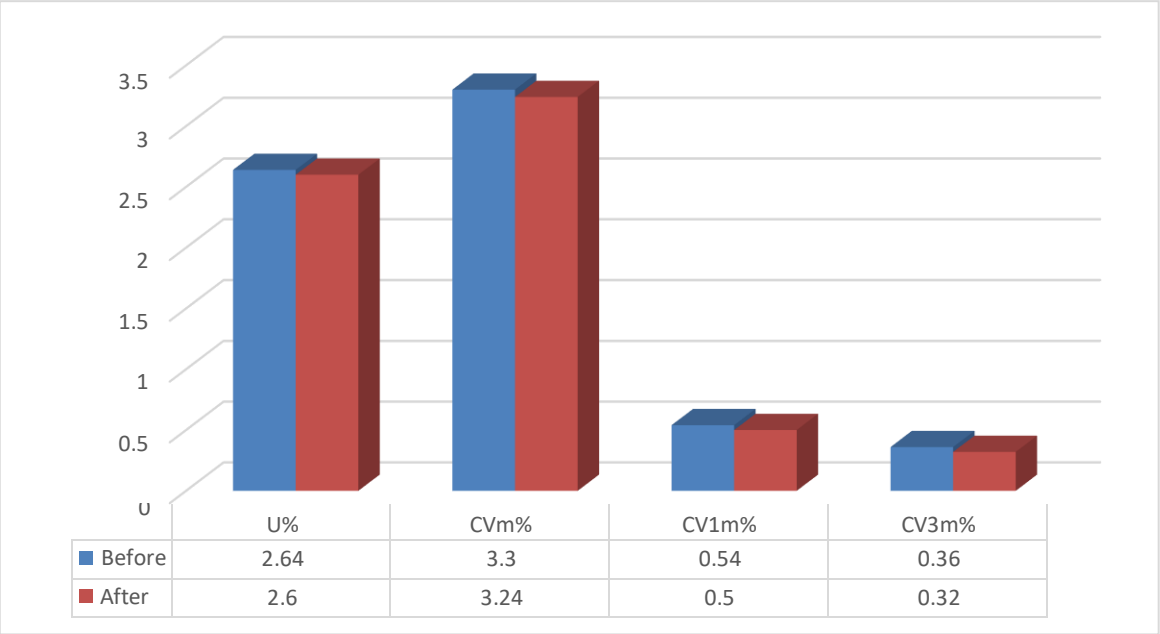

Fig: 4.2.3 Draw Sliver Test (ii)

Drafting System ¾
Setting
Front zone -38m.m
Back zone- 42m.m

Simplex

(i) Check gauging points & pressure (ii)Clean cot rollers by Corium-Z-97Multipurpose cleaner or Speedol-s-97 Cleaning solution industrial chemical Multipurpose Cleaner .

In This experiment, trial taken at Simplex before and after maintenance, MARZOLI -FT-6

M/C Model= FT-6, Made in Italia. **S/F-01** **Process: 05% Mélange**

Effect of Sliver quality	Before	After	Remarks
U%	4.91	4.85	HK=0.74
CVm%	6.18	6.12	
CV 1m%	1.90	1.83	
CV 3m%	1.02	1.00	

Table: 34 Roving Testing

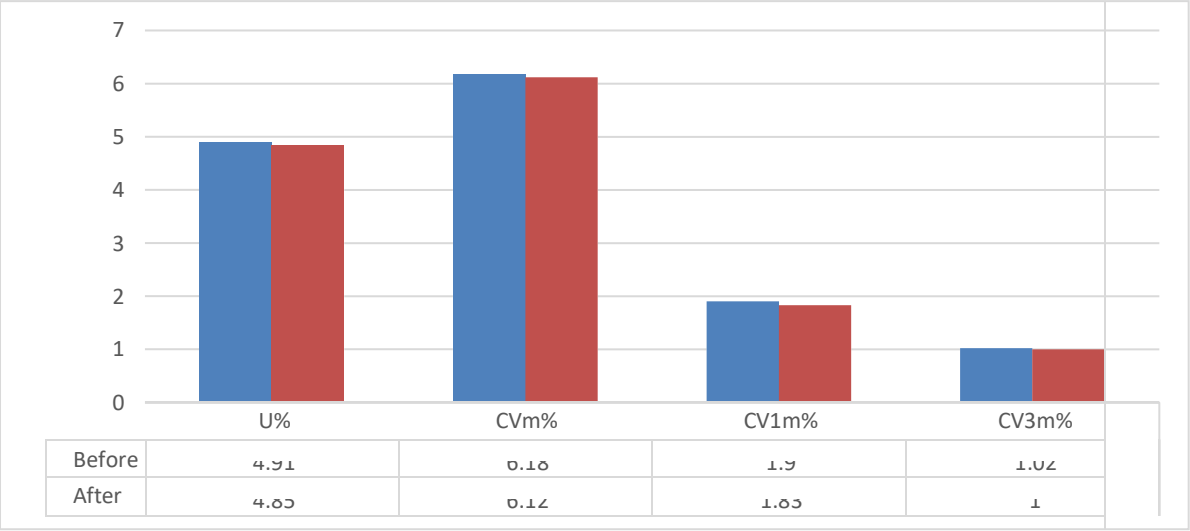

Fig: 4.2.4 Roving Testing

Drafting System 4/4, SKF PK 5035-125947(4Cylinder)

Setting

Front zone- 40m .m

Middle zone-48m.m

Back zone-70m.m

4.2.1 : Trial Experiment of Ring Frame before and after Correction/Maintenance.

Ring Frame

Grey mélange or mélange yarn is a blend of different colored fibers to develop various shades in the yarn.

M/C Model= Laxmi, LR 60/A. Made in India **Count -26/1 GM.**

Particulars	Before	After	Remarks
U%	12.89	12.38	
Neps (200%)	499.5	368.8	
Thick (+50%)	361.3	309.5	
Thin (-50%)	20.8	5.5	

Table: 35 Ring Frame Yarn Testing

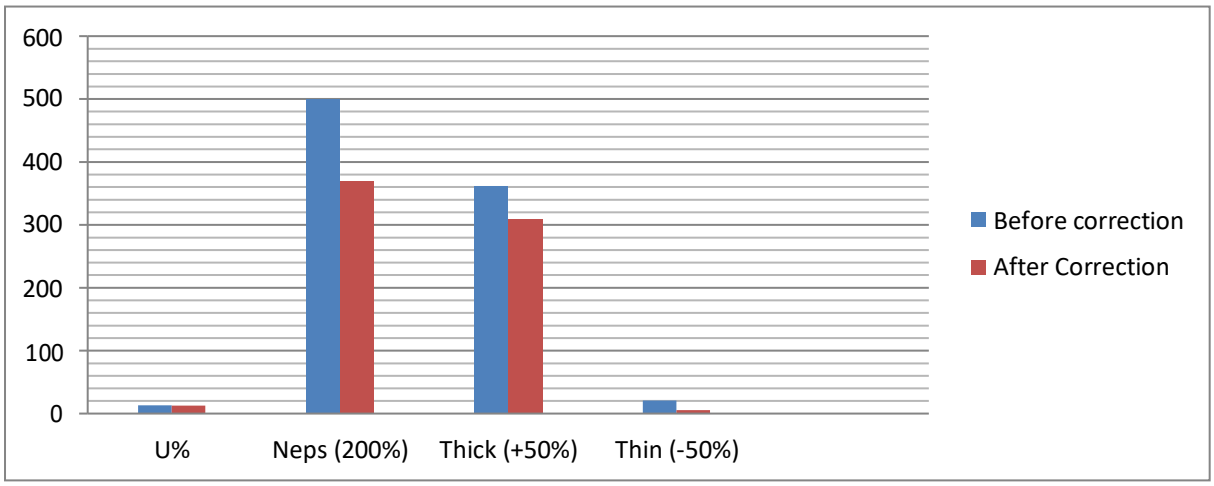

Fig: 4.2.5 Ring Frame Yarn Testing

Improve Setting for Mélange & Fancy yarn

Drafting system 3/3, P 3/1

Setting

Front zone – 42.5m.m

Back zone- 65m.m

Spindle to Spindle Gauge -70m.m

Spindle head to lapped hook (Olon gauge)-45-50m.m

Ring Traveler clearer gauge -2m.m

Inject: Inject yarn is a specialized fancy yarn and it is made up of two different materials & used two Roving separately in the drafting zone. The effect done by back roller speed variations in the certain length.

M/C Model= Laxmi, LR 60/A. Made in India **Count -28/1 Inject**

Particulars	Before	After	Remarks
U%	15.74	14.18	
Neps (200%)	807.3	472.5	
Thick (+50%)	1078	703	
Thin (-50%)	224.8	36	

Table: 36 Ring Frame Yarn Testing(inject)

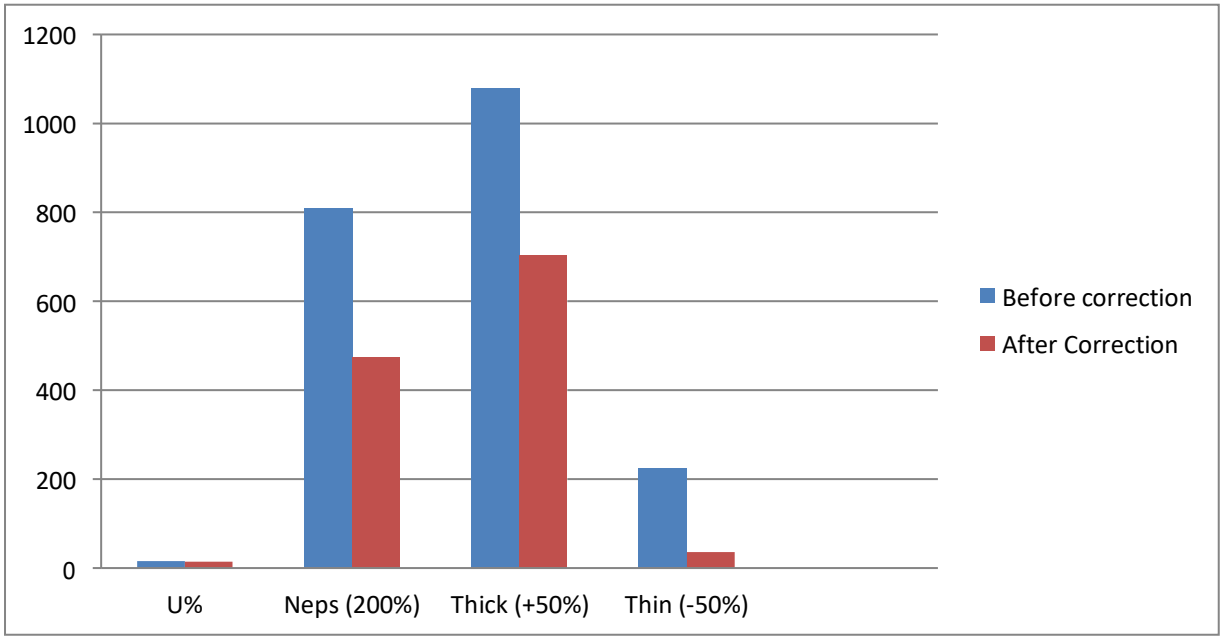

Fig: 4.2.6 Ring Frame Yarn Testing **[**Figure Related Appendix no 07]

Cotton: The most common plant fiber is cotton, which is typically spun into fine yarn for mechanical weaving or knitting into cloth.

M/C Model= Laxmi, LR 60/A. Made in India **Count -30/1** **100% Cotton**

Particulars	Before	After	Remarks
U%	11.26	11.16	
Neps (200%)	225.8	196.3	
Thick (+50%)	154.3	121	
Thin (-50%)	1.3	1.0	

Table: 37 Ring Frame Yarn Testing(Cotton)

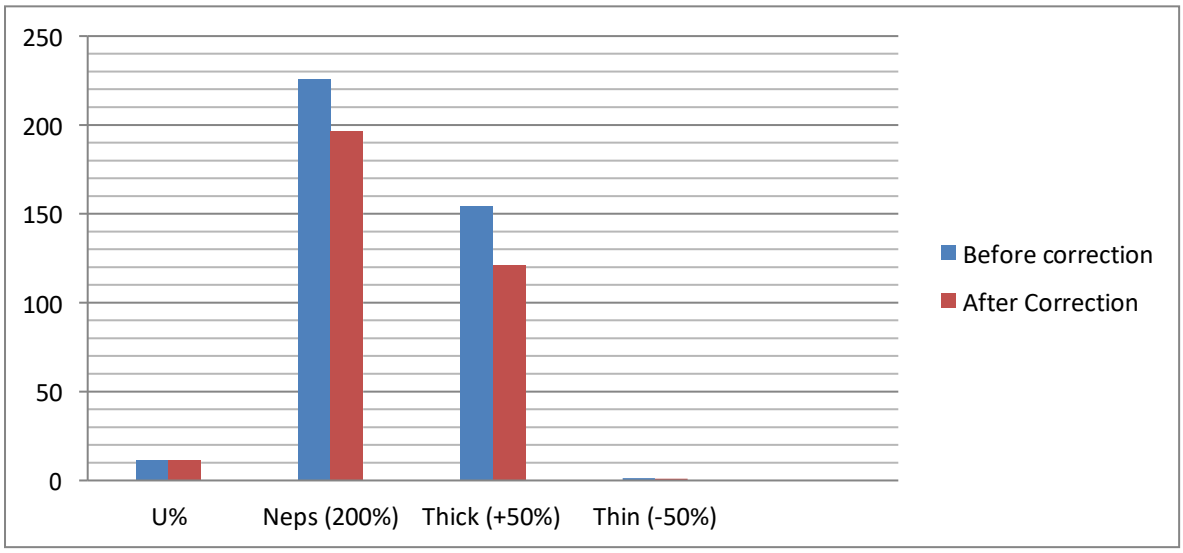

Fig: 4.2.7 Ring Frame Yarn Testing

For cotton spinning lace gauge used then fancy yarn

Setting

Backzone-57m.m

Frontzone-42m.m

Spindle to Spindle Gauge -70m.m

Spindle head to lapped hook (Olon gauge)-45-50m.m

Ring Traveler clearer gauge -2m.m

Neps yarn: Neps commonly produce by faulty carding up-to spinning yarn. The yarn is a long lengthen interlock fiber. The fabric surface has pique or floating –white particles**.**

M/C Model= Laxmi, LR 60/A. Made in India **Count -26/1 Neps**

Particulars	Before	After	Remarks
U%	18.61	21.15	
Neps (200%)	5238	6328	
Thick (+50%)	2968	3440	
Thin (-50%)	200	947.5	

Table: 38 Ring Frame Neps Yarn Testing

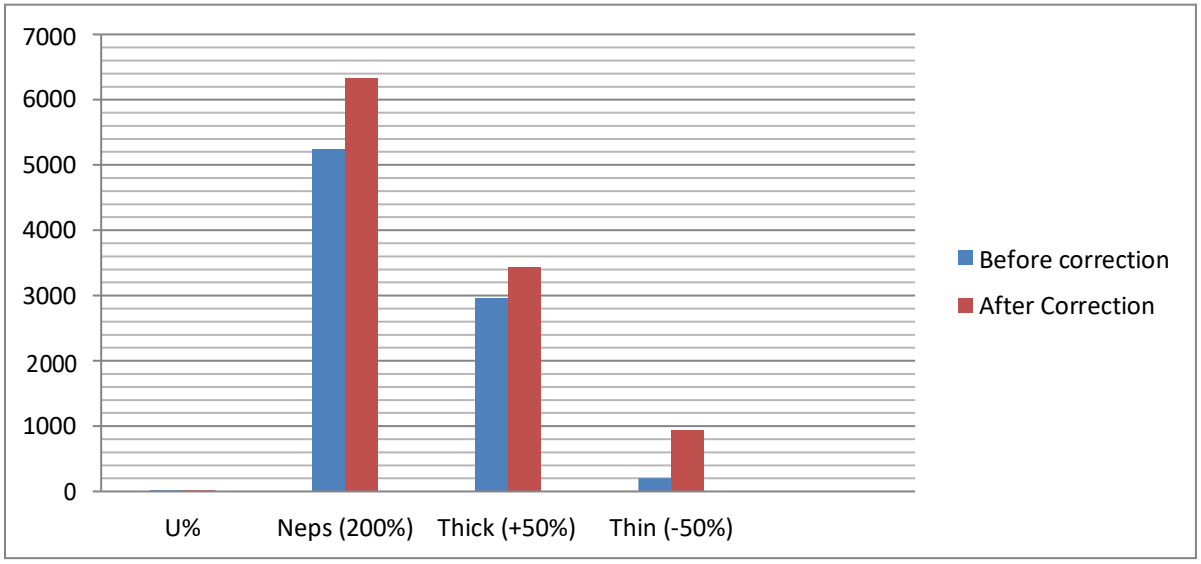

Fig: 4.2.8 Ring Frame Yarn Testing [Figure Related Appendix no 17]

Slub: Slub yarn define is a yarn with thick and thin sections alternating regularly of irregularly, this effect done by back roller speed variation.

M/C Model= Laxmi, LR 60/A. Made in India **Count 24/1 Slub Yarn**

Particulars	Before	After	Remarks
U%	19.71	18.83	
Neps (200%)	720	1020	
Thick (+50%)	1460	1440	
Thin (-50%)	120	240	

Table: 39 Ring Frame Slub Yarn

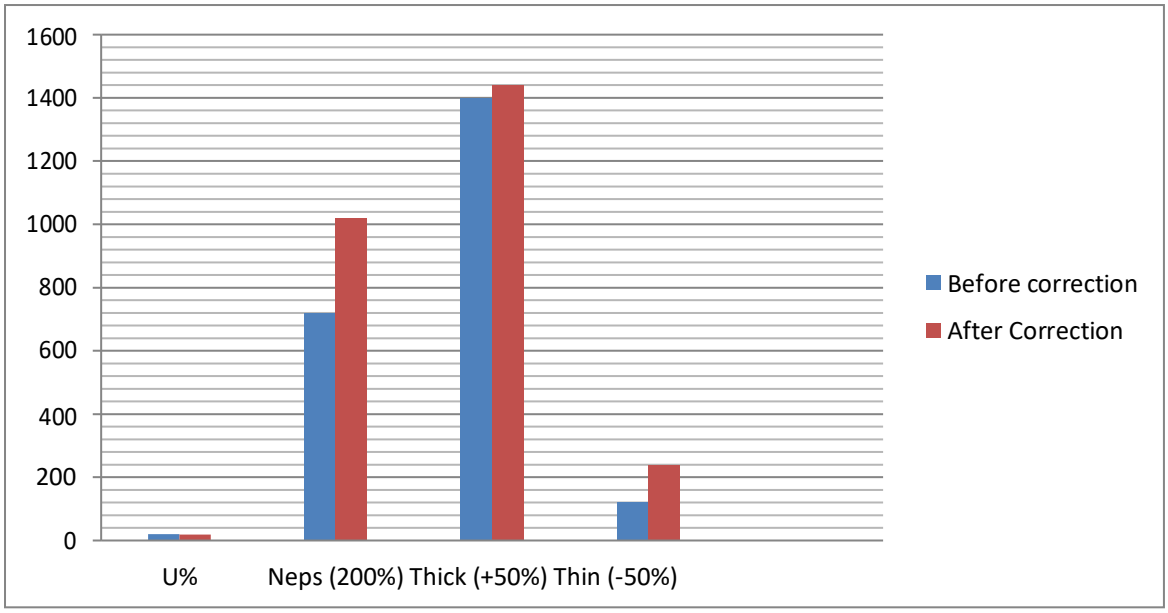

Fig: 4.2.9 Ring Frame Slub Yarn [Figure Related Appendix no 21-22]

Ring Frame (Yarn CSP)

CSP	GM Mélange	Inject	Cotton	Neps	Slub Yarn
CSP Before	2206	2220	2481	2780	2248
CSP After	2283	2686	2523	3503	2290

Table: 40 Ring Frame (Yarn CSP)

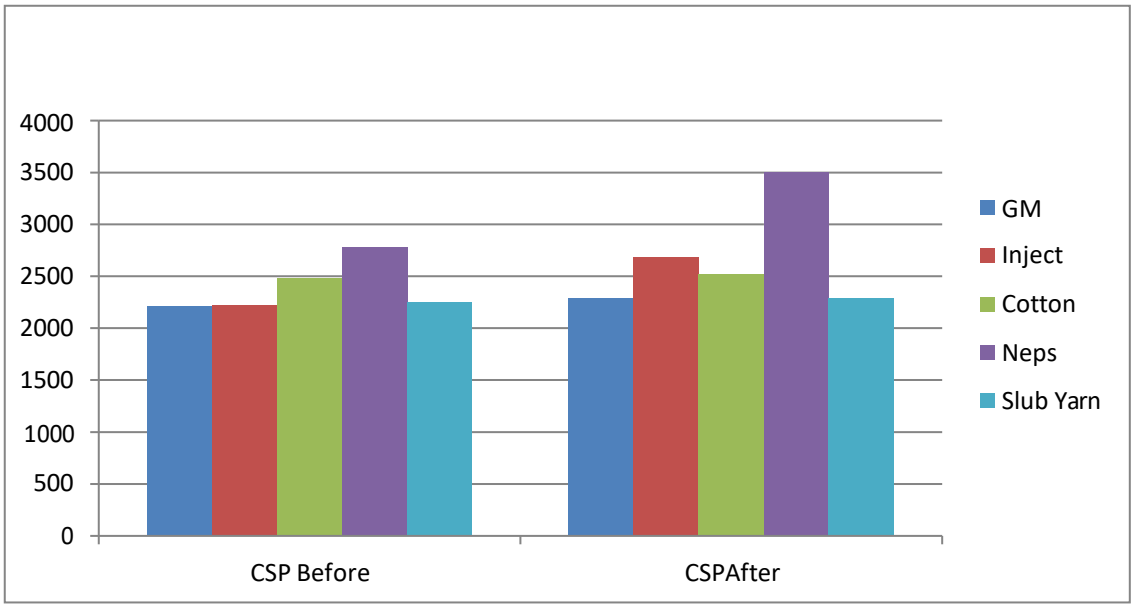

Fig: 4.2.10 CSP of yarn After Maintenance of Ring frame.

Figure shown the increase of CSP due to the following maintenance work:

1) Checked Eccentricity of fluted roller.
2) Checked Spindle centering
3) Lappet eye centering.
4) Traveler clearer setting.

Chapter-5: CONCLUSIONS.

The works reported in this thesis is a detail study on spinning machineries and it's implementing procedure on spinning machineries. In our country most effective use of maintenance system are Preventive and routine maintenance applied on spinning machinery but if we start to introduce present modern maintenance technique like TPM (Total productive Maintenance) then maintenance of spinning machinery will be improved more.

Total productive maintenance (TPM) successfully gives the improvement in the availability, performance efficiency and the quality rate, results in improvement of the overall equipment effectiveness of the equipment. TPM is the effective tool to increase the productivity of spinning industries. We can compete with the other countries in this increased globalization. Beside this I have also tried to mention in my thesis some other modern system of maintenance like SMP. So now-a -days for better output with competitive market we need to follow modern technique of maintenance on spinning machineries.

➢ Recommendation for Future Work

- improved maintenance planning
- Clear maintenance reports and ease of access to historical information for maintenance audit
- Reduced management overhead
- Fewer breakdowns
- Less stock-outs

Adapting the following recommendation can increase machine availability and over all equipment effectiveness.

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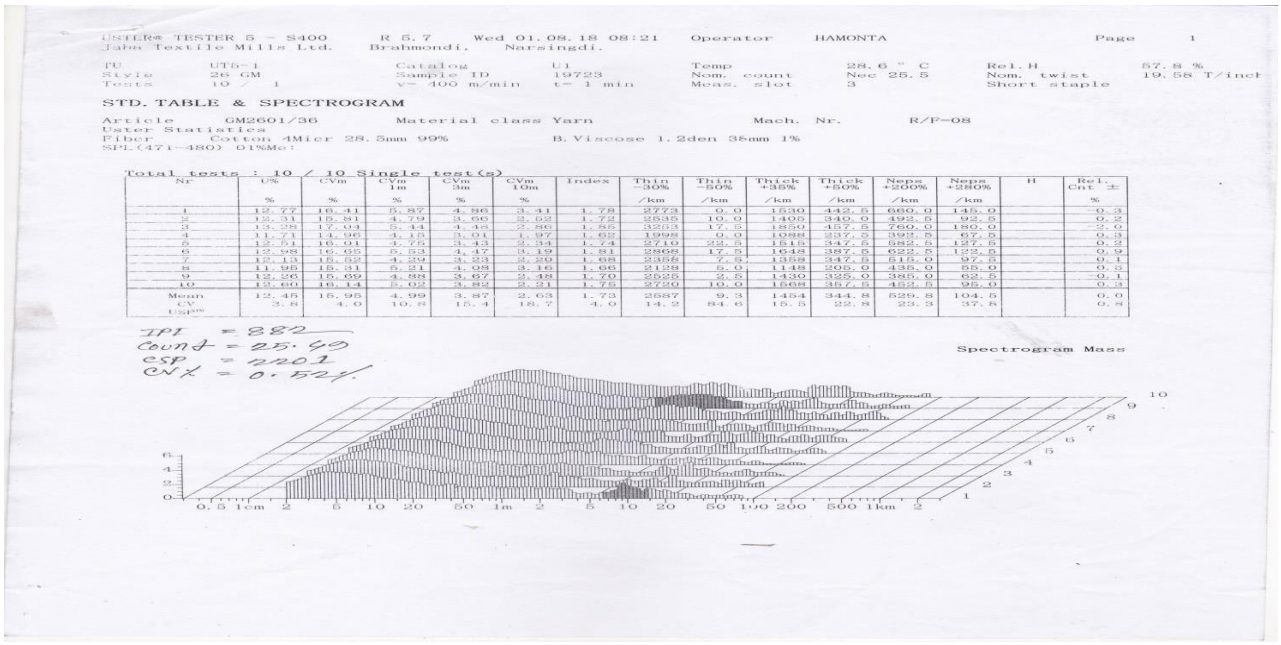
Appendix-I

Uster test & Spectrogram different kinds of yarn from Joba textile Mills Ltd.



USTER® TESTER 5 – S400 R 5.7 Wed 01.08.18 08:21 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 28.6 ° C Rel. H 57.8 %
Style 26 GM Sample ID 19723 Nom. count Nec 25.5 Nom. twist 19.58 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

Article GM2601/36 Material class Yarn Mach. Nr. R/F-08
Uster Statistics
Fiber Cotton 4Micr 28.5mm 99% B Viscose 1.2den 38mm 1%
SPL(471-480) 01%Me:

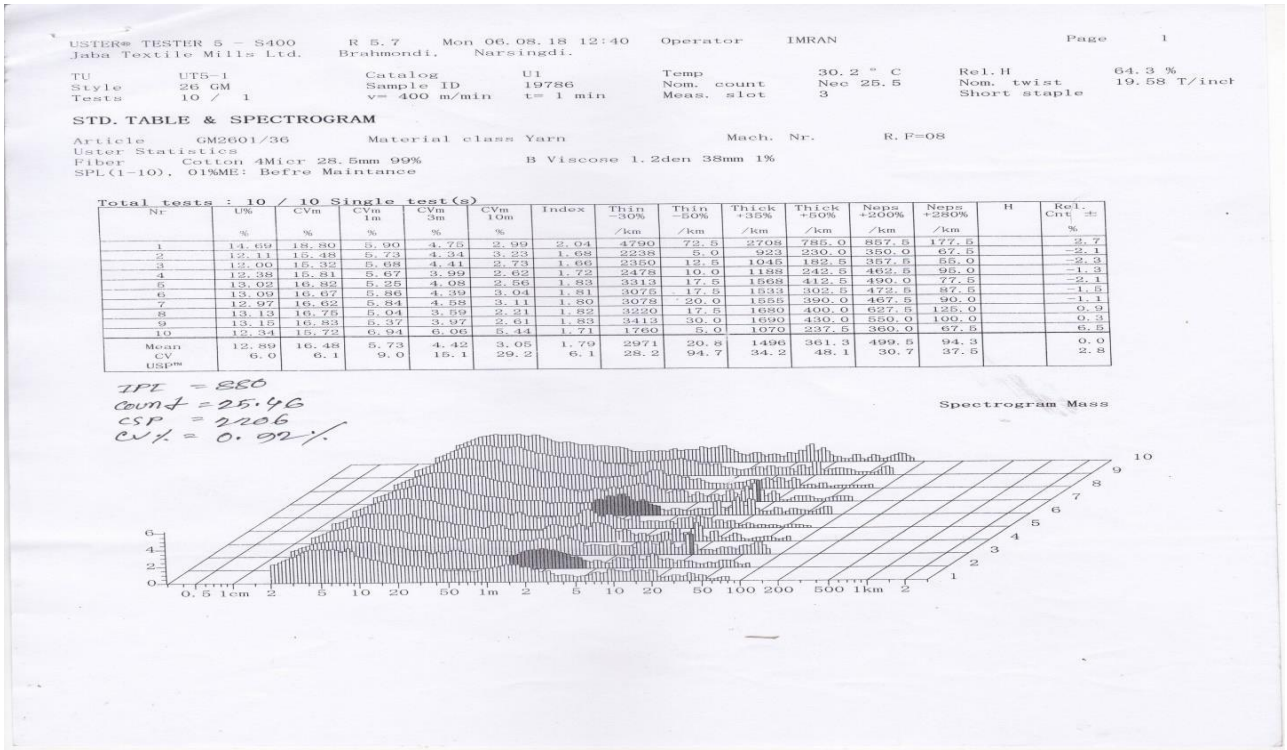
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	12.77	16.41	5.87	4.86	3.41	1.78	2773	0.0	1530	442.5	660.0	145.0		-0.3
2	12.31	15.81	4.79	3.66	2.52	1.72	2535	10.0	1405	340.0	492.5	92.5		-0.2
3	13.28	17.04	5.44	4.48	2.86	1.86	3253	17.5	1850	457.5	760.0	180.0		-2.0
4	11.71	14.96	4.15	3.01	1.97	1.62	1998	0.0	1088	237.5	392.5	67.5		0.3
5	12.51	16.01	4.76	3.43	2.34	1.74	2710	25.5	1515	347.5	585.0	127.5		0.2
6	12.98	16.65	5.53	4.47	3.19	1.81	2868	17.5	1648	387.5	622.5	122.5		0.9
7	12.13	15.63	4.39	3.23	2.39	1.68	2386	7.5	1358	347.5	515.0	97.5		0.1
8	11.95	15.31	5.21	4.08	3.16	1.66	2128	5.0	1148	205.0	435.0	55.0		0.3
9	12.26	15.69	4.88	3.67	2.48	1.70	2525	2.5	1430	325.0	385.0	62.5		-0.1
10	13.60	16.13	5.02	3.82	2.81	1.75	2730	10.0	1568	315.5	453.5	95.0		0.3
Mean	12.48	16.05	4.99	3.87	2.63	1.73	2887	9.3	1454	344.8	529.8	104.5		0.0
CV	3.8	4.0	10.4	15.4	18.7	4.0	14.2	84.6	16.5	22.8	23.3	37.8		0.8
USP™														

IPI = 282
Count = 25.49
CSP = 2201
CV% = 0.52%

Spectrogram Mass

App-01



USTER® TESTER 5 – S400 R 5.7 Mon 06.08.18 12:40 Operator IMRAN Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 30.2 ° C Rel. H 64.3 %
Style 26 GM Sample ID 19786 Nom. count Nec 25.5 Nom. twist 19.58 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

Article GM2601/36 Material class Yarn Mach. Nr. R. F=08
Uster Statistics
Fiber Cotton 4Micr 28.5mm 99% B Viscose 1.2den 38mm 1%
SPL(1-10), 01%ME: Befre Maintance

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	14.69	18.80	5.90	4.75	2.99	2.04	4790	72.5	2708	785.0	857.5	177.5		2.7
2	12.11	15.48	5.73	4.34	3.23	1.68	2238	5.0	923	230.0	350.0	67.5		-2.1
3	12.00	15.32	5.68	4.41	2.73	1.66	2350	12.5	1045	182.5	357.5	55.0		-2.3
4	12.38	15.81	5.67	3.99	2.62	1.73	2478	10.0	1188	242.5	462.5	95.0		-1.3
5	13.02	16.82	5.25	4.08	2.56	1.83	3313	17.5	1568	412.5	490.0	77.5		-2.1
6	13.09	16.67	5.86	4.39	3.04	1.81	3075	17.5	1533	302.5	472.5	87.5		-1.5
7	12.97	16.62	5.84	4.58	3.11	1.80	3078	20.0	1555	390.0	467.5	90.0		-1.1
8	13.13	16.75	5.04	3.59	2.21	1.82	3220	17.5	1680	400.0	627.5	125.0		0.9
9	13.15	16.83	5.37	3.97	2.61	1.83	3413	30.0	1690	430.0	550.0	100.0		0.3
10	12.34	15.72	6.94	6.06	5.44	1.71	1760	5.0	1070	237.5	360.0	67.5		6.5
Mean	12.89	16.48	5.73	4.42	3.05	1.79	2971	20.8	1496	361.3	499.5	94.3		0.0
CV	6.0	6.1	9.0	15.1	29.2	6.1	28.2	94.7	34.2	48.1	30.7	37.5		2.8
USP™														

IPI = 280
Count = 25.46
CSP = 2206
CV% = 0.92%

Spectrogram Mass

App-02

USTER® TESTER 5 – S400 R 5.7 Fri 03.08.18 16:37 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	28.9 ° C	Rel.H	61.1 %
Style	26GM	Sample ID	19755	Nom. count	Nec 25.5	Nom. twist	19.58 T/inch
Tests	10 / 1	v= 400 m/min	t= 1 min	Meas. slot	3	Short staple	

STD. TABLE & SPECTROGRAM

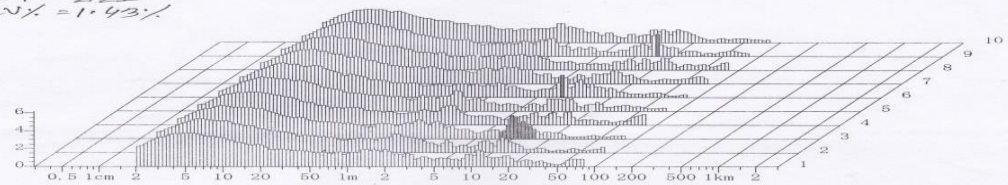
Article GM2601/36 Material class Yarn Mach. Nr. R/F=08
Uster Statistics
Fiber Cotton 4Micr 28.5mm 99% Viscose 1.4den 38mm 1%
SPL(471-480) 01%ME:

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	12.09	15.54	5.32	4.18	3.06	1.69	2275	7.5	1198	272.5	340.0	75.0		-1.4
2	12.11	15.47	5.21	4.06	2.83	1.68	2360	12.5	1185	232.5	352.5	42.5		2.3
3	11.94	15.27	5.17	3.80	2.43	1.66	2250	2.5	1070	237.5	292.5	42.5		-0.6
4	13.25	17.00	5.98	4.75	3.75	1.84	3323	40.0	1643	495.0	570.0	102.5		-1.1
5	12.25	15.70	4.90	3.86	2.64	1.70	2473	7.5	1318	280.0	417.5	105.0		-1.2
6	13.29	17.01	6.07	4.74	2.88	1.84	3248	22.5	1795	482.5	625.0	137.5		2.0
7	12.63	16.23	4.96	3.52	2.54	1.76	2820	5.0	1630	385.0	542.5	110.0		-3.4
8	12.28	15.76	4.91	3.90	2.84	1.71	2428	15.0	1358	315.0	452.5	87.5		1.1
9	12.70	16.23	5.05	3.88	2.96	1.76	2840	20.0	1555	360.0	435.0	87.5		-1.4
10	12.39	15.79	5.27	4.20	2.98	1.71	2385	7.5	1298	267.5	380.0	62.5		3.7
Mean	12.49	16.00	5.28	4.09	2.80	1.74	2640	14.0	1405	329.8	440.8	85.3		0.0
CV	3.8	3.8	7.9	9.7	15.9	3.8	15.0	79.9	16.9	27.4	24.5	35.7		2.2
USP%														

IPI = 783
COUNT = 25.47
CSP = 2121
CV% = 1.43%

Spectrogram Mass



App-03

USTER® TESTER 5 – S400 R 5.7 Tue 07.08.18 16:23 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	32.6 ° C	Rel.H	53.3 %
Style	26 GM	Sample ID	19802	Nom. count	Nec 25.5	Nom. twist	19.58 T/inch
Tests	10 / 1	v= 400 m/min	t= 1 min	Meas. slot	3	Short staple	

STD. TABLE & SPECTROGRAM

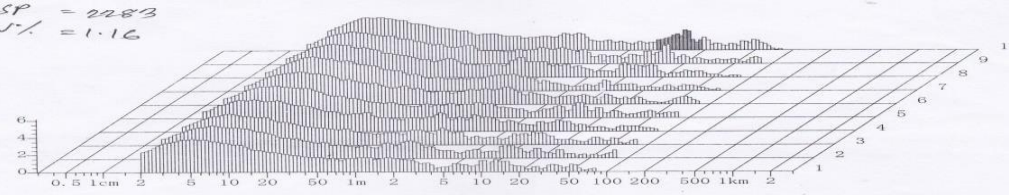
Article GM2601/36 Material class Yarn Mach. Nr. R.F=08
Uster Statistics
Fiber Cotton 4Micr 28.5mm 99% B.Viscose 1.2den 38mm 1%
SPL(471-480) 01%Me:

Total tests : 10 / 10 Single test(s)

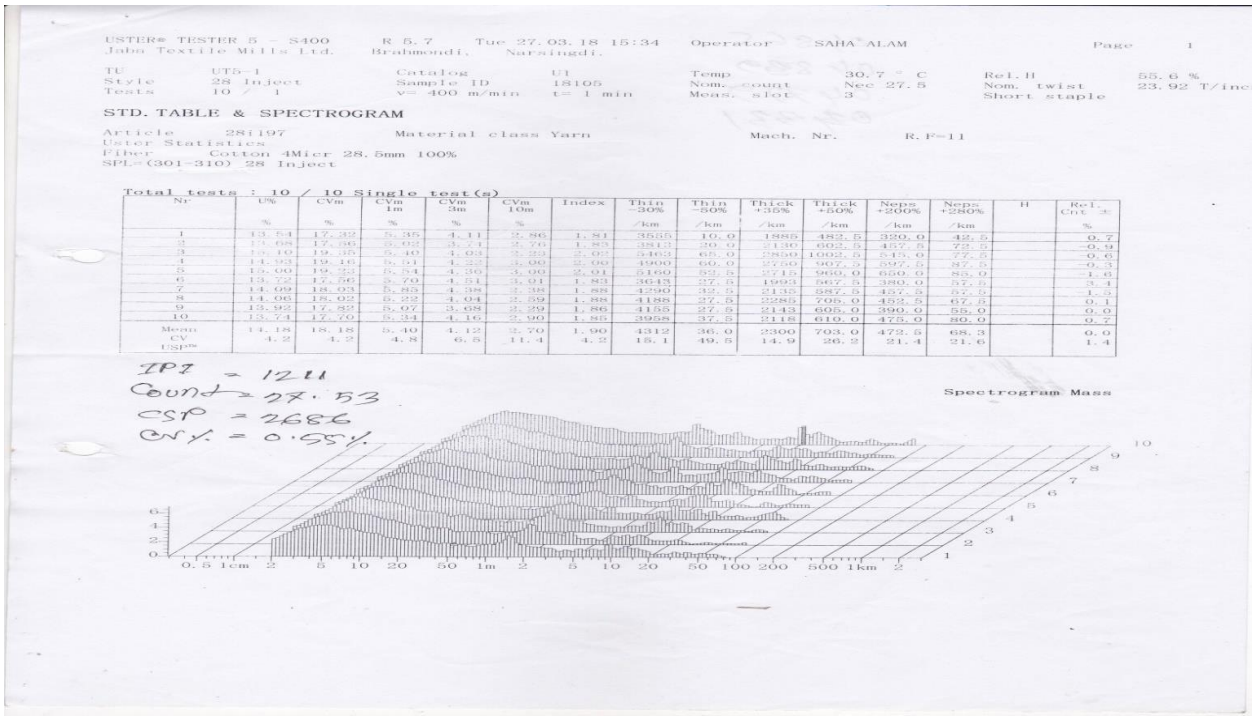
Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	11.88	15.21	4.90	3.87	3.09	1.65	2158	2.5	1190	227.5	302.5	75.0		-1.9
2	11.89	15.19	5.09	4.07	2.99	1.65	2010	2.5	1133	247.5	252.5	57.5		1.6
3	13.04	16.64	7.43	6.69	6.22	1.81	2353	10.0	1308	295.0	370.0	65.0		2.0
4	12.00	15.43	4.81	3.27	2.07	1.67	2130	2.5	1385	280.0	407.5	80.0		-1.0
5	12.33	15.71	5.33	4.29	3.12	1.71	2350	0.0	1275	275.0	327.5	65.0		1.3
6	12.56	15.99	4.81	3.38	2.27	1.74	2533	5.0	1378	312.5	342.5	52.5		-1.2
7	12.76	16.36	4.70	3.71	2.99	1.78	2728	5.0	1693	490.0	450.0	95.0		0.1
8	12.72	16.25	5.21	3.87	2.53	1.76	2863	17.5	1560	345.0	405.0	47.5		-1.3
9	12.34	15.80	5.47	4.37	2.86	1.71	2358	7.5	1268	272.5	392.5	87.5		1.4
10	12.26	15.75	5.30	4.18	2.89	1.71	2258	2.5	1338	350.0	437.5	80.0		-1.0
Mean	12.38	15.83	5.30	4.17	3.10	1.72	2374	5.5	1353	309.5	368.8	70.5		0.0
CV	3.2	3.1	14.9	22.9	37.1	3.1	11.3	92.9	12.3	24.0	16.9	22.0		1.5
USP%														

IPI = 682
COUNT = 25.60
CSP = 2283
CV% = 1.16

Spectrogram Mass



App-04



USTER® TESTER 5 – S400 R 5.7 Tue 27.03.18 15:34 Operator SAHA ALAM Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 30.7 ° C Rel.H 55.6 %
Style 28 Inject Sample ID 18105 Nom. count Nec 27.5 Nom. twist 23.92 T/inc
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

Article 28i197 Material class Yarn Mach. Nr. R.F=11
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100%
SPL=(301-310) 28 Inject

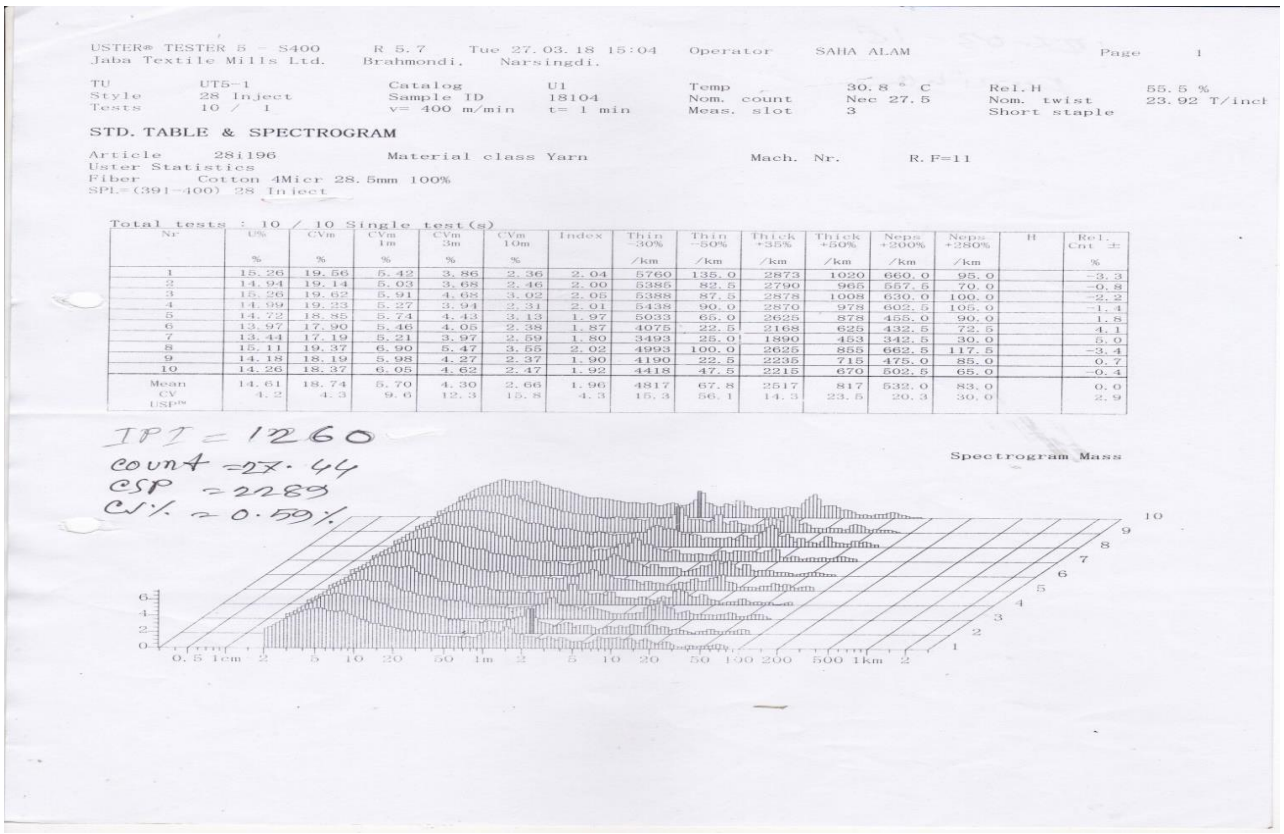
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	13.54	17.32	5.35	4.11	2.86	1.81	3555	10.0	1885	482.5	320.0	42.5		0.7
2	13.68	17.56	5.03	3.71	2.76	1.83	3813	20.0	2130	602.5	455.0	72.5		-0.9
3	13.10	19.35	5.40	4.03	2.20	2.03	5463	65.0	2850	1002.5	515.0	77.5		-0.6
4	14.93	19.16	5.51	4.22	3.00	2.00	4900	60.0	2750	907.5	597.5	87.5		-0.3
5	15.00	19.33	5.54	4.36	3.00	2.01	5160	55.5	2715	960.0	650.0	85.0		-1.6
6	13.75	17.56	5.70	4.54	3.01	1.83	3643	27.5	1993	567.5	380.0	57.5		3.4
7	14.09	18.03	5.83	4.38	3.38	1.88	4290	35.5	2135	587.5	430.5	57.5		1.5
8	14.06	18.02	5.22	4.04	3.59	1.88	4188	27.5	2285	705.0	452.5	67.5		0.1
9	13.92	17.82	5.07	3.68	3.29	1.86	4155	27.5	2143	605.0	390.0	55.0		0.0
10	13.74	17.70	5.34	4.16	2.90	1.85	3958	37.5	2118	610.0	475.0	80.0		0.7
Mean	14.18	18.18	5.40	4.12	2.70	1.90	4312	36.0	2300	703.0	472.5	68.3		0.0
CV	4.2	4.2	4.8	6.5	11.4	4.2	18.1	49.5	14.9	26.2	21.4	21.6		1.4
USP™														

IPI = 1211
Count = 27.53
CSP = 2686
CV% = 0.55%

Spectrogram Mass

App-05



USTER® TESTER 5 – S400 R 5.7 Tue 27.03.18 15:04 Operator SAHA ALAM Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 30.8 ° C Rel.H 55.5 %
Style 28 Inject Sample ID 18104 Nom. count Nec 27.5 Nom. twist 23.92 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

Article 28i196 Material class Yarn Mach. Nr. R.F=11
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100%
SPL=(391-400) 28 Inject

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	15.26	19.56	5.42	3.86	2.36	2.04	5760	135.0	2873	1020	660.0	95.0		-3.3
2	14.94	19.14	5.03	3.68	2.46	2.00	5385	82.5	2790	965	557.5	70.0		-0.8
3	15.26	19.62	5.91	4.68	3.02	2.05	5388	87.5	2878	1008	630.0	100.0		-2.2
4	14.99	19.23	5.27	3.94	2.31	2.01	5438	90.0	2870	978	602.5	105.0		-1.4
5	14.72	18.85	5.74	4.43	3.13	1.97	5033	65.0	2625	878	455.0	90.0		1.8
6	13.97	17.90	5.46	4.05	2.38	1.87	4075	22.5	2168	625	432.5	72.5		4.1
7	13.44	17.19	5.21	3.97	2.59	1.80	3493	25.0	1890	453	342.5	30.0		5.0
8	15.11	19.37	6.90	5.47	3.55	2.02	4993	100.0	2625	855	662.5	117.5		-3.4
9	14.18	18.19	5.98	4.27	2.37	1.90	4190	22.5	2238	715	475.0	85.0		0.7
10	14.26	18.37	6.05	4.62	2.47	1.92	4418	47.5	2215	670	502.5	65.0		-0.4
Mean	14.61	18.74	5.70	4.30	2.66	1.96	4817	67.8	2517	817	532.0	83.0		0.0
CV	4.2	4.3	9.6	12.3	15.8	4.3	15.3	56.1	14.3	23.5	20.3	30.0		2.9
USP™														

IPI = 1260
Count = 27.44
CSP = 2289
CV% = 0.59%

Spectrogram Mass

App-06

USTER® TESTER 5 – S400 R 5.7 Sat 27.01.18 14:29 Operator HIMON Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 28.5 ° C Rel.H 42.2 %
Style 28 inject Sample ID 17032 Nom. count Nec 27.5 Nom. twist 23.34 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

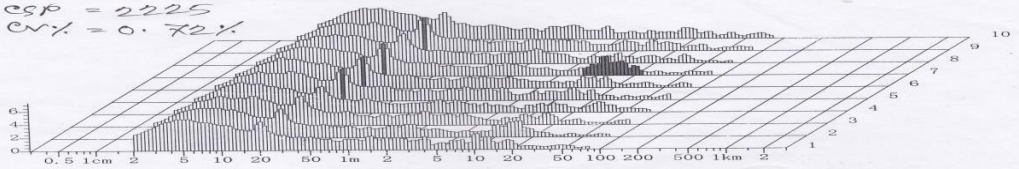
Article 28i158 Material class Yarn Mach. Nr. R/F=13
Uster Statistics
Fiber Polyester 1.4den 38mm 90% Cotton 4Micr 28.5mm 10%
SPL=(1-10) 28i158

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	15.18	19.48	6.19	4.80	2.98	2.05	5208	107.5	2688	882.5	587.5	90.0		-7.0
2	15.65	19.82	6.31	5.03	3.33	2.08	5470	102.5	2725	962.5	642.5	95.0		-6.5
3	14.26	18.25	5.77	4.25	3.03	1.92	4220	42.5	2103	880.0	532.5	112.5		2.9
4	14.98	18.99	6.20	5.02	4.06	1.99	4840	50.0	2368	745.0	492.5	72.5		0.3
5	14.19	18.14	5.38	3.93	2.60	1.90	4343	35.0	2153	592.5	535.0	115.0		3.8
6	15.12	19.40	6.03	4.64	3.23	2.04	5310	72.5	2490	812.5	572.5	112.5		0.1
7	15.35	19.66	6.60	5.40	3.25	2.07	5325	112.5	2540	872.5	525.0	95.0		-4.2
8	14.06	17.97	5.41	4.08	2.96	1.89	3820	40.0	2158	667.5	462.5	72.5		5.0
9	14.74	18.77	5.90	4.56	3.12	1.97	4495	60.0	2358	782.5	575.0	117.5		3.8
10	14.63	18.69	5.53	4.18	2.74	1.96	4538	37.5	2480	822.5	435.0	72.5		1.9
Mean	14.81	18.92	5.93	4.59	3.13	1.99	4767	66.0	2406	769.0	536.0	95.5		0.0
CV	3.5	3.5	6.9	10.4	12.7	3.5	11.6	46.7	9.1	17.1	11.5	19.3		4.4
USP™														

IPI = 1371
Count = 29.29
CSP = 2225
CV% = 0.72%

Spectrogram Mass



App-07

USTER® TESTER 5 – S400 R 5.7 – Fri 29.06.18 21:20 Operator Rubel Hossain Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 33.2 ° C Rel.H 65.1 %
Style 28 inject Sample ID 19381 Nom. count Nec 27.5 Nom. twist 23.92 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

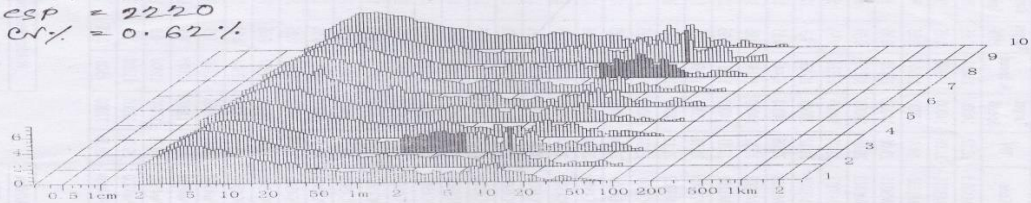
Article LOT-281220 Material class Yarn Mach. Nr. R/F=11
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100%
SPL=(461-470) 28 inject

Total tests : 10 / 10 Single test(s)

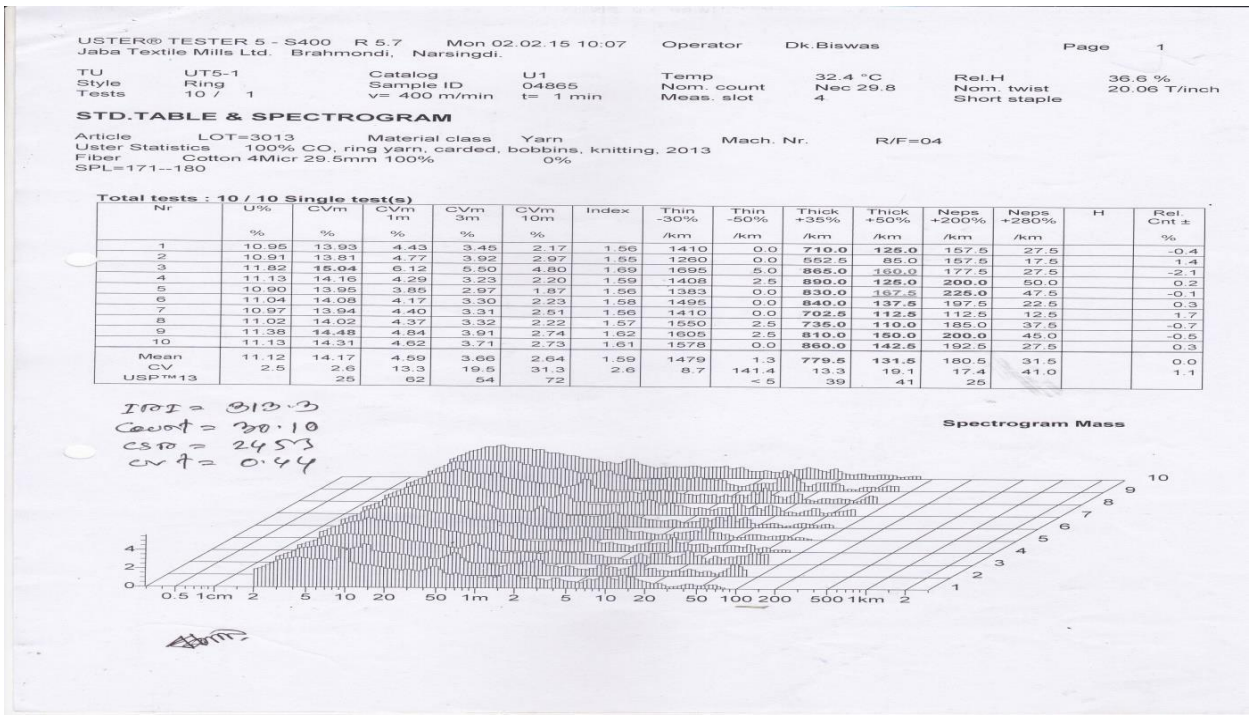
Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt %
	%	%	%	%	%									
1	14.54	18.64	6.36	4.98	3.99	1.95	4370	20.0	2440	750.0	542.5	82.5		4.1
2	15.36	20.05	6.68	5.59	4.00	2.09	5448	72.5	2850	990.0	707.5	110.0		-1.6
3	16.53	22.21	10.18	6.76	4.73	2.32	5978	145.0	2933	1022.5	802.5	160.0		-4.0
4	15.50	19.97	6.63	5.17	2.91	2.09	5500	87.5	2978	1067.5	900.0	192.5		-2.9
5	15.50	20.43	7.63	5.81	3.78	2.13	5680	87.5	2898	1130.0	772.5	162.5		-2.7
6	16.26	20.90	6.96	5.73	4.09	2.18	6220	165.0	3363	1305.0	947.5	180.0		11.0
7	15.62	20.14	6.33	5.04	3.54	2.10	5835	100.0	3168	1230.0	987.5	215.5		1.0
8	16.60	22.14	11.38	9.82	7.25	2.31	6120	205.0	3075	1155.0	777.5	167.5		-2.0
9	16.61	23.76	14.20	12.09	8.87	2.48	6078	347.5	3038	1237.5	872.5	150.0		-5.8
10	14.93	19.20	7.12	5.74	3.50	2.01	4938	47.5	2638	882.5	762.5	152.5		
Mean	15.74	20.74	8.35	6.66	4.57	2.17	5616	124.8	2938	1077	807.3	157.0		0.0
CV	4.6	7.5	32.1	35.3	42.7	7.5	10.4	77.6	8.9	15.9	15.9	24.1		4.6
USP™														

IPI = 2008
Count = 27.60
CSP = 2220
CV% = 0.62%

Spectrogram Mass



App-08



USTER® TESTER 5 - S400 R 5.7 Mon 02.02.15 10:07 Operator Dk.Biswas Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 32.4 °C Rel.H 36.6 %
Style Ring Sample ID 04865 Nom. count Nec 29.8 Nom. twist 20.06 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 4 Short staple

STD.TABLE & SPECTROGRAM

Article LOT=3013 Material class Yarn Mach. Nr. R/F=04
Uster Statistics 100% CO, ring yarn, carded, bobbins, knitting, 2013
Fiber Cotton 4Micr 29.5mm 100% 0%
SPL=171--180

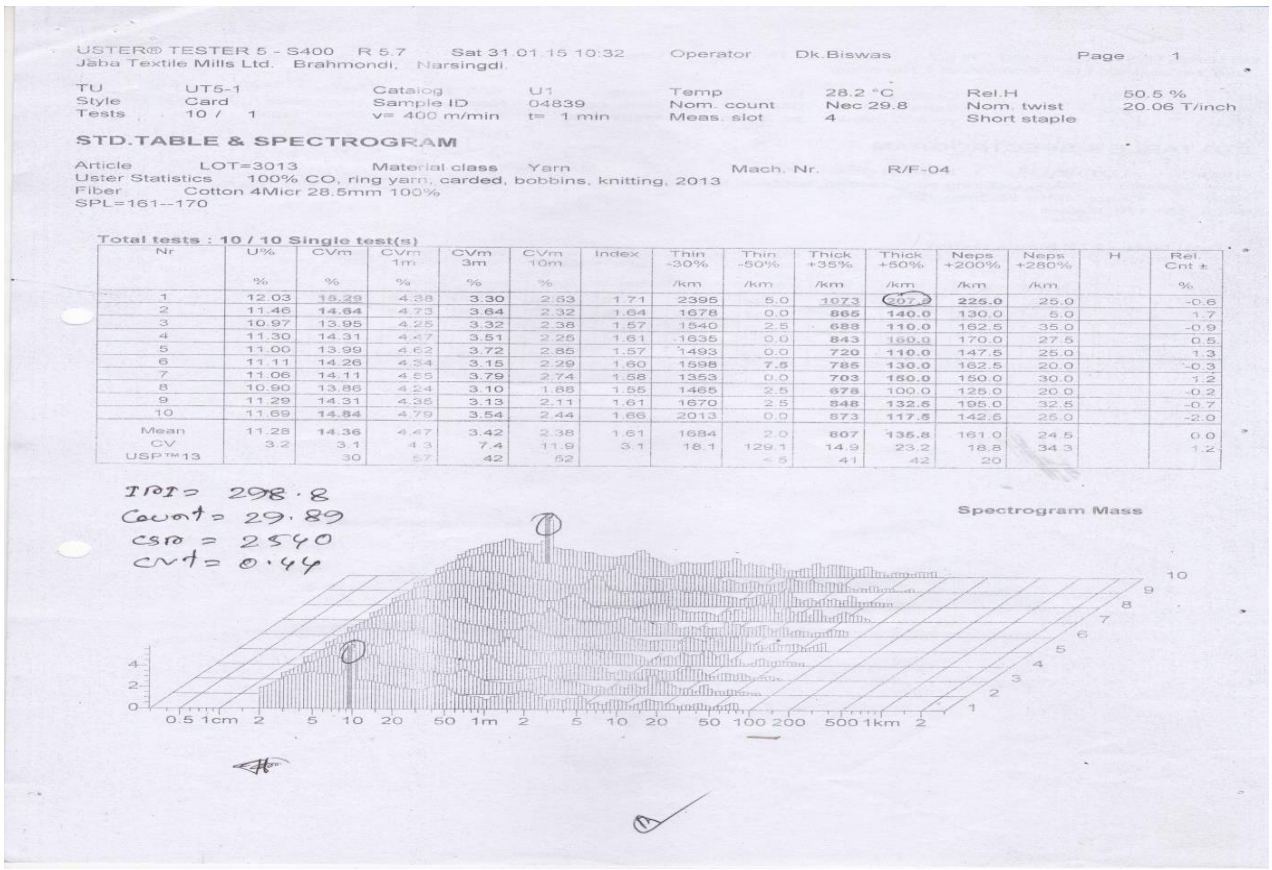
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	10.95	13.93	4.43	3.45	2.17	1.56	1410	0.0	**710.0**	**125.0**	157.5	27.5		-0.4
2	10.91	13.81	4.77	3.92	2.97	1.55	1260	0.0	552.5	85.0	157.5	17.5		1.4
3	11.82	**15.04**	6.12	5.50	4.80	1.69	1695	5.0	**865.0**	160.0	177.5	27.5		-2.1
4	11.13	14.16	4.29	3.23	2.20	1.59	1408	2.5	**890.0**	**125.0**	**200.0**	50.0		0.2
5	10.90	13.95	3.85	2.97	1.87	1.56	1383	0.0	**830.0**	167.5	**225.0**	47.5		-0.1
6	11.04	14.08	4.17	3.30	2.23	1.58	1495	0.0	**840.0**	**137.5**	197.5	22.5		0.3
7	10.97	13.94	4.40	3.31	2.51	1.56	1410	0.0	**702.5**	**112.5**	112.5	12.5		1.7
8	11.02	14.02	4.37	3.32	2.22	1.57	1550	2.5	**735.0**	**110.0**	185.0	37.5		-0.7
9	11.38	**14.48**	4.84	3.91	2.74	1.62	1605	2.5	**810.0**	**150.0**	**200.0**	45.0		-0.5
10	11.13	14.31	4.62	3.71	2.73	1.61	1578	0.0	**860.0**	**142.5**	192.5	27.5		0.3
Mean	11.12	14.17	4.59	3.66	2.64	1.59	1479	1.3	**779.5**	**131.5**	180.5	31.5		0.0
CV	2.5	2.6	13.3	19.5	31.3	2.6	8.7	141.4	13.3	19.1	17.4	41.0		1.1
USP™13		25	62	54	72			< 5	39	41	25			

IBI = 313.3
Count = 30.10
CSP = 2453
CV f = 0.44

Spectrogram Mass

App-09



USTER® TESTER 5 - S400 R 5.7 Sat 31.01.15 10:32 Operator Dk.Biswas Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 28.2 °C Rel.H 50.5 %
Style Card Sample ID 04839 Nom. count Nec 29.8 Nom. twist 20.06 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 4 Short staple

STD.TABLE & SPECTROGRAM

Article LOT=3013 Material class Yarn Mach. Nr. R/F-04
Uster Statistics 100% CO, ring yarn, carded, bobbins, knitting, 2013
Fiber Cotton 4Micr 28.5mm 100%
SPL=161--170

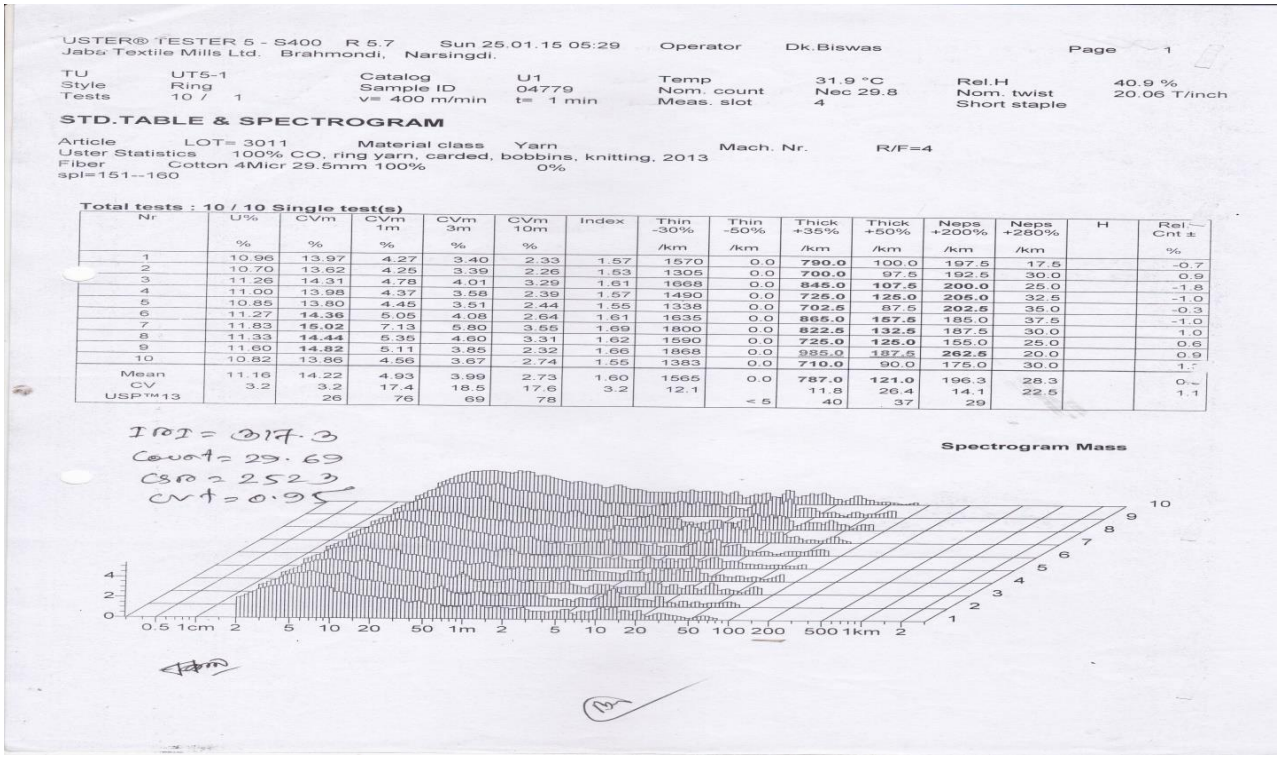
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	12.03	15.29	4.38	3.30	2.53	1.71	2395	5.0	1073	207.5	**225.0**	25.0		-0.6
2	11.46	14.64	4.73	3.64	2.32	1.64	1678	0.0	**865**	**140.0**	130.0	5.0		1.7
3	10.97	13.95	4.25	3.32	2.38	1.57	1540	2.5	683	**110.0**	162.5	35.0		-0.9
4	11.30	14.31	4.67	3.51	2.25	1.61	1635	0.0	843	160.0	170.0	27.5		0.5
5	11.00	13.99	4.62	3.72	2.85	1.57	1493	0.0	720	**110.0**	147.5	25.0		1.3
6	11.11	14.26	4.34	3.15	2.29	1.60	1598	7.5	785	**130.0**	162.5	20.0		-0.3
7	11.06	14.11	4.55	3.79	2.74	1.58	1353	0.0	703	160.0	150.0	30.0		1.2
8	10.90	13.86	4.24	3.10	1.88	1.55	1465	2.5	678	100.0	125.0	20.0		-0.2
9	11.29	14.31	4.35	3.13	2.11	1.61	1670	2.5	848	132.5	195.0	32.5		-0.7
10	11.69	14.84	4.79	3.54	2.44	1.66	2013	0.0	873	**117.5**	142.5	25.0		-2.0
Mean	11.28	14.36	4.47	3.42	2.38	1.61	1684	2.0	807	**135.8**	161.0	24.5		0.0
CV	3.2	3.1	4.3	7.4	11.9	3.1	18.1	129.1	14.9	23.2	18.8	34.3		1.2
USP™13		30	57	42	52			< 5	41	42	20			

IBI = 298.8
Count = 29.89
CSP = 2540
CV f = 0.44

Spectrogram Mass

App-10



USTER® TESTER 5 - S400 R 5.7 Sun 25.01.15 05:29 Operator Dk.Biswas Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 31.9 °C Rel.H 40.9 %
Style Ring Sample ID 04779 Nom. count Nec 29.8 Nom. twist 20.06 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 4 Short staple

STD.TABLE & SPECTROGRAM

Article LOT= 3011 Material class Yarn Mach. Nr. R/F=4
Uster Statistics 100% CO, ring yarn, carded, bobbins, knitting, 2013
Fiber Cotton 4Micr 29.5mm 100% 0%
spl=151--160

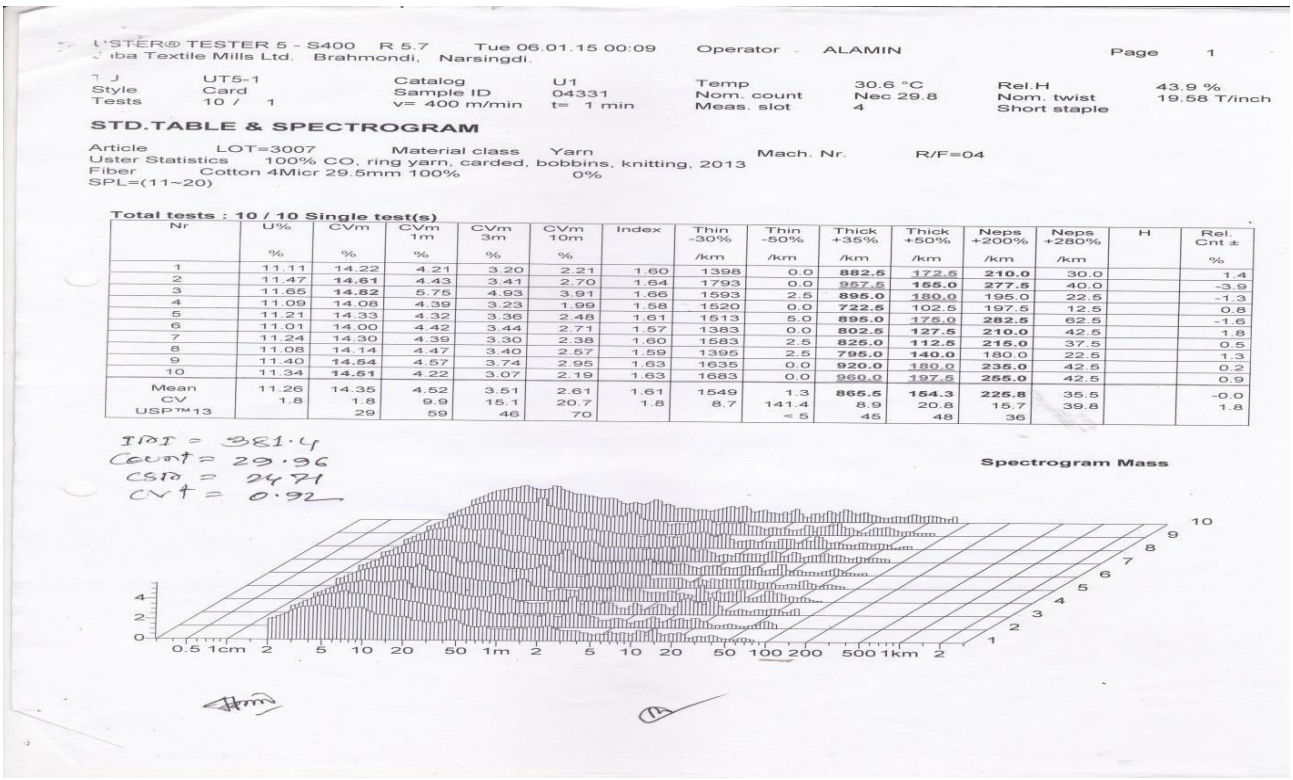
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	10.96	13.97	4.27	3.40	2.33	1.57	1570	0.0	**790.0**	100.0	197.5	17.5		-0.7
2	10.70	13.62	4.25	3.39	2.26	1.53	1305	0.0	**700.0**	97.5	192.5	30.0		0.9
3	11.26	14.31	4.78	4.01	3.29	1.61	1668	0.0	**845.0**	**107.5**	**200.0**	25.0		-1.8
4	11.00	13.98	4.37	3.58	2.39	1.57	1490	0.0	**725.0**	**125.0**	**205.0**	32.5		-1.0
5	10.85	13.80	4.45	3.51	2.44	1.55	1338	0.0	**702.5**	87.5	**202.5**	35.0		-0.3
6	11.27	**14.36**	5.05	4.08	2.64	1.61	1635	0.0	**865.0**	**157.5**	185.0	37.5		-1.0
7	11.83	**15.02**	7.13	5.80	3.55	1.69	1800	0.0	**822.5**	**132.5**	187.5	30.0		1.0
8	11.33	**14.44**	5.35	4.60	3.31	1.62	1590	0.0	**725.0**	**125.0**	155.0	25.0		0.6
9	11.60	**14.82**	5.11	3.85	2.32	1.66	1868	0.0	985.0	187.5	**262.5**	20.0		0.9
10	10.82	13.86	4.56	3.67	2.74	1.55	1383	0.0	**710.0**	90.0	175.0	30.0		1.3
Mean	11.16	14.22	4.93	3.99	2.73	1.60	1565	0.0	**787.0**	**121.0**	196.3	28.3		0.1
CV	3.2	3.2	17.4	18.5	17.6	3.2	12.1		11.8	26.4	14.1	22.5		1.1
USP™13		26	76	69	78			< 5	40	37	29			

IPI = 317.3
Count = 29.69
CSD = 252.3
CV = 0.95

Spectrogram Mass

App-11



USTER® TESTER 5 - S400 R 5.7 Tue 06.01.15 00:09 Operator ALAMIN Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TJ UT5-1 Catalog U1 Temp 30.6 °C Rel.H 43.9 %
Style Card Sample ID 04331 Nom. count Nec 29.8 Nom. twist 19.58 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 4 Short staple

STD.TABLE & SPECTROGRAM

Article LOT=3007 Material class Yarn Mach. Nr. R/F=04
Uster Statistics 100% CO, ring yarn, carded, bobbins, knitting, 2013
Fiber Cotton 4Micr 29.5mm 100% 0%
SPL=(11~20)

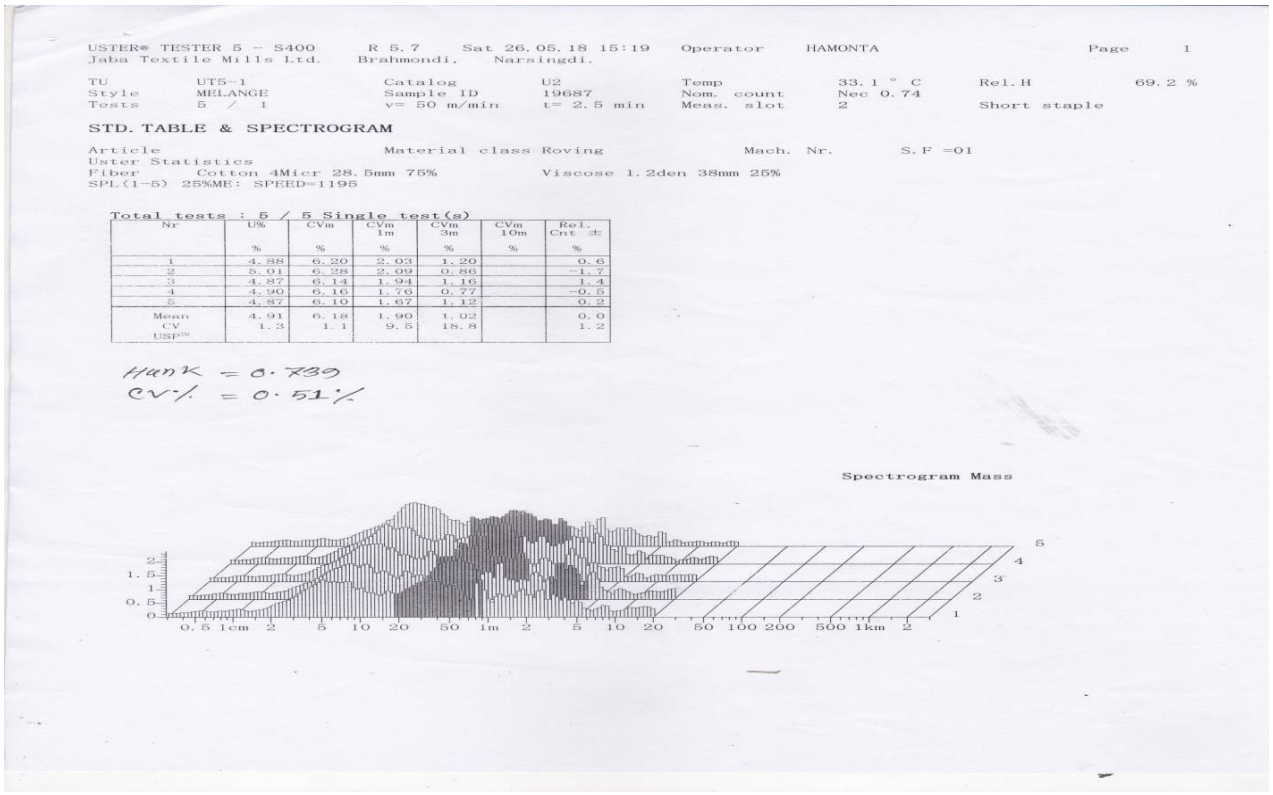
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30%	Thin -50%	Thick +35%	Thick +50%	Neps +200%	Neps +280%	H	Rel. Cnt ±
	%	%	%	%	%		/km	/km	/km	/km	/km	/km		%
1	11.11	14.22	4.21	3.20	2.21	1.60	1398	0.0	**882.5**	172.5	**210.0**	30.0		1.4
2	11.47	**14.61**	4.43	3.41	2.70	1.64	1793	0.0	957.5	**155.0**	**277.5**	40.0		-3.9
3	11.65	**14.82**	5.75	4.93	3.91	1.66	1593	2.5	**895.0**	180.0	195.0	22.5		-1.3
4	11.09	14.08	4.39	3.23	1.99	1.58	1520	0.0	**722.5**	102.5	197.5	12.5		0.8
5	11.21	14.33	4.32	3.36	2.48	1.61	1513	5.0	**895.0**	175.0	**282.5**	62.5		-1.6
6	11.01	14.00	4.42	3.44	2.71	1.57	1383	0.0	**802.5**	**127.5**	**210.0**	42.5		1.8
7	11.24	14.30	4.39	3.30	2.38	1.60	1583	2.5	**825.0**	**112.5**	**215.0**	37.5		0.5
8	11.08	14.14	4.47	3.40	2.57	1.59	1395	2.5	**795.0**	**140.0**	180.0	22.5		1.3
9	11.40	14.54	4.57	3.74	2.95	1.63	1635	0.0	**920.0**	180.0	**235.0**	42.5		0.2
10	11.34	**14.51**	4.22	3.07	2.19	1.63	1683	0.0	960.0	197.5	**255.0**	42.5		0.9
Mean	11.26	14.35	4.52	3.51	2.61	1.61	1549	1.3	**865.5**	**154.3**	**225.8**	35.5		-0.0
CV	1.8	1.8	9.9	15.1	20.7	1.8	8.7	141.4	8.9	20.8	15.7	39.8		1.8
USP™13		29	59	46	70			< 5	45	48	36			

IPI = 381.4
Count = 29.96
CSD = 247.1
CV = 0.92

Spectrogram Mass

App-12



USTER® TESTER 5 – S400 R 5.7 Sat 26.05.18 15:19 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U2	Temp	33.1 ° C	Rel. H	69.2 %
Style	MELANGE	Sample ID	19687	Nom. count	Nec 0.74		
Tests	5 / 1	v= 50 m/min	t= 2.5 min	Meas. slot	2	Short staple	

STD. TABLE & SPECTROGRAM

Article Material class Roving Mach. Nr. S.F =01
Uster Statistics
Fiber Cotton 4Micr 28.5mm 75% Viscose 1.2den 38mm 25%
SPL(1-5) 25%ME: SPEED=1195

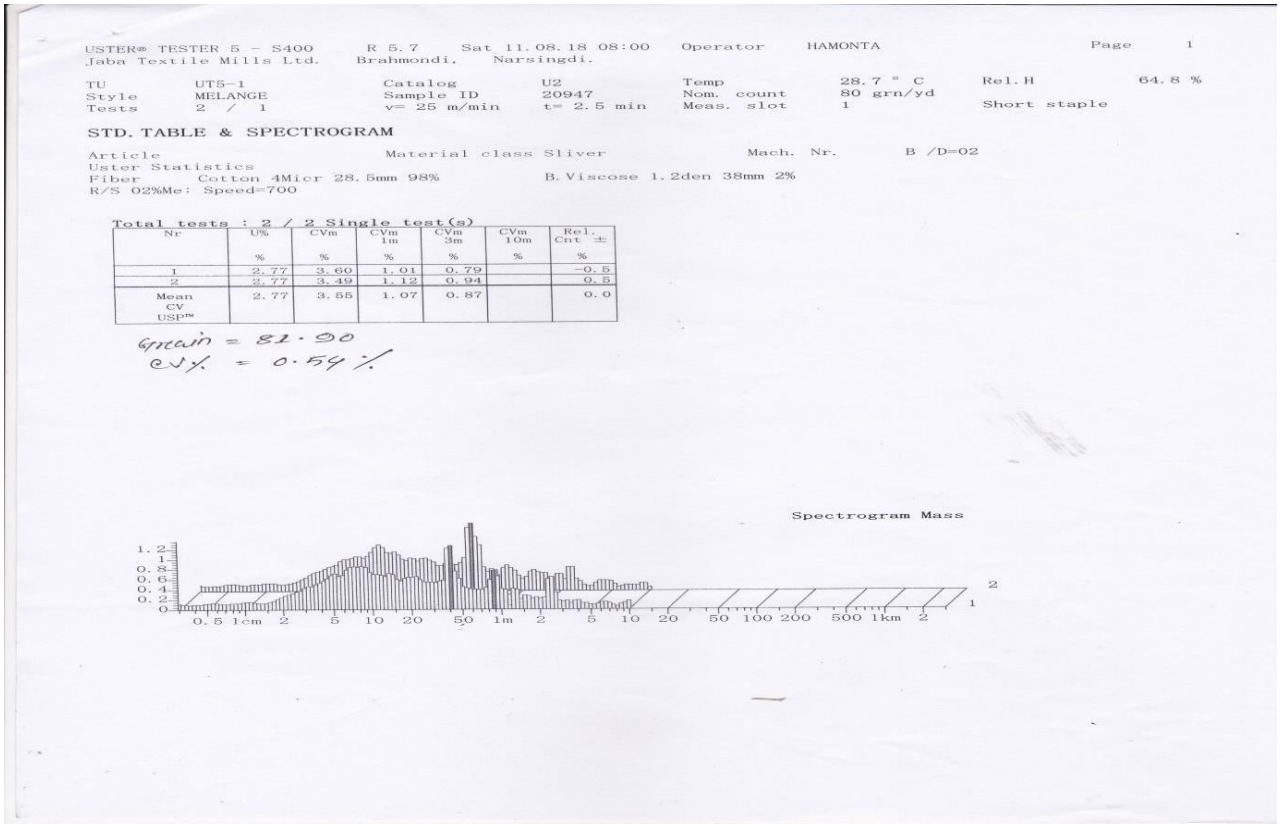
Total tests : 5 / 5 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Rel. Cnt ±
	%	%	%	%	%	%
1	4.88	6.20	2.03	1.20		0.6
2	5.01	6.28	2.09	0.86		-1.7
3	4.87	6.14	1.94	1.16		1.4
4	4.90	6.16	1.76	0.77		-0.5
5	4.87	6.10	1.67	1.12		0.2
Mean	4.91	6.18	1.90	1.02		0.0
CV	1.3	1.1	9.5	18.8		1.2
USP™						

Hank = 0.739
CV% = 0.51%

Spectrogram Mass

App-13



USTER® TESTER 5 – S400 R 5.7 Sat 11.08.18 08:00 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U2	Temp	28.7 ° C	Rel. H	64.8 %
Style	MELANGE	Sample ID	20947	Nom. count	80 grn/yd		
Tests	2 / 1	v= 25 m/min	t= 2.5 min	Meas. slot	1	Short staple	

STD. TABLE & SPECTROGRAM

Article Material class Sliver Mach. Nr. B /D=02
Uster Statistics
Fiber Cotton 4Micr 28.5mm 98% B. Viscose 1.2den 38mm 2%
R/S 02%Me: Speed=700

Total tests : 2 / 2 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Rel. Cnt ±
	%	%	%	%	%	%
1	2.77	3.60	1.01	0.79		-0.5
2	2.77	3.49	1.12	0.94		0.5
Mean	2.77	3.55	1.07	0.87		0.0
CV						
USP™						

Grain = 81.90
CV% = 0.54%

Spectrogram Mass

App-14

USTER® TESTER 5 – S400 R 5.7 Thu 09.08.18 10:27 Operator MD. RUBEL Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U2	Temp	28.2 ° C	Rel. H	70.8 %
Style	MELANGE 05%	Sample ID	20933	Nom. count	90 grn/yd		
Tests	2 / 1	v= 25 m/min	t= 2.5 min	Meas. slot	1	Short staple	

STD. TABLE & SPECTROGRAM

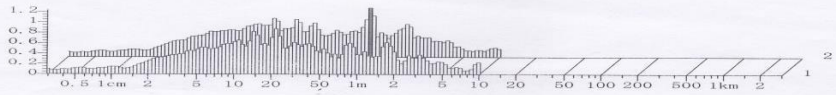
Article Material class Sliver Mach. Nr. C /D=07
Uster Statistics
Fiber Cotton 4Micr 28.5mm 95% B Viscose 1.2den 38mm 5%
- 05%ME: Speed=55Kg/hr

Total tests : 2 / 2 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Rel. Cnt ±
	%	%	%	%	%	%
1	2.46	3.11	1.33	0.75		0.1
2	2.51	3.15	1.17	0.68		-0.1
Mean	2.49	3.13	1.25	0.71		0.0
CV						
USP[5%]						

Grain Hank = 89.98
CV % = 0.65

Spectrogram Mass



App-15

USTER® TESTER 5 – S400 R 5.7 Sat 02.06.18 16:01 Operator Rubal Hossain Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	33 ° C	Rel. H	62 %
Style	26 Neps	Sample ID	19200	Nom. count	Nec 25.5	Nom. twist	23.34 T/inch
Tests	10 / 1	v= 400 m/min	t= 1 min	Meas. slot	3	Short staple	

STD. TABLE & SPECTROGRAM

Article CP2600N/09 Material class Yarn Mach. Nr. R.P=33
Uster Statistics
Fiber Cotton 1Micr 28.5mm 100%
SPL=(181-190) CP2600N/09

(26 s/i Neps)

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt ± %
1	20.42	27.12	10.70	9.29	7.56	2.94	8643	437.5	5320	3175	5180	2763		-3.7
2	20.12	26.63	10.96	10.11	8.67	2.89	8265	365.0	5338	3130	5315	2810		-2.8
3	18.25	24.30	9.63	8.28	6.54	2.64	6793	207.5	4868	2638	4618	2465		-0.7
4	18.42	24.47	10.03	8.30	5.87	2.65	7018	230.0	4668	2533	4360	2213		0.7
5	20.40	26.81	10.85	8.89	6.29	2.91	8843	512.5	5530	3225	5245	2735		0.1
6	20.07	26.27	10.65	9.52	7.40	2.85	8503	330.0	5175	2973	4885	2583		1.8
7	19.46	25.79	9.40	8.06	5.53	2.80	8345	317.5	5280	3125	5350	2780		0.3
8	20.03	26.29	10.60	9.39	7.81	2.85	8640	407.5	5325	3043	5008	2408		0.1
9	20.52	26.95	12.25	10.07	8.20	2.92	8245	422.5	5215	3130	4803	2553		1.9
10	18.41	24.43	8.68	6.99	5.14	2.65	7320	160.0	4933	2830	4850	2473		-2.2
Mean	19.61	25.90	10.36	8.95	6.90	2.81	8062	345.0	5165	2980	4961	2578		-0.0
CV	4.6	4.3	9.7	12.0	17.3	4.3	9.1	34.2	5.1	8.0	6.5	7.5		2.0
USP[5%]														

IPI = 82.86
Count = 25.45
CSP = 2226
CV % = 0.62%

Spectrogram Mass

App-16

USTER® TESTER 5 – S400 R 5.7 Sat 02.06.18 11:04 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	31.1 ° C	Rel. H	64.5 %
Style	26 NEPS	Sample ID	19194	Nom. count	Nec 25.5	Nom. twist	22.78 T/inch
Tests	10 / 1	v= 400 m/min	t= 1 min	Meas. slot	3	Short staple	

STD. TABLE & SPECTROGRAM

Article CP2600N/10 Material class Yarn Mach. Nr. R.F=33
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100% 0%
26Neps

Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt ± %
	%	%	%	%	%									
1	21.15	28.35	11.80	10.54	8.96	3.07	10520	947.5	5598	3440	6328	3503		-11.8
2	19.66	26.02	9.87	8.35	6.18	2.82	8720	480.0	5310	3220	5708	3055		-1.2
3	18.61	24.54	9.26	8.10	6.37	2.66	7708	200.0	5030	2968	5238	2780		5.5
4	20.41	26.70	9.45	8.42	7.06	2.90	9215	630.0	5573	3280	5463	2858		0.6
5	18.42	24.27	10.56	9.48	7.67	2.63	7063	210.0	4653	2660	4925	2675		3.2
6	19.32	25.44	9.35	7.93	6.24	2.76	8080	437.5	5455	3290	5340	2758		4.3
7	17.79	23.70	9.48	8.26	5.97	2.57	7020	190.0	4640	2595	4718	2460		2.7
8	19.68	25.90	9.23	7.51	5.63	2.81	8978	465.0	5235	3118	5320	2803		3.8
9	19.80	26.44	10.38	9.14	6.23	2.87	8845	542.5	5195	3103	5643	2980		6.1
10	18.72	24.86	9.67	8.03	6.35	2.70	7563	292.5	4943	2840	5035	2530		0.9
Mean	19.36	25.62	9.90	8.57	6.67	2.78	8431	439.5	5163	3051	5372	2840		0.0
CV	5.2	5.3	8.2	10.4	14.8	5.3	13.0	53.7	6.7	9.2	8.5	10.4		5.4
USP™														

IPI = 8862
Count = 25.78
CSP = 2289
CV% = 0.52%

Spectrogram Mass

App-17

USTER® TESTER 5 – S400 R 5.7 Sat 02.06.18 11:18 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	31.4 ° C	Rel. H	67.3 %
Style	26 NEPS	Sample ID	19195	Nom. count	Nec 25.5	Nom. twist	22.78 T/inch
Tests	10 / 1	v= 400 m/min	t= 1 min	Meas. slot	3	Short staple	

STD. TABLE & SPECTROGRAM

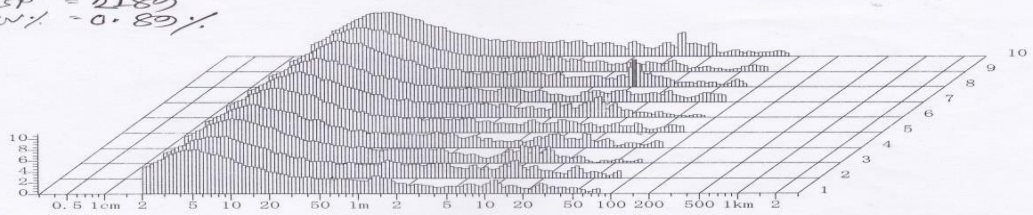
Article CP2600N/11 Material class Yarn Mach. Nr. R.F=33
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100% 0%
26Neps

Total tests : 10 / 10 Single test(s)

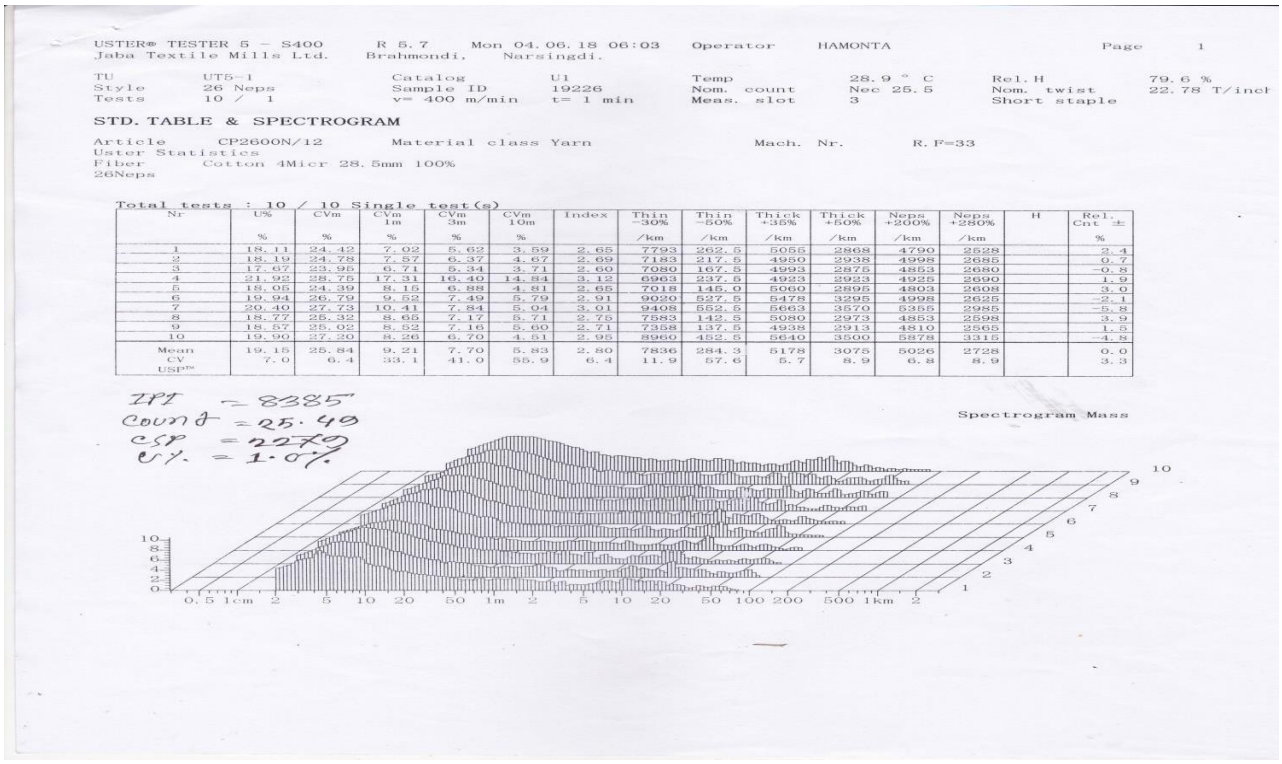
Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt ± %
	%	%	%	%	%									
1	20.31	26.92	7.41	6.15	4.83	2.92	10445	882.5	5973	3875	6343	3520		-0.9
2	21.24	28.10	9.87	7.98	5.39	3.05	11163	937.5	6038	3788	6250	3470		-2.9
3	19.06	25.18	7.57	6.15	4.43	2.73	9163	367.5	5675	3355	5765	3110		3.2
4	20.29	26.73	9.84	8.74	7.30	2.90	9915	675.0	5695	3603	6185	3318		-1.5
5	20.48	26.86	8.19	6.79	5.13	2.91	10875	900.0	6115	3895	6405	3513		1.8
6	20.40	27.00	9.02	6.92	4.13	2.93	10698	842.5	6010	3740	6538	3623		-1.3
7	20.74	27.16	10.63	9.69	8.18	2.95	10328	797.5	6028	3838	6255	3335		1.9
8	21.68	28.45	8.76	7.04	4.52	3.09	11808	1117.5	6490	4300	6555	3690		0.7
9	20.46	26.91	8.04	6.43	4.90	2.92	11168	845.0	6050	3843	6485	3468		-0.3
10	21.99	28.76	9.31	7.19	4.46	3.12	11940	1235.0	6420	4240	6415	3623		-0.7
Mean	20.67	27.21	8.86	7.31	5.33	2.95	10750	860.0	6049	3848	6320	3467		-0.0
CV	4.0	3.8	12.0	15.9	25.1	3.8	7.8	27.3	4.3	7.1	3.7	5.0		1.9
USP™														

IPI = 11028
Count = 25.62
CSP = 2189
CV% = 0.89%

Spectrogram Mass



App-18



USTER® TESTER 5 – S400 R 5.7 Mon 04.06.18 06:03 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 28.9 ° C Rel.H 79.6 %
Style 26 Neps Sample ID 19226 Nom. count Nec 25.5 Nom. twist 22.78 T/inch
Tests 10 / 1 v= 400 m/min t= 1 min Meas. slot 3 Short staple

STD. TABLE & SPECTROGRAM

Article CP2600N/12 Material class Yarn Mach. Nr. R.F=33
Uster Statistics
Fiber Cotton 4Micr 28.5mm 100%
26Neps

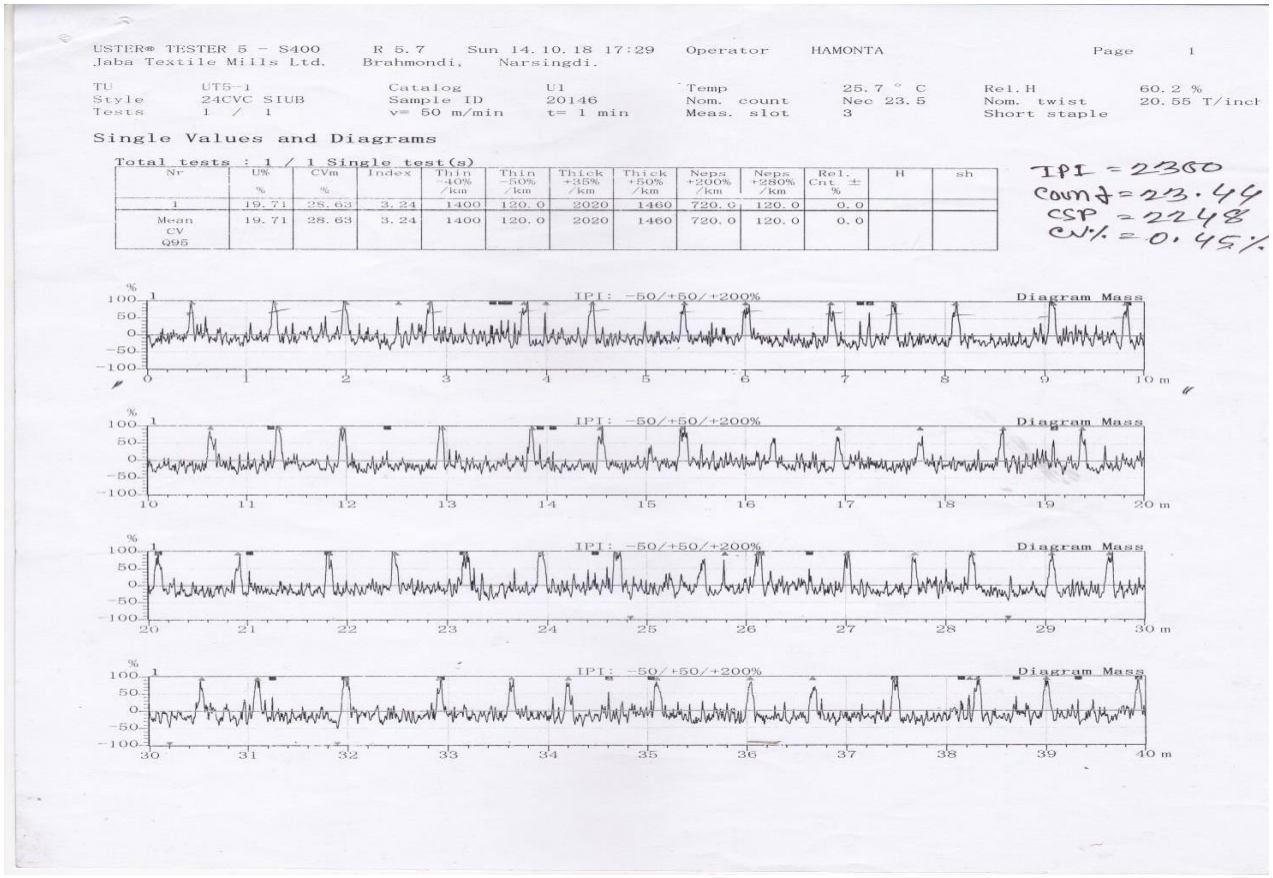
Total tests : 10 / 10 Single test(s)

Nr	U%	CVm	CVm 1m	CVm 3m	CVm 10m	Index	Thin -30% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	H	Rel. Cnt ± %
	%	%	%	%	%									
1	18.11	24.42	7.02	5.62	3.59	2.65	7793	262.5	5055	2868	4790	2528		2.4
2	18.19	24.78	7.57	6.37	4.67	2.69	7183	217.5	4950	2938	4998	2685		0.7
3	17.67	23.96	6.71	5.34	3.71	2.60	7080	167.5	4993	2875	4853	2680		-0.8
4	21.92	28.75	17.31	16.40	14.84	3.12	6963	237.5	4923	2923	4925	2690		1.9
5	18.08	24.39	8.16	6.88	4.81	2.65	7018	145.0	5060	2895	4803	2608		3.0
6	19.94	26.79	9.52	7.49	5.79	2.91	9020	527.5	5478	3295	4998	2625		-2.1
7	20.40	27.73	10.41	7.84	5.04	3.01	9408	552.5	5663	3570	5355	2985		-5.8
8	18.77	25.32	8.68	7.17	5.71	2.75	7583	142.5	5080	2973	4853	2598		3.9
9	18.57	25.02	8.52	7.16	5.60	2.71	7358	137.5	4938	2913	4810	2565		1.5
10	19.90	27.20	8.26	6.70	4.51	2.95	8960	452.5	5640	3500	5878	3315		-4.8
Mean	19.15	25.84	9.21	7.70	5.83	2.80	7836	284.3	5178	3075	5026	2728		0.0
CV	7.0	6.4	33.1	41.0	55.9	6.4	11.9	57.6	5.7	8.9	6.8	8.9		3.3
USP™														

IPI = 8385
Count = 25.40
CSP = 2270
CV% = 1.07%

Spectrogram Mass

App-19



USTER® TESTER 5 – S400 R 5.7 Sun 14.10.18 17:29 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU UT5-1 Catalog U1 Temp 25.7 ° C Rel.H 60.2 %
Style 24CVC SIUB Sample ID 20146 Nom. count Nec 23.5 Nom. twist 20.55 T/inch
Tests 1 / 1 v= 50 m/min t= 1 min Meas. slot 3 Short staple

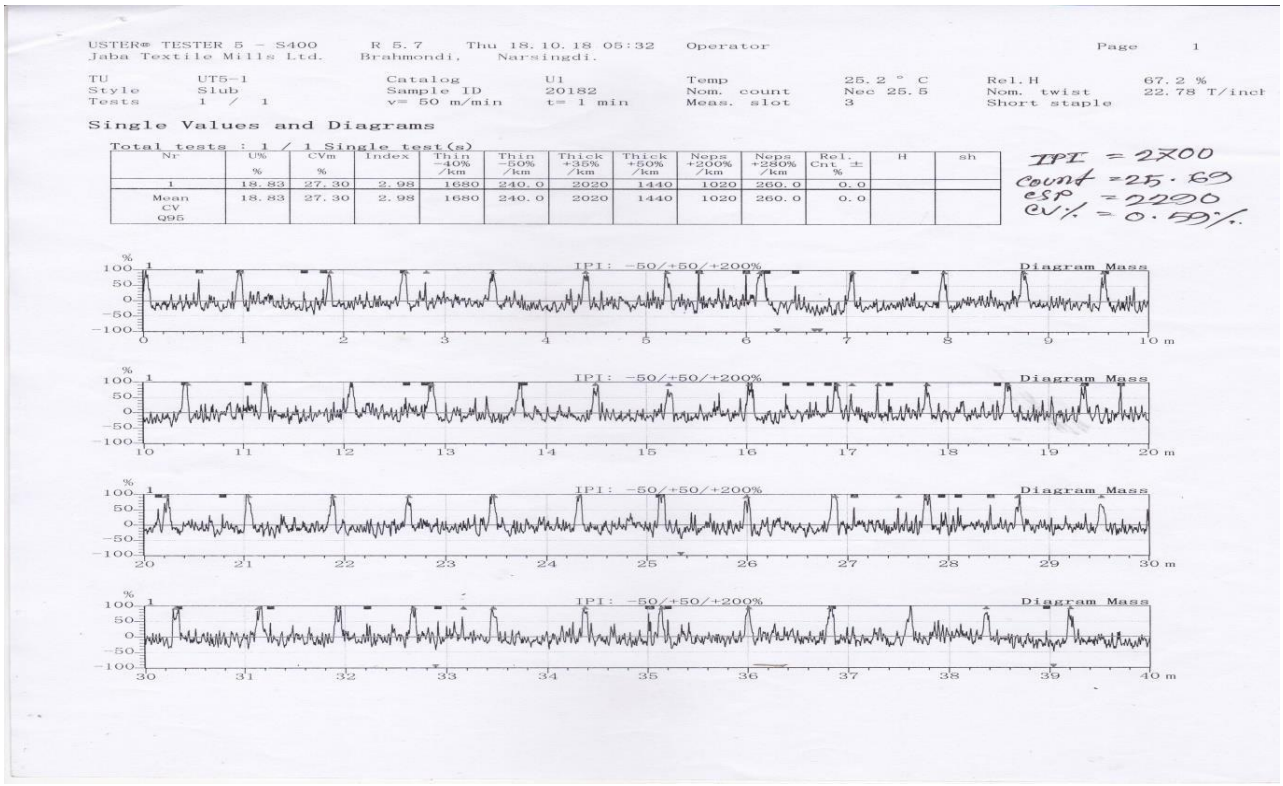
Single Values and Diagrams

Total tests : 1 / 1 Single test(s)

Nr	U%	CVm	Index	Thin -40% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	Rel. Cnt ± %	H	sh
	%	%										
1	19.71	28.63	3.24	1400	120.0	2020	1460	720.0	120.0	0.0		
Mean	19.71	28.63	3.24	1400	120.0	2020	1460	720.0	120.0	0.0		
CV												
Q95												

IPI = 2360
Count = 23.44
CSP = 2248
CV% = 0.45%

App-20



USTER® TESTER 5 – S400 R 5.7 Thu 18.10.18 05:32 Operator Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	25.2 ° C	Rel.H	67.2 %
Style	Slub	Sample ID	20182	Nom. count	Nec 25.5	Nom. twist	22.78 T/inch
Tests	1 / 1	v= 50 m/min	t= 1 min	Meas. slot	3	Short staple	

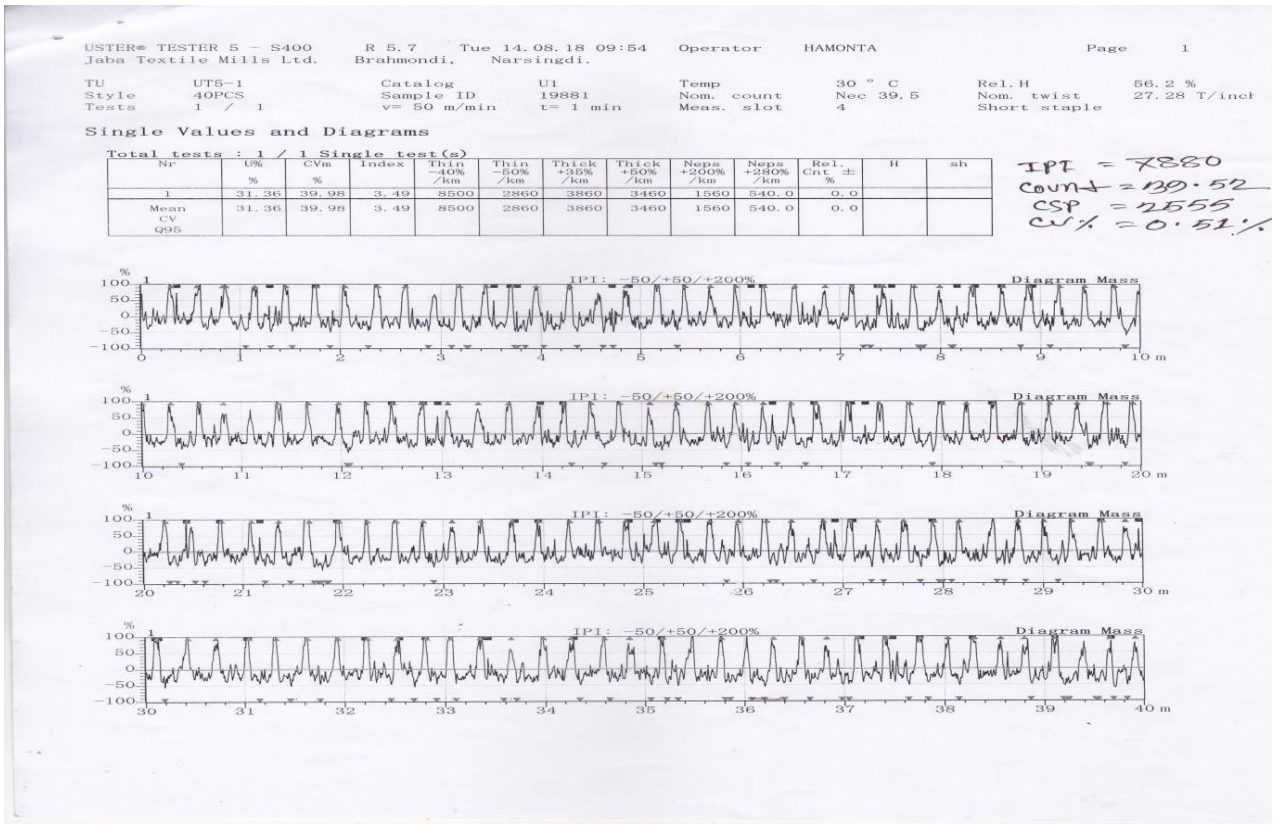
Single Values and Diagrams

Total tests : 1 / 1 Single test(s)

Nr	U% %	CVm %	Index	Thin -40% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	Rel. Cnt ± %	H	sh
1	18.83	27.30	2.98	1680	240.0	2020	1440	1020	260.0	0.0		
Mean	18.83	27.30	2.98	1680	240.0	2020	1440	1020	260.0	0.0		
CV												
Q95												

IPI = 2700
count = 25.69
csp = 2290
CV% = 0.59%

App-21



USTER® TESTER 5 – S400 R 5.7 Tue 14.08.18 09:54 Operator HAMONTA Page 1
Jaba Textile Mills Ltd. Brahmondi, Narsingdi.

TU	UT5-1	Catalog	U1	Temp	30 ° C	Rel.H	56.2 %
Style	40PCS	Sample ID	19881	Nom. count	Nec 39.5	Nom. twist	27.28 T/inch
Tests	1 / 1	v= 50 m/min	t= 1 min	Meas. slot	4	Short staple	

Single Values and Diagrams

Total tests : 1 / 1 Single test(s)

Nr	U% %	CVm %	Index	Thin -40% /km	Thin -50% /km	Thick +35% /km	Thick +50% /km	Neps +200% /km	Neps +280% /km	Rel. Cnt ± %	H	sh
1	31.36	39.98	3.49	8500	2860	3860	3460	1560	540.0	0.0		
Mean	31.36	39.98	3.49	8500	2860	3860	3460	1560	540.0	0.0		
CV												
Q95												

IPI = 7880
count = 39.52
CSP = 2555
CV% = 0.51%

App-22

Appendix-II

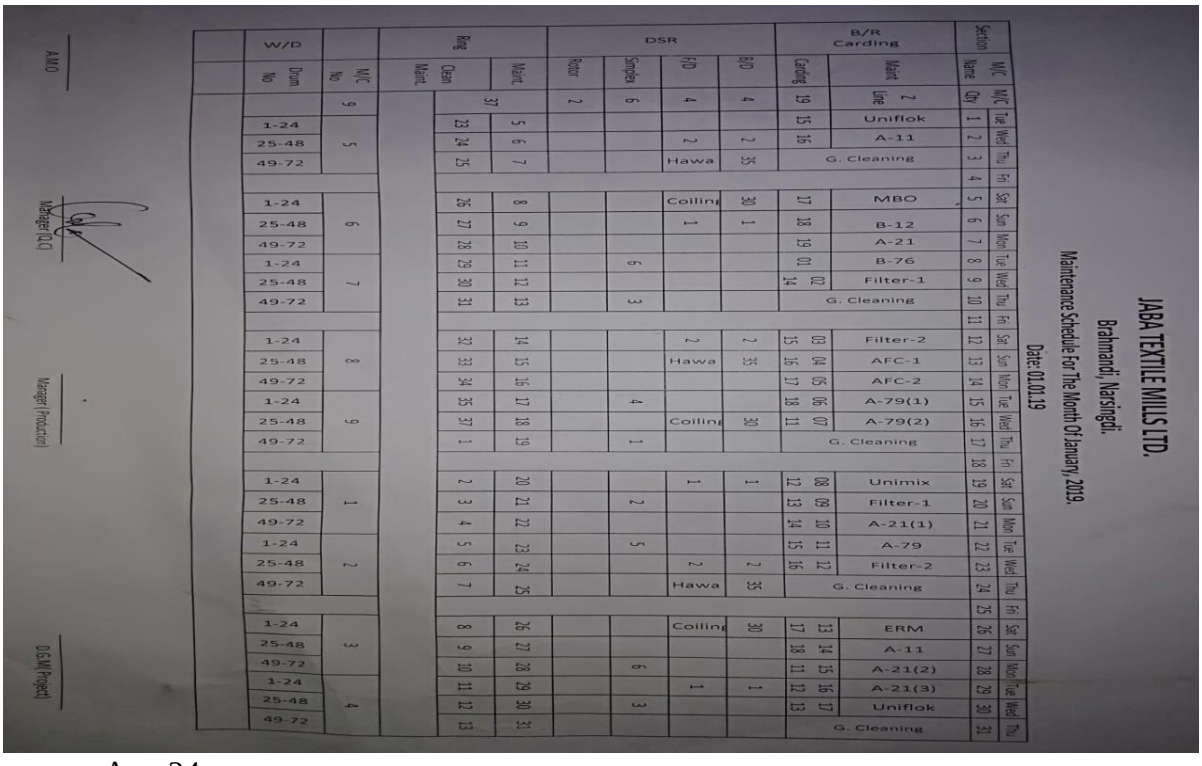
Maintenance Schedule & Maintenance Manpower

Akota Composite Mills Ltd.
Mutiad, Sreepur, Gazipur.
MAINTENANCE SCHEDULE
Month Of November-2018

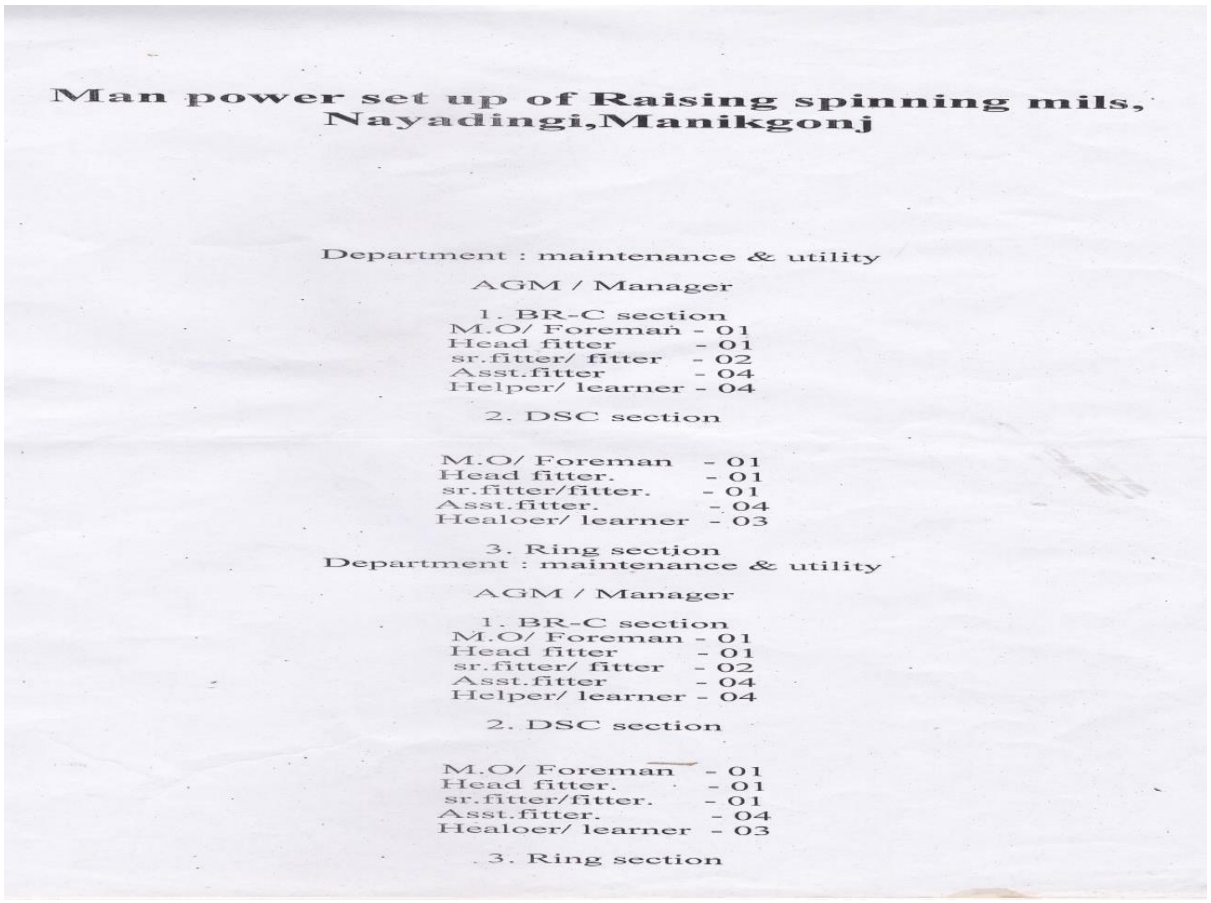
Auto Cone	Ring	D.S.C	Carding	Blow Room	Date
M/c-4. D-46 -60	M/C: 26 / 37	G. Clean	G. Clean	G. Clean	01.11.18
Friday	Friday	Friday	Friday	Friday	02.11.18
M/c-5. D-01 -15	M/C: 09, 10/ 11, 12	S / F-03	CR-05 & CH-02	Hopper Fidder-01 C.B.O	03.11.18
M/c-5. D-16 -30	M/C: 07, 08/ 13, 14	D / F-2	CR-06 & CH-01	Hopper Fidder-02 C.B.O	04.11.18
M/c-5. D-31 -45	M/C: 05, 06/ 15, 16	S / F-04	CR-07 & CH-12	Piono Motion -01 C.P.C	05.11.18
M/c-5. D-46 -60	M/C: 03, 04/ 53, 54	D / F-4	CR-01 & CH-11	Piono Motion -02 C.P.C	06.11.18
M/c-6. D-01 -15	M/C: 01, 02/ 55, 56	S / F-05	CR-02 & CH-10	Scutcher - 01 H.B.B	07.11.18
G. Clean	M/C: 51 / 52	G. Clean	G. Clean	G. Clean	08.11.18
Friday	Friday	Friday	Friday	Friday	09.11.18
M/c-6. D-16 -30	M/C: 27, 49/ 50, 57	D / F-5	CR-03 & CH-09	Scutcher- 02 C.D.R	10.11.18
M/c-6. D-31 -45	M/C: 28, 47/ 48, 58	S / F-06	CR-04 & CH-08	Bale Plaker H.B.B	11.11.18
M/c-6. D-46 -60	M/C: 17, 29/ 46, 59	D / F-1	CR-05 & CH-07	Hopper Fidder-01 C.B.O	12.11.18
M/c-1. D-01 -15	M/C: 18, 30/ 45, 60	S / F-07	CR-06 & CH-06	Auto Blander (Case) C.P.C	13.11.18
M/c-1. D-16 -30	M/C: 19, 36 / 44, 61	D / F-2	CR-07 & CH-05	Hopper Fidder-02 C.B.O	14.11.18
G. Clean	M/C: 35 / 62	G. Clean	G. Clean	G. Clean	15.11.18
Friday	Friday	Friday	Friday	Friday	16.11.18
M/c-1. D-31 -45	M/C: 20, 34/ 43, 63	S / F-01	CR-01 & CH-04	Auto Blander (Front)	17.11.18
M/c-1. D-46 -60	M/C: 21, 33/ 42, 64	D / F-4	CR-02 & CH-03	Piono Motion -01 C.P.C	18.11.18
M/c-2. D-01 -15	M/C: 22, 32/ 41, 65	S / F-02	CR-03 & CH-02	Piono Motion -02 C.P.C	19.11.18
M/c-2. D-16 -30	M/C: 23, 31/ 40, 66	D / F-5	CR-04 & CH-01	Scutcher - 01 H.B.B	20.11.18
M/c-2. D-31 -45	M/C: 24, 25/ 38, 39	S / F-03	CR-05 & CH-12	Scutcher- 02 C.D.R	21.11.18
M/c-2. D-46 -60	M/C: 26 / 37	G. Clean	G. Clean	G. Clean	22.11.18
Friday	Friday	Friday	Friday	Friday	23.11.18
M/c-3. D-01 -15	M/C: 09, 10/ 11, 12	D / F-1	CR-06 & CH-11	Bale Plaker H.B.B	24.11.18
M/c-3. D-16 -30	M/C: 07, 08/ 13, 14	S / F-04	CR-07 & CH-10	Hopper Fidder-01 C.B.O	25.11.18
M/c-3. D-31 -45	M/C: 05, 06/ 15, 16	D / F-2	CR-01 & CH-09	Hopper Fidder-02 C.B.O	26.11.18
M/c-3. D-46 -60	M/C: 03, 04/ 53, 54	S / F-05	CR-02 & CH-08	Double Roller C.P.C	27.11.18
M/c-4. D-01 -15	M/C: 01, 02/ 55, 56	D / F-4	CR-03 & CH-07	Hopper Fidder-02 C.B.O	28.11.18
M/c-4. D-16 -30	M/C: 51 / 52	G. Clean	G. Clean	G. Clean	29.11.18

Deputy General Manager

App-23



App-24



Man power set up of Raising spinning mils, Nayadingi,Manikgonj

Department : maintenance & utility

AGM / Manager

1. BR-C section
M.O/ Foreman - 01
Head fitter - 01
sr.fitter/ fitter - 02
Asst.fitter - 04
Helper/ learner - 04

2. DSC section

M.O/ Foreman - 01
Head fitter. - 01
sr.fitter/fitter. - 01
Asst.fitter. - 04
Healoer/ learner - 03

3. Ring section

Department : maintenance & utility

AGM / Manager

1. BR-C section
M.O/ Foreman - 01
Head fitter - 01
sr.fitter/ fitter - 02
Asst.fitter - 04
Helper/ learner - 04

2. DSC section

M.O/ Foreman - 01
Head fitter. - 01
sr.fitter/fitter. - 01
Asst.fitter. - 04
Healoer/ learner - 03

3. Ring section

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M.O/ Foreman. - 01
Head fitter. - 01
sr.fitter/ fitter. - 04
Asst.fitter. - 06
Helper/ learner. - 06

4. Auto conner section

M.O/ Foreman. - 01
Head fitter. - 01
sr.fitter/ fitter. - 01
Asst.fitter. - 04
Helper/ learner. - 03

Department : Utility

1. Generator section

Manager/ Dy. Manager. - 01
Engineer/ Asst. Engineer. - 01
SAE. - 04
Sr.fitter/ fitter. - 02
Helper/learner. - 04

2. A/C plant

Manager. - 01
M.O/ Foreman - 01
sr. Fitter/Fitter - 01
Asst. Fitter. - 05
Helper/ learner. - 06

this set up for 30000 spindle floor

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Jaba Textile Mills Limited.

Please mention every floor level people's experiece and educational qualification separation them by giving comma.

An example has been given in the following table.

Factory Capacity : 15000 Kgs/day, **Section** : Spining, No of SPL : 39450

No of staff				Year of Experience in relevant field.				Qualification			
General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift
23	6	6	6	2,4,5,6	2,4	2,4	2,4	S.S.C, Vii, BTEB trade certificate, Vocational	Viii, S.S.C	Vocational, Viii	Vocatio nal, Viii

Factory Name : Jaba Textile Mills Limited.

Factory Capacity : 2 ton / day

Section : Knitting

Table 1 : Floor Level people (Fitter / Technician)

No of staff			Year of Experience in relevant field.			Qualification		
General Shift	A Shift	B Shift	General Shift	A Shift	B Shift	General Shift	A Shift	B Shift
1	4	4	18	4,5	4,5	Viii	S.S.C H.S.C	S.S.C/H.S.C

Table 2 : Floor Level people (Electrician)

No of staff				Year of Experience in relevant field.				Qualification			
General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift
6	2	2	2	8,6,4	2,3	2,3	2,3	S.S.C	S.S.C H.S.C	S.S.C H.S.C	S.S.C H.S.C

Factory Name : Jaba Textile Mills Limited.
Factory Capacity : 15000 Kgs / day (SPG)
Section : 2 Ton / day (Knitting)

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Jaba Textile Mills Limited.

Please mention every floor level people's experiece and educational qualification separation them by giving comma.

An example has been given in the following table.

Factory Capacity : 15000 Kgs/day, **Section** : Spining, No of SPL : 39450

No of staff				Year of Experience in relevant field.				Qualification			
General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift
23	6	6	6	2,4,5,6	2,4	2,4	2,4	S.S.C, Vii, BTEB trade certificate, Vocational	Viii, S.S.C	Vocational, Viii	Vocatio nal, Viii

Factory Name : Jaba Textile Mills Limited.

Factory Capacity : 2 ton / day

Section : Knitting

Table 1 : Floor Level people (Fitter / Technician)

No of staff			Year of Experience in relevant field.			Qualification		
General Shift	A Shift	B Shift	General Shift	A Shift	B Shift	General Shift	A Shift	B Shift
1	4	4	18	4,5	4,5	Viii	S.S.C H.S.C	S.S.C/H.S.C

Table 2 : Floor Level people (Electrician)

No of staff				Year of Experience in relevant field.				Qualification			
General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift	General Shift	A Shift	B Shift	C Shift
6	2	2	2	8,6,4	2,3	2,3	2,3	S.S.C	S.S.C H.S.C	S.S.C H.S.C	S.S.C H.S.C

Factory Name : Jaba Textile Mills Limited.
Factory Capacity : 15000 Kgs / day (SPG)
Section : 2 Ton / day (Knitting)

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