SMEDA-JICA INDUSTRY SUPPORT PROGRAM

BEST PRACTICES MANUAL

SPINNING SECTOR

Compiled by: Industry Support Cell

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BACKGROUND

This manual has been prepared under the SMEDA – JICA Industry Support Program. With the courtesy of Government of Japan and JICA (Japan International Cooperation Agency), Senior Volunteers Program started in Pakistan in 2004 for the Up-gradation of Textile Industry. The objective of this program was to provide expertise, knowledge transfer and skill up-gradation for the enhancement of productivity, efficiency and to impart know how to local industry for better management practices.

Senior Japanese Spinning Expert **Mr. Tomio FUWA** offered his services for Spinning Sector of Pakistan for a period of two years (2004 – 2006). During this period **Mr. Tomio FUWA** provided guidance / consultancy to various individual Spinning Units.

Thirty three factories were selected under this Program as a model unit, where Japanese Expert spent two weeks each along with SMEDA team members **Mr. Rana Muhammad Wajid Khan** & **Mr. Muhammad Ayaz.**

This manual highlights the main areas where the guidance was provided. This includes process details, key findings, suggestions made, steps taken and recommended formats. It has been prepared by Mr. Rana Muhammad Wajid Khan & Mr. Muhammad Ayaz and reviewed and checked by Mr. Tomio FUWA.

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AREAS IDENTIFIED AND SUGGESTED REMEDIES

1 5 S (A Japanese Management Technique)

It is appropriate to discuss at the outset the immediate step for bringing improvement in all the areas of the Spinning mill. Whatever weaknesses were found in the various departments from Mixing to Packing are mostly attributed to the lack of management. Majority of the points discussed in coming sections may not be new to the practitioners but they are somehow overlooked. When we consider all those in combination they affect the productivity and quality substantially. Therefore, 5S (a Japanese quality management concept) was introduced and advised by JICA expert to use in the whole organisation for creating a high quality, a highly productive and a safe working environment. Following are the details about 5S.

1.1 What is 5 S?

5S is a simple and systematic five step Japanese approach for clean, neat, properly organized workplace through employee's initiatives. It should be gradually adopted and than it will become a habit. It is an acronym for five Japanese words Seiri, Seiton, Seiso, Seiketsu, and Shitsuke.

The meaning of 5S is explained as follows:

Seiri: To sort and throw away unnecessary items.

Seiton: A place for everything and every thing in its place.

Seiso: Maintain high standards of cleanliness, dust free and dirt free.

Seiketsu: Standardize all procedures.

Shitsuke: Train and maintain discipline.

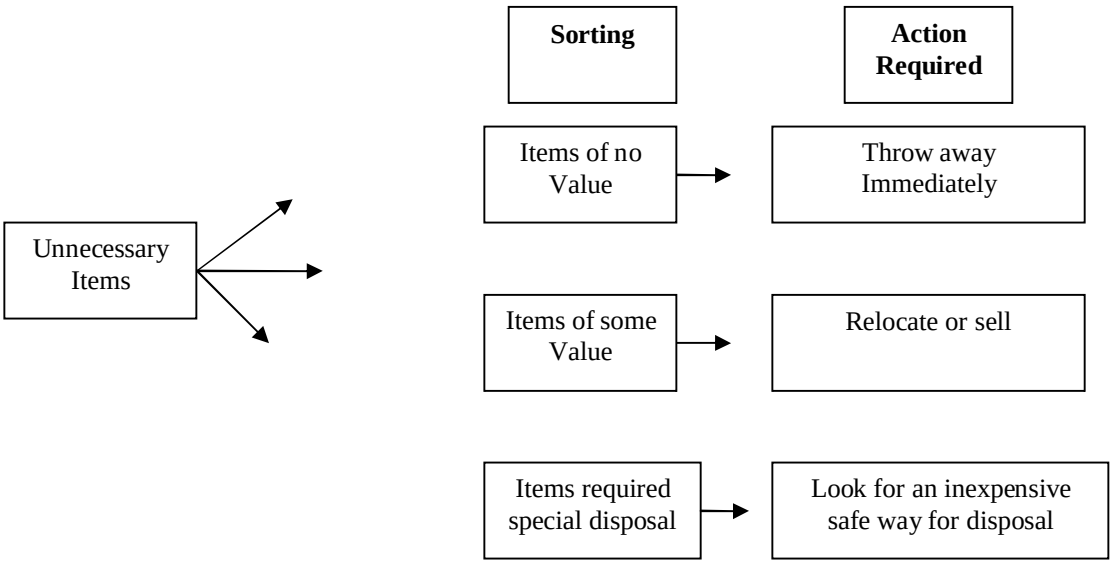
5S can provide a solid foundation for other productivity and quality programs such as Total Quality Management, Total Productive Maintenance, Waste Reduction and Just in Time Production and Inventory. 5S reduces the gap between the top and bottom levels of employees and develops a team work.

1.2 How to Practice 5S?

1.2.1 Seiri

Identify the things which are not of use anymore. Examples are defective equipments, outdated material and obsolete documents etc. The following guide can be used to classify all the necessary items.

Guide to classify Unnecessary Items

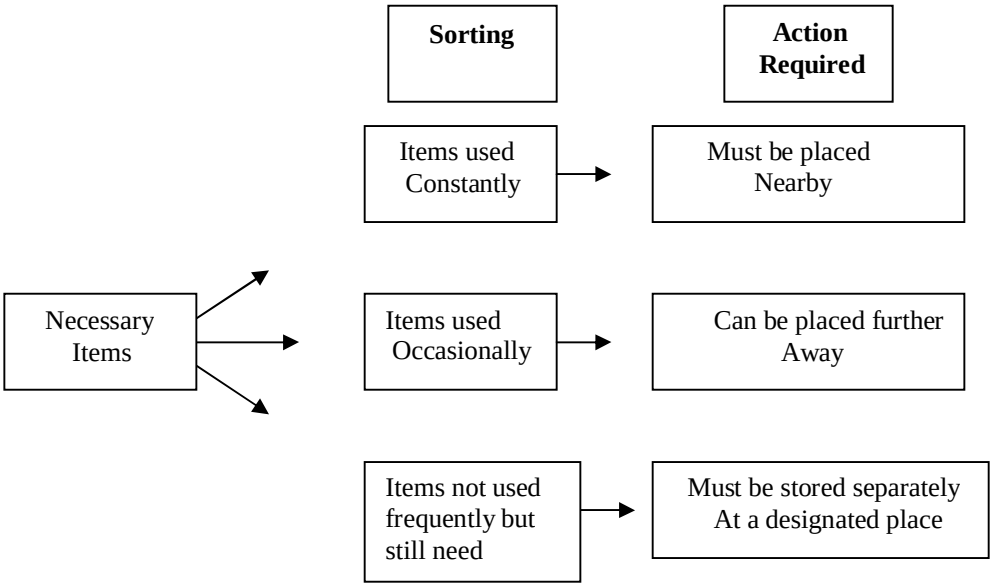


The company should have a set of objective criteria on the retention and disposal of items.

1.2.2 Seiton

It is important to plan for the location of the things. The plan will make it easier to locate items when they are needed. It is important to return the items to their original place after use. The following guide line can be used to help in arranging the necessary items.

Guide to classify Necessary Items



Concerned personnel are likely to forget the location of certain items not often used. To prevent this **"Visual Control"** can be used to mark out the items and their locations. With properly marked storage places, out of place items can be easily spotted. The use of colours, labels, charts can be used for visual control.

1.2.3 Seiso

The practice of Seiso is important for the company's image and health of its employees. It is also prerequisite for the production of quality goods and services.

Following are some of ways to implement Seiso at the workplace:

- Organize a big cleaning day once or twice a year that involves everyone.
- Set aside some time each day to clean workplace. Cleaning work is easier and faster when done daily as the dirt accumulated would be minimal.
- Employees to be made responsible for the cleanliness of their own immediate work areas.

- Conduct regular cleaning of machines and tools that are in use. This would be a good starting point for productive maintenance because clean machinery and equipment encounter fewer breakdowns.

1.2.4 Seiketsu

To maintain a high standard of workplace by keeping everything clean and orderly at all times the 5S movement must be sustained within the company by repeating Seiri, Seiton and Seiso activities. The 5S must be implemented according to a company wide standard. The purpose is to make sure that the entire organization follows the same rules; same names and colors etc.

Following are some guidelines for Seiketsu (Standarderizing):

- Create a cleaning system for house keeping. For example, make a weekly schedule for cleaning and organizing the workplace.
- Form 5S teams among the various departments to brainstorm on possible housekeeping projects. These will help in creating a sense of ownership and participation among the employees. The achievements by these teams should motivate both management and colleagues to share their experiences.
- Organize inter-departmental competitions on housekeeping. These will produce motivation and create the importance of housekeeping at the workplace. Also it will help to create new ideas on visual control to be implemented resulting higher productivity.

1.2.5 Shitsuke

The 5S program is a long term approach to improve the work environment. The benefits could only be fully realized through the continued efforts of every employee in the organization. Total participation is must for Shitsuke to succeed. The organization should train all the employees and develop a company culture whereby good housekeeping becomes a habit for everyone.

Following are some ways to implement it:

- Every one should play an effective role in housekeeping efforts at the workplace to set good examples for others to follow.
- Plan a comprehensive training on 5S and implement it.
- With continuous improvement in mind, the changes brought at workplace will convince employees and create positive attitude towards 5S.
- Create a 5S culture where everyone willingly participates and give rewards on good practices.

2 MIXING

2.1 Bales Management

The ultimate object of the spinner is to produce yarn with required quality at lowest possible price. Since, raw material constitutes about 70% of the cost of yarn, therefore, to achieve the ultimate objective and the most important factor is the bale management i.e. selection, grading and mixing in a most economical way.

The following are the observations and suggestions for improving the bale management:

2.1.1 Ensure Cotton Mixing Ratio

It is observed that cotton mixing ratio is not maintained properly in the mixing. The controls are not so much defined. This results in inconsistency in the mixing. The following are the guidelines to ensure the cotton mixing ratio.

(i) If the cotton received is from different ginners, it is better to maintain the percentage of cotton from different ginner's throughout the lot, even though the type of cotton is same.

(ii) If different kinds of imported cotton are being used for mixing in different percentages (on weight basis), this ratio should be maintained using weighing balance.

(iii) If bales are opened manually, then, mixing ratio percentage is not ensured. Because some bales opened early while others still to be opened. It is necessary that all bales being opened should finish at same time for having mixing consistency.

(iv) To get homogeneous mix, maintain same percentage of each grade in each line of lay down.

2.1.2 Cotton Micronaire

The following are the guidelines that should be followed while preparing for daily mixing:

(i) Micronaire range of the cotton bales used should be same for all the daily mixings.

(ii) It is always advisable to use a mixing with very low Micronaire range, preferably 0 .6 to 1.0, because:

- It is easy to optimize the process parameters in blow room and at Cards
- drafting faults will be reduced
- dyed cloth appearance will be better because of uniform dye pickup etc

(iii) Consistency in micronaire must be maintained. Variation of average micronnaire of daily mixing should not be more than 0.1.

2.1.3 Cotton Color

(i) Range of color of cotton bales used should be consistent for all the mixings of a lot.

(ii) There should not be much variation in average cotton color of bales used for all the mixings of a lot.

2.2 Pre-Cleaning of Bales

It is common practice in Pakistan that ginners use metal strips to hold the cotton bales. These metal strips cause the surface of the bales to be rusty. This rust causes holes at fabric stage. Therefore, it is good to clean the bales before opening in tufts. A brush may be used to clean the surface of the bales and remove rust from the surface. Another important observation in this context is that when bales are brought to the mixing area, sometimes the wire is cut just before putting them in the lay down. Therefore, bales do not get enough time to acclimatize. It is important to cut the bale wires and clean the bales immediately when bales are brought to mixing room. This will give the bales enough time to acclimatize.

2.3 Sandwich / Stack Mixing

Sandwich/Stack mixing is a widely used way of doing the mixing compared to using automatic bale opener (Blendomat). If stack mixing is done perfectly it is a good way of mixing. Improper stack mixing will lead to Barre or shade variation problem.

2.3.1 Guidelines for Stack Mixing

It is observed that most of the mills are using sandwich mixing method but do not follow it properly which in turn results in improper mixing. The following are the general guidelines for proper stack mixing:

(i) Mixing should be made in layers and waste should be mixed properly in the layers.

(ii) In case of manual opening, one man - one bale at a time should be followed and worker should store all the jute, cloth, nylon or any other contamination in a bag, should not throw on the floor.

(iii) Mixing heap should be stored 24 hrs before use; fresh mixing will cause variation and hence rejection in lap and also lap licking will occur (in case of lap feed system)

(iv) Bale arrangement in the lay down should be made properly and followed accordingly such that two bales of same area are not placed together in the lay down to facilitate the homogeneous mixing.

2.3.2 Guidelines for Mixing with Automatic Bale Opener

If automatic bale opening machine is used, the bales should be arranged as per following example:

"Let us assume that there are five different micronaires and five different colors in the mixing, 50 bales are used in the mixing. 5 to 10 groups should be made by grouping the bales in a mixing so that each group will have average micronaire and average color as that of the overall mixing. The position of a bale for micronaire and color should be fixed for the group and it should repeat in the same order for all the groups."

2.4 Cutting of Mixing

In case of sandwich mixing, if cutting of mixing is not straight then it creates non homogeneity of material. It is a common mistake made in the mixing. In order to achieve homogeneity, recker should be used for straight cutting of mixing heap.

2.5 Space b/w Wall & Heap

If there is no space between wall and mixing heap, it affects the conditioning of material near the wall due to improper air circulation. To achieve homogeneous conditioning of the material, there should be some space between wall and mixing heap.

2.6 Useable Waste

During the different stages of spinning, waste is generated. The waste generated can be reused in mixing to save the cost. But there should be a balance. Mixing more reusable waste in mixing will result in processing difficulties which will increase the cost rather than saving. It is observed that in many mills useable waste % is not controlled or even not documented. This results in the inconsistency in mixing and affects the yarn quality.

It is recommended that random and uncontrolled amount of reusable waste in the mixing should be avoided at all costs since considerable count variations will result together with quality variations. It is advisable to restrict reusable waste to 5% in mixing for carded yarns and 2.5% in the mixing for combed yarns.

It is also observed that in many mills, there was no department wise record of reusable waste. It is advised to maintain the record of reusable waste from each department so that it can be monitored and controlled effectively.

2.7 Breaking of Useable Waste

Use of useable waste without breaking into small pieces causes difficulty in homogenously mixing the waste with the material. Therefore, it is suggested to use waste by converting it into small pieces. This results in homogenous mixing of useable waste into mixing and will result in less variation in quality results. Secondly, in case of automatic bale opener (blendomat) using the reusable waste in bale form is much better for even mixing of waste.

2.8 Identification and Separation of Mixing Heaps

It is a common observation that when making new mixing heap, old and new mixing heap got mixed or in case of heap of different kinds, there is no proper identification and separation between the heaps. This happened because either there is no partition between the two heaps or it is not effective. It results in

uneven mixing. It is suggested that while making new heap, it should be separated from the old heap by using any kind of partition that fulfills our objective. Also, use identification plates for different mixing heaps.

2.9 Shape of Heap

If shape of heap is not rectangle type, it causes non homogeneous mix after cutting. To get homogeneous mix after cutting, heap should be rectangular and cake cutting should be done for homogeneous mix.

2.10 Use of Polypropylene Bags

It has been observed that in some mills polypropylene bags are being used for storing and transporting the useable waste which when mixed causes contamination. To avoid this problem, instead of polypropylene bags cloth bags should be used.

2.11 Details of Polyester Fibre

There should be proper record about the lot details of Polyester fibres; otherwise, it is difficult to find out the number of crimps and oil percentage and comparing it with the standard values. If oil percentage is more than the standard value it affects the behavior of polyester during processing i.e. more licky laps will be produced and fibre stickiness to the coiler plate of card will also increase.

2.12 Identifications for Useable Waste

Identification of useable waste should be proper. Because if there is no identification for useable waste, there is chance of mixing the useable waste with other type of cotton. Therefore, identification is better from quality point of view.

2.13 Blendomat

It is observed in some mills that safety rope around the blendomat is not being used. It is advised that safety rope around the Blendomat should always be used and also, safety rope on both ends should be placed. It is very important from safety point of view.

Another important point is controlling the air suction at the blendomat. It is observed that sometimes air suction seals are not properly intact which causes weak suction.

2.14 Different Production of Pluckers

It is observed that sometimes production is not same on all the Pluckers that affects mixing ratio of material coming from all the Pluckers. This means that material in all the Pluckers is not finished at same time. In order to get homogeneous mixing; all Pluckers should have same production.

2.15 Trolleys for Transportation of Cotton

In mixing room, it is also common in many mills that Cotton is transferred manually from mixing heap to Bale Breaker. It is observed that this practice increases the working load on the workers. It is suggested that trolleys should be used for transportation of cotton from mixing heap to Bale Breaker (in case of long distance) to control these problems.

2.16 Condenser Cleaning

It is observed that cotton is always hanging in condenser. Condenser cleaning should be done after regular intervals because cotton hanging in the condenser body creates resistance in trash dropping through small holes of condenser.

2.17 Filling of Plucker

It is observed that sometimes Plucker is being filled in running condition that is not good from quality point of view. This practice causes weight variations. It is advised that Plucker should be filled in idle condition and cotton inside the Plucker should be pressed to avoid weight variation problems.

2.18 Acclimatization of Heap

Mixing heap should be stored for acclimatization. It is observed that in some cases, it is not being stored which affects quality results. It is advised that newly made heap should be stored for conditioning to get good yarn quality results.

2.19 Atmospheric Conditions

Cotton is a hygroscopic material, hence it easily adapts to the atmospheric air conditions. Air temperature inside the mixing room and blowroom area should be more than 25 degree centigrade and the relative humidity (RH %) should be around 45%, because high moisture in the fibre leads to poor cleaning and dryness in the fibre leads to fibre damage which ultimately reduces the spin ability of cotton.

3 BLOW ROOM

3.1 Handling and Storage of Laps

Many mills in Pakistan are using the Lap feed system. An important consideration in this regard is the handling and storage of laps. The following are the important points to be considered:

- Lap must be handled with care also it must be protected from being rubbed.
- Laps should not be stored on the floor. A plat form should be used for storage of laps.

- Identification system should be in place to identify the laps produced from different Scutchers. This may be accomplished by using color coding on the lap rods or using covers of different color to protect the lap.

3.2 Actual Lap Rejection & Number of Lap Produced

It is a common practice in the industry that lap rejection is calculated by checking the 20 laps from one scutcher/day. It is not an effective measure of lap rejection. It is better to focus on the actual lap rejection which can be calculated easily by using statistical techniques. In the mills every lap is weighed by the operator. A check sheet is prepared or a control chart is used and the operator has to put a mark after weighing the lap on the check sheet or control chart. In this way, not only lap weight can be controlled but also actual number of laps produced/shift and actual lap rejection can be calculated. But for that purpose operators are needed to be trained. Using the control chart will ensure that lap weight remains in control and before it goes out of the limit, a corrective action can be taken. Another advantage is that it monitors the trend, sometimes C.V of lap is good but weight is on higher or lower side so, monitoring the trend in that case will help to judge it.

3.3 Lap Rods

Lap rods influence the quality of sliver at card. It has to be straight so that, on card during running it should not take jerk that will cause stretch to the lap and affects the C. V. % of the carding sliver. In most of the mills it is found that lap rods are not straight. There is no system to check and ensure the straightness of lap rods. It is advisable to have a weekly schedule to check all the lap rods and correct the faulty ones.

3.4 Use of Roving

It is a common practice in the industry to use rovings on the scutcher to avoid lap licking. It is observed that the number of rovings being used is not controlled that affects lap licking. Therefore, adequate and same number of rovings should be used on all Scutchers.

Secondly, sometimes Roving feeding angle on Scutcher is found sharp that causes breakage of roving. It is suggested that roving hook or guide should be used to avoid this problem.

Another observation is that sometimes operators do not tie up roving as it breaks. It is advised that roving should run continuously and if it breaks, operator should tie up roving immediately for good quality of laps. Operator should be trained to follow the practice.

3.5 Callender Roller Weight

In most of the mills that have Scutchers, it is observed that callender roller weight touches to the floor surface, it affects pressing of lap sheet. Therefore, callender roller weight should not touch with floor surface to have the proper weight on the lap sheet.

3.6 Piano Motion

Piano motion at Scutcher requires proper attention. It is observed that sometimes piano motion paddles continuously touch the rest bolts. This results in thin lap sheet. This should be checked regularly as this affects the quality of lap. First, adjust the paddles and feed roller gauge and then adjust the rest bolt.

3.7 Condition of Kirshner Beater Spikes

Condition of krishner beater spikes is also very important because poor condition of Kirshner beater spikes results in poor opening of fibres. To get better results, either the spikes should be repaired or replaced.

3.8 Lap Weight Control Limit

It is advised that standard lap weight and control limits should be displayed near the weighing scale so that; operators (either new or old) have a clear indication for passing or rejecting the lap. Just verbal communication is not enough.

3.9 Placement of Old and New Laps

It is suggested that position of lap stand should be horizontal instead of vertical which is found normally. Horizontal position make ease for the placement of laps and then using first in first out order. Vertical placement of laps creates difficulty to take out old laps prior to new laps.

3.10 Shell Roller

Timing of shell roller is very important. It is observed that shell roller moves at a faster speed even after the doffing of lap that causes additional cutting of initial piece of lap hence more material wastage. It is advised that timing of shell roller should be set properly.

3.11 Reusing Rejected Laps

Rejected laps should not be directly mixed into mixing heap. It is suggested that rejected laps should be directly fed to Bale Breaker instead of mixing into heap.

3.12 Use of Condenser Air

In some mills, Condenser air is thrown directly outside that causes wastage of cotton fibres. It is advised that some perforated sheet or filter should be placed to collect cotton fibres and avoid wastage of fibres.

3.13 Causes of Faulty Laps

- Improper air current being produced by Scutcher fan causes lap variation. If fan speed is too slow then cotton moves in the cage in a sluggish manner and if fan speed is too high then, the cotton will be drawn towards the center of cage.
- If lap is thicker on one side then, it may be due to the improper damper setting that allows the greater amount of cotton on one side.
- Large tuft size will cause irregular lap.
- To produce the lap with minimum variation, it is important to maintain the level of material in each hopper.
- The amount of rejected laps being reprocessed tends to produce more off weight laps.
- Uniform pressure on the calendar rolls will prevent conical laps.
- Licking of lap results due to too much soft waste in mixing, damp cotton or damp atmosphere, too high fan speed, insufficient weight on the calendar roll, dirty cage or worn calendar roll and beater blade.
- Lap with defective edge results from cotton accumulation between the cages and stripping plates, waste accumulation at sides of machines or grid bars.

3.14 Further Guidelines for Blow Room

- It is advisable to run the fans at optimum speeds. Higher fan speeds will increase the material velocity and will create turbulance in the bends. This will result in curly fibres which will lead to entanglements i.e. neps.

- It is advisable to reduce the number of fans in the line.
- Material level in the storage chambers should be full and it should never be less than 1/4th level.
- All blow room machines should work with maximum efficiency. The feed roller speeds should be selected in such a way that it works at least 90% of the running time of the next machine.
- Blow room stoppages will always affect the sliver quality both in terms of linear density and tuft size. Blow room stoppages should be nil in a mill.
- Grid bars should be inspected periodically; damaged grid bars should be replaced.
- Grid bars in the front rows can be replaced earlier.
- Fibre rupture should be checked for each opening point. 2.5 % span length should not drop by more than 3%. If the uniformity ratio drops by more than 3%, then it is considered that there is fibre rupture.
- Nep is increased in the blow room process. The increase should not be more than 100%.
- The nep increase in each opening machine should be checked with different beater speeds and settings, and the optimum parameters should be selected. But it is important to remember that everything should be based on yarn quality check. e.g. if nep increase in blow room is more and the beater speed or feed roller setting is changed, the tuft size will become more. This may result in bad carding sliver quality. Sometimes if the neps are slightly more and the fibre is well opened, the neps can be removed by cards and combers and the yarn quality may be better. Therefore all trials should be done upto yarn stage.
- Blow room machinery lay out should be designed in such a way that there should be minimum number of bends, and there should not be sharp bends to avoid fibre entanglements.
- Fibre traveling surface should be smooth and clean.

4 CARD

4.1 Variation in Fly Percentage

Fly percentage on all the cards should be as per standard. If fly percentage is more than set standard, it will affect the yield percentage and if it will less than set standard, it will affect the quality results.

4.2 Web Checking

Web checking should be done regularly. Department incharge should check the web physically. A very quick method to check the web is by using 6/6 inch plate. It gives an idea of neps that are present in the web. In this method web is taken out from the card and placed over the 6/6 inch plate and number of neps present are counted in that area. Standard values for cotton is 3 neps. For polyester 1 nep in the web on two 6/6 inch plates.

4.3 CAN Condition

CAN condition should be checked and CAN having defective wheels, defective inner surface and defective springs should be repaired or replaced if required. If tension of CAN springs is different, it results in imbalance of CAN plate and increases the tension of sliver. Damaged CANS should not be used as it affects the quality of sliver.

There should be a cleaning schedule for the CANS. CANS must be cleaned including wheels and springs. If there is too much waste inside the CANS, it resists the movement of CAN plate. Similarly, waste in the wheels would restrict the CAN movement. Therefore, cleaning of CANS should be given due importance.

4.4 Identification of CANS

CAN identification system should be in place. Every machine should have CANS with respective machine number marking and should be used accordingly. It is necessary for cross mixing at the drawing.

If CAN numbers on delivery side are not followed properly, it affects on homogeneity of material. To control this problem, it is suggested that CAN numbers should be followed properly on delivery side to ensure homogeneity of material. Sometimes it is observed that sliver is used on CANS for identification of material (carded, combed etc) which is not an efficient way. It is suggested that plastic or rubber band should be used for better identification.

4.5 Storage for Empty and Full CANS

There should be proper storage area for empty and full cans. CANS must be stored according to CAN numbers so that it can be easily retrieved.

4.6 Lap Change

In case of lap feed system, it is observed that lap change is not done properly. The following should be considered while changing the lap:

- Old lap should not be pulled rather it should be cut smoothly to reduce the irregularity in the feeding.
- Stop limit switch should be placed and used. It is observed that either limit switches not present on the machine or sometimes operator do not use the limit switches. Limit switches reduces the delivery speed of card when lap approaches to end and hence facilitates the lap change by the operator.
- Lap joint should be removed properly.

4.7 CAN Change

One lap one CAN change system is better because it is easy to remove joint. However, if it is not possible then, lap joint must be removed. Operator should be

trained to remove the joint properly and should know its importance in quality of the end product.

4.8 Flats Movement

Flat movement should be smooth otherwise it affects the carding action and hence the fly %. To ensure the smooth movement of flat and better carding action, following should be taken care of:

- There should be no jerks in the movement of flats.
- In case of Crosrol cards, check the flats bearing at regular interval. Jammed or bearing without seal should be replaced.
- At the bend, bearing or flat edge should touch the cylinder bed.
- In case of flat bars use carbon block. Use of carbon makes the flat movement smooth and prevents rust.
- All Flat edges should touch with the cylinder bed

4.9 Flats Cleaning

Flats' cleaning is very important as it is directly in contact with the material. Before flats come into the operation it should be cleaned properly. Flat cleaning brush should be in good condition and moving properly for better cleaning. Secondly, if there is no direct fly suction than a schedule should be made for removing the fly manually by operator.

4.10 Condition of Top Set Wire

Condition of top set wire should be checked regularly by the department incharge. If it is not smooth, it affects the Carding action and hence quality of the sliver. Therefore, it is advised that grinding should be done for better carding action.

4.11 Mechanical Autolevller

Autoleveller have considerable influence on the quality of sliver. It is observed that in case of mechanical autolevellers (tongue and groove arrangement), shaft of mechanical autoleveller is found eccentric and sometimes mechanical autoleveller pump needle is not in working condition. This affects the sliver quality. To get better quality sliver, mechanical autoleveller and its shaft should work properly and its maintenance should be done properly.

4.12 Eccentric Callender Rollers

Condition and working of calendar roller is important because calendar roller is directly in contact with the sliver. Therefore, if callender rollers are eccentric then, uneven sliver will be produced. To get better quality sliver, callender rollers should not be eccentric and poor condition callender rollers should be replaced. .

4.13 Eccentric Crush Rollers

Condition and working of crush rollers is important therefore, if eccentric crush rollers are found on Card, it is difficult to take out web from doffer with the same flow and hence causes thick and thin spots in the web. The second function of crush rollers is to crush the trash. Eccentric crush rollers can not perform that function well.

4.14 Crush Roller Setting

Pressure on crush roller should be same on all the Cards. Different setting of crush roller affects the quality of material as main function of crush roller is to take out web from doffer. It is advised that same setting of crush roll pressure should be used on all Cards for same material.

4.15 Use of Sliver "Pallies"

It has been found that sliver "pallies" are used for the cleaning of cards during running condition. It is not an effective way of cleaning rather there are more chances of break up of sliver pieces from "pallies" getting mixed into sliver web and causing slubs. Hence cleaning should be done with woven fabric cloth instead of "pallies".

4.16 Use of Air Pressure

Cleaning of cards with air pressure should be done with extreme care. Machine cleaning with air pressure during the running condition results in mixing of fly and waste into the material and on the other Cards. It is advised that air pressure should not be used in the running condition of the machines.

4.17 Uneven CAN Plate Surface

Uneven CAN plate surface resists the CAN plate movement that causes resistance of sliver coils over the CAN plate during its upward and downward movement. Also uneven CAN plate surface increases sliver tension and produces fuzzy surface of sliver. It is suggested that CAN plate surface should be even for the control of sliver tension and fuzzy surface.

4.18 Coiler Plate

Movement of coiler plate should be smooth. If coiler plate during running have a little jerk, then it affects the symmetry of coil distribution on CAN. It is advised that to get even distribution of sliver coils, coiler plate should run smoothly.

Another observation is that Coiler plate setting sometimes found incorrect i.e. plate comes out of the coiler surface or tilted to one side. It disturbs the coiling therefore, it must be adjusted.

4.19 Position of Card Trumpet

Sometimes, it is observed that trumpet position over the coiler calendar roller is not correct on the machines i.e. very high. It is advised that setting on the machines should be same. Trumpet should be set as close to the coiler calendar roller as possible for better sliver quality.

4.20 CAN Stopper Belt

Sometimes CAN stopper belt is not being used. It is advised that CAN stopper belt should be used as indicated by the manufacturer.

4.21 Less Number of Belts

It is observed in some mills that in case of Chinese cards the numbers of belts are less than the actual requirement on the machines. This affects drafting and speeds due to the slippage and also increases motor load. It is suggested that total number of required belts should be used on the machine.

4.22 Waste Collection

Suction for waste collection should be adequate in case of automatic waste collection. Otherwise, this causes waste accumulation under the taker-in and cylinder. In case of manual collection, it is suggested that this waste must be removed from time to time by the operator as per pre defined schedule.

4.23 Sliver Guides

The position of sliver guides and its movement is important consideration for better sliver quality. If sliver guide is jammed or its position is not correct, it affects the tension of sliver and hence creates false draft. To overcome this problem, fluff should be removed from sliver guide regularly and its position should be adjusted if required. Sometimes, it is also observed that sliver guides

are missing from the machines. This should also be avoided as it tends to create false drafts.

4.24 Size of Flat Bar Slides

Size of flat bars is an important consideration. Because, if flat bars are undersized, it affects the working of new top set wire. New wire on undersized flat bars touches with cylinder surface and becomes rough and blunt that appears as shining spots on the wires. This ultimately affects the carding action. It is advised that undersized flat bars should be replaced with new flat bars.

4.25 Sliver Length Control

It has been observed that counter meters on cards in some mills are not functioning. Therefore, Sliver length per CAN on all the cards can not be adjusted if counters are not working. Operators change the CANS according to their own judgment. This deteriorates the quality at subsequent stages and affects the production. Also, all CAN at drawing will not finish at same time and sliver joint removal can not be done. It is advised that Sliver length counter should be used for improvement in quality and production at subsequent stages.

4.26 Callender Roller Clearer

Sometimes callender roller clearers on Cards are found missing which affects the cleaning of callender rollers. It is advised that callender roller clearer should be available on the machine for the cleaning of callender rollers.

4.27 Cleaning of Cards

Whenever cleaning the machine, it should be started after the lap finishes or material from feeding side has been removed. There should not be any material in process within the machine. It causes slub as dust and dirt particles get accumulated. Good cleaning practices in the carding will pay off in terms of quality.

4.28 Stair Position

It is observed that sometimes machine bed is found out of balance especially in case of Crosrol cards. It is advised that balancing of machine should be done properly while installing.

4.29 Use of Shutter

It has been observed that during overhauling of machines, suction points are not being closed. It is advised that shutter should be used to stop the suction.

4.30 Wire Grinding Schedule

It is advised that a proper wire grinding schedule should be made and followed for better quality. In many mills there is no proper schedule. Schedule should be placed on each machine accordingly.

4.31 Further Guidelines for Carding

4.31.1 Settings:

- The most critical setting in a carding machine is between cylinder and flat tops. While processing cotton, it can be as close as 0.175 mm provided the mechanical accuracy of flat tops is good. Closer the setting between cylinder and flats, better the yarn quality. Neps are directly affected by this setting. Of course, very close setting increases the flat waste.
- The work done by the first few stationary flats is very high; therefore the wear of these flats is also high. It would be better if the first 50% of the flats are changed earlier than the last 50%.
- The setting between cylinder and cylinder under-casing should be as per manufacturer's recommendation. The design of under-casing is different for different manufacturers. This setting is very important, as wrong settings will affect the fibre transfer and can also create air turbulence.

4.31.2 Wire Maintenance:

- Some mills increase the life of the flat tops compared to cylinder wire. But it is better to change flat tops and cylinder wire together for better and consistent yarn quality.
- It is a good practice to check the individual card quality before changing the wire.

4.31.3 Others:

- Before mounting, the eccentricity of cylinder and doffer should be checked. Eccentric cylinder and doffer will affect the U% and will affect C.V. % also.
- Selvedge of feeding bat should be good. It should not be folded and doubled. This will increase the neps and sometimes it may result in cylinder loading. Lap fed to the carding machine should be narrower than the nominal width of the machine.
- Worn or damaged scraper blades will lead to web sticking to crush rollers. Insufficient pressure between scraper blade and crush roller will also result in web sticking. If the callender roller pressure is too high web sticking will also be high.
- Use smallest coil trumpet that is practically suitable
- Adjust the coils so that coil of sliver does not press against the side of the CAN.

4.32 Causes of Different Defects

4.32.1 Cloudy Web

This fault may occur due to following reasons:

- Damaged or dull taker-in wire
- Irregular fibre distribution
- Taker-in under casing set too far from taker-in
- Feed plate set too far from taker-in
- Slow taker-in speed
- Lap licking
- Damaged wire of cylinder and doffer

4.32.2 Horizontal Faults in the Web

- Improper joining of taker-in under-casing with cylinder under-casing
- Waste build up at taker-in under-casing
- Improper joining of doffer cover and front bottom sheet
- Improper meshing of gears
- The position of cylinder under-casing at taker-in side is too low
- The gauge of cylinder under-casing and taker-in side is too narrow
- Fibre or waste build up in feed roller cover

4.32.3 Holes in the Web

- Fibre or waste build up on under-casings
- Defective card clothing
- Loading of cylinder and doffer clothing with husks or foreign matter

4.32.4 Flat Strips too Heavy

- Over loaded cylinder
- Back plate incorrectly set
- Taker-in screen too close to taker-in
- Front plate to cylinder setting too wide
- Flat cleaning brush gauge wide
- Flat cleaning comb gauge wide
- Uneven height of top flats
- Flat speed too low
- Flat setting too wide

4.32.5 Too Much Fly

- Incorrectly set under-casing
- Worn out flat chain resulting in more gap between the flats
- Front plate incorrectly set or damage
- Lap too wide
- Fibre damage

4.32.6 High Nep Content

- In correct card settings
- Damaged cylinder and doffer wire
- Damaged flats
- Damaged taker-in wire
- Web too thick
- Loading of clothing with husks or foreign matter
- Slow speed of cylinder or taker-in or flats

4.32.7 Disappearing Web

- Damaged doffer wire

4.32.8 Web Sticking to Crush Roll

- Worn or damaged scrapper blade
- Insufficient tension on scraper springs
- Insufficient draft between crush roll and calendar rolls
- High crush roll pressure
- Relative humidity too high
- Too much seed particles in the cotton
- Due to static charges generated from material passing though the card

4.32.9 Broken Web Selvedges

- Lap too wide for the card
- Lap guide incorrectly set
- Rough under screen
- Damage top flats on both sides
- Poorly formed lap specially from the sides
- Incorrectly set under screen particularly at the doffer end

4.32.10 Web Sagging

- Insufficient grip of web by top callender roll
- Small diameter of trumpet on draw box plate
- Increased relative humidity in card

5 LAP FORMING

5.1 CANS Arrangement

If CANS arrangement behind the lap former machine is in a vertical arrangement, it increases useable waste. It is suggested that CANS arrangement behind the machine should be horizontal. In this practice comparatively less amount of waste is produced.

5.2 Sliver Guides

Sometimes it is observed that sliver guides on lap former are not moving. It increases tension on sliver and creates false drafts due to stretching. It is advised that sliver guides should be checked regularly to ensure that smooth movement of sliver guides. Also check the sliver guides bearing covers. If these are missing it will affects bearing life due to fluff accumulation.

5.3 Doffing Position

Doffing position of lap former should be such that it facilitates the lap replacement. Improper doffing position increases the work load on operator and causes handling problem during lap insertion on Comber machine. It is advised that doffing position of Lap Former should be corrected to avoid this problem.

5.4 Roller Slide

Roller slides should not be worn. Worn roller slide causes improper grip of rollers results in thick and thin web. It is advised that worn/broken slide should be checked regularly and repaired if required.

5.5 Spool Color Coding

When processing two different types of material, spool should be coded with color marking for identification and it should be followed accordingly. If there is no proper spool color coding w. r. t. type of material or it is not being followed properly then there is chance of mixing different types of material.

5.6 CANS Crossing

If CANS crossing is not followed on lap former then there is less homogeneity in the lap produced. It is advised that CAN crossing should be strictly followed to get homogeneity.

5.7 Bearing Nipples

It has been observed that bearing nipples are loose and sometimes are not available on steel rollers which make it difficult to grease the bearings and results in reducing their life.

5.8 Sliver Guide Roller

It is observed that sometimes front sliver guide roller is not moving that increases tension on slivers passing under it. Also there is some gap between slivers due to wide setting of sliver guide plate. This gap may cause holes in comber web and ultimately appears as thin places. To control this problem, it is suggested that guide roller should move and gap between slivers should be reduced.

5.9 Loose Guide Plates

Guide plate should not be loose and adjusted properly, as it affects width of sliver fleece.

5.10 Side of Lap

If one side of lap is not smooth or clear, it affects lap quality. This problem occurs due to rough surface of supporting plates or due to less pressure. To get smooth surface of lap, coating should be done on the surface of plate or pressure increased.

5.11 Sliver Joints

Sometimes it is observed that sliver joints are being removed on Lap Former machine that affects the efficiency of Lap Former. It is advised that there is no need to remove the sliver joints at Lap Former rather the joint should be inserted in a more appropriate way with extra care and following SOPs for this purpose.

6 COMBING

6.1 Dirty Cylinder Wire Surface

Dirty cylinder wire surface causes thick places in the comber fleece and ultimately in the yarn. To overcome this problem, it is suggested that there are three options for better cleaning of cylinder wire surface. Firstly, cleaning with comb, secondly change normal brush to wire brush and thirdly adjust brush gauge after certain time intervals.

6.2 Marks on Callender Rollers

Cut marks on the calendar roller should be avoided. If there are cut marks on callender roller surface, it produces uneven sliver. It is advised either to grind the surface of callender rollers or replace them.

6.3 Sliver Table Guide

It is observed that sliver table guides are not fixed which affects sliver tension. It is advised that sliver guides on sliver table should be fixed to control this problem.

6.4 Bottom Roller Clearers

Sometimes bottom roller clearers are missing on machines. The function of bottom roller clearer is to avoid lapping on bottom roller and to clean the surface of steel rollers. It is advised that bottom roller clearers should be available on the machine to avoid lapping on rollers.

6.5 Waste Accumulation

Suction on the drafting roller should be adequate otherwise; waste is accumulated on drafting roller clearers due to weak suction (Rieter combers) that causes slub. This fault can be corrected by increasing suction of machine.

6.6 Top Combs and Nipper Knives Cleaning

It is observed that mostly top combs and nipper knives are found dirty. Top combs and nipper knives should be in clean condition. If these are not properly cleaned it is difficult to remove short fibres with dirty condition of combs and nipper knives. It is advised that cleaning of top combs and nipper knives should be done after regular intervals to get good combing action.

6.7 Cleaning of Comber

Sometimes filter is running during cleaning time of lap former and comber machines that is not economical from cost point of view. This practice increases the electric charges. It is advised that during cleaning process of lap former and combers, filter should also be stopped to decrease electric units.

It is also observed that sometimes cleaning is done with lap inside the machine which results in waste getting mixed with the new lap. It is suggested that before cleaning, remove the lap from the machine. It is also suggested that while using air pressure for cleaning, combing cylinder head should be moved to inside so that waste should not accumulate on the combing cylinder.

6.8 End Bushes Vibration

End bushes vibration of drafting rollers should be avoided as it produces thick and thin sliver and also results in uneven drafting. It is advised that end bushes should be checked daily. A schedule should be followed for the cleaning of end bushes after a certain period to control this problem. If end bushes showed serious vibration, replace them immediately.

6.9 Pressure Gauges

Sometimes pressure gauges on combers are not functional. If pressure gauges on combers are not functional, it creates difficulty to check the pressure. Also marking of required pressure should be indicated on the gauges. This will make facilitate adjustment and control of pressure if it is lower or higher than the recommended pressure.

7 DRAWING

7.1 Identification of CANS

CAN identification system should be in place. Every machine should have CANS with respective machine number marking or any other marking as on the machine. Operator should be trained to use the respective CANS at each delivery. It is necessary for cross mixing at the drawing.

7.2 CAN Condition

CAN condition should be checked and CAN having defective wheels, defective inner surface and defective springs should be repaired or replaced if required. If tension of CAN springs is different, it results in imbalance of CAN plate and increases the tension of sliver. Damaged CANS should not be used as it affects the quality of sliver.

There should be a cleaning schedule for the CANS. CANS must be cleaned including wheels and springs. If there is too much waste inside the CANS, it resists the movement of CAN plate. Similarly, waste in the wheels would restrict the CAN movement. Therefore, cleaning of CANS should be given due importance.

7.3 Storage for Empty and Full CANS

There should be proper storage area for empty and full CANS. CANS must be stored according to CAN numbers so that it can be easily retrieved.

7.4 Sliver Blending

Blending of CANS at the draw frame creel is beneficial from quality point of view therefore, Cross canning (mixing) of CANS on finisher should be done. Higher the number of doublings lower the irregularity caused due to random variations. Doubling does not normally eliminate periodic faults, but it reduces the effects of random variations.

For effective cross canning, a cross mixing plan should be made and placed on the machine. Operator should be instructed to follow this plan. The proper identification on the CANS and on the machines is necessary for effective sliver blending.

7.5 End Bushes of Top Rollers

End bushes of top rollers should be checked daily. There should be no vibration in the end bushes. The vibration of end bushes leads to heating rubber cots and results in uneven drafting. The end bushes that show serious vibration should be replaced. Top rollers must also be checked for eccentricity which also causes unevenness in the sliver.

7.6 Sliver Joining

Sliver joining should be done properly. The following procedure may be followed:

- take out 2-3 cm of sliver
- overlap the both ends
- rub twice (one time in each direction)

7.7 Block Creeling

All the CANS at the creel should finish at the same time. CANS should not be changed randomly. Also, CAN on delivery side should be finished at the same time as the CANS on feeding/creel side finishes. In this way it is possible to remove the sliver joints easily. This will improve the sliver quality.

7.8 Cleaning of Drafting Section

A schedule for drafting section cleaning should be in place. “Cloth Pullis” should not be used for cleaning. Care must be taken while cleaning so that waste should not go along with the material.

7.9 Top Rollers Change Schedule

Top rollers should be marked with different colors and colored top roller change schedule should be prepared. This schedule should be placed on the machine.

7.10 Sliver Joint Removal

It is observed that in some mills sliver joint at finisher is being removed after the joint goes into the CAN. This practice is not effective. It is advised that sliver joint should be removed after it passes through the scanning rollers or just before entering the drafting zone. This will reduce the material wastage and make this practice more effective for joint removal.

7.11 Sliver Sample for Testing

It is our common observation that in most of the mills, method of taking sample for sliver testing (grain checking, U% etc) is not correct. Sample is taken from full CAN. This will reduce the sliver length in the CAN, results in additional joints at the Simplex and hence affect the quality. It is suggested that sample of sliver should be taken directly from the machine after doffing in required quantity to avoid reduction in sliver length and hence improvement of quality.

7.12 Less Number of Belts

It is observed that in some mills, less number of belts is being used than required which affects drafting due to the slippage and also increase electric load on the motor. It is suggested that total number of required belts should be used on the machine.

7.13 Spectrogram

In some mills, it is observed that spectrogram mode on finisher drawings was not being used. If Spectrogram option on the finisher drawings is available then, it should be used. It is helpful to ensure the quality of sliver as it help to detect the formation of high peak which occurs mainly due to the worn out gear teeth, broken edge of pulley, broken belt or used multi joint belt.

7.14 Slow Speed Time

Slow speed time on the drawing frame should not be excessive, as at slow speed autoleveller does not work resulting in the production of irregular sliver. It is suggested that slow speed time should be reduced. In some mills it was reduced upto 2sec. In this context another important point is that when taking sample for sliver testing (grain, U% etc.), the slow speed material should not be used for testing.

7.15 Number of Wrappings / Shift

Number of wrapping/shift should be adequate enough. More wrapping/shift will not only increase work load but also increase the useable waste. It is suggested that two times wrapping is enough in one shift. This practice will reduce useable waste.

7.16 CAN Plate Height

CAN plate should be very close to the coiler plate. If there is more gap between CAN plate and coiler plate, it causes sliver coils to drop down from the plate surface. It is advised that CAN plate height should be adjusted so that there should be no gap between CAN plate and coiler plate.

7.17 Coiler Plate

Movement of coiler plate should be smooth. If coiler plates during running have a little jerk, then it affects the symmetry of coil distribution on CAN. It is advised that to get even distribution of sliver coils, coiler plate should run smoothly.

Another observation is that coiler plate setting is sometimes incorrect i.e. plate comes out of the coiler surface or tilted to one side. It disturbs the coiling therefore, it must be adjusted.

7.18 Stop Motions

Stop Motions at the machine should work properly for better machine performance and to ensure the operational safety. Stop motions should be check regularly and in case of any malfunctioning, these should be repaired or replaced.

7.19 Calendar Roller Surface

Cut marks on the calendar roller should be avoided. Cut marks on callender roller surface will produce uneven sliver. It is advised either to polish the surface of callender rollers or replace them.

7.20 Waste on Sliver Coils

Waste on top coil of sliver from coiler portion causes slub. It is suggested that to control waste, make schedule of cleaning coiler tube with a brush at regular intervals.

7.21 Clearer on Callender Roller

Sometimes callender roller clearer is missing. The function of clearer is to clean the surface of callender roller. It is suggested that clearer should be available on callender roller for better cleaning.

7.22 Inter Crossing of Sliver

Crossing of sliver at the creel should not occur as it affect the sliver quality i.e. causes unevenness due to rubbing. To avoid this problem, it is suggested that one sliver should pass through one sliver guide.

7.23 Use of Creel

Creel distance on the drawing affect the C. V. %. It is observed that in case of six numbers of doublings three creels are used i.e. first creel is not used and last three creels are used. This increases the creel distance and ultimately affect the C.V. %.

It is advised that creel distance should be kept short so as to reduce the tension in the sliver and results in better C.V percentage.

7.24 Guides on Creel Roller

Sliver guides at the creel should be used because it affects the sliver tension and ultimately the C. V. %. It is advised that sliver guides should be used at the creel.

7.25 Direction of Sliver Guides

Direction of sliver guides on drawing should be correct so that it does not cause stretch to sliver. It should be towards front side instead of back.

7.26 Sliver Coils

Sliver coils on all draw frames should be of same type. Different types of sliver coils affect the evenness and capacity of sliver in the CAN. Therefore, it is suggested that all drawing frames should have same type of coils.

7.27 Arrangement of Slivers

Arrangement of sliver in case of blended yarn processing (PC, CVC etc) is very important. Arrangement of cotton and polyester/viscose or any other material to be blended should be same on both deliveries. Otherwise, it affects the blending of fibres and fibres distribution across the diameter of sliver.

7.28 Sliver Pieces in the CANS

It has been observed that Sliver pieces are found inside the CANS. These pieces continuously touch the sliver and may go along with it during unwinding and affect the sliver quality. It is suggested that operators should be provided cloth bags so that the pieces which they take off during sliver joining can be placed in it. Also, train the operators to follow this practice.

7.29 Sliver Cutting Plate

Sliver cutting plate should be available on the drawing machine. The purpose of sliver cutting plate is to cut the sliver when sliver length in CAN is completed.

7.30 Further Guidelines for Drawing Section

- Since the draw frame delivery speed is very high, the top roller shore hardness should be around 80 degrees. It should not be less than that.
- It is advisable to buff the rubber cots once in 30 days (minimum) to maintain consistent yarn quality.
- Coiler size should be selected depending upon the material processed. For synthetic fibres, bigger coiler tubes are used. This will help to avoid coiler choking and kinks in the slivers due to coiling in the CAN.
- Speed of the coiler will also affect the coiling. Speed of the coiler should be selected properly. In draw frames like RSB D-30 (RIETER), any coiler speed can be selected through the variator type pully. Since, the option is open; there is also more probability for making mistakes. One should take enough care to set the coiler speed properly.
- Whenever coiler speed is adjusted, the diameter of the coil is also changed. Hence it is necessary to check the gap between the slivers and CAN. If it is more than 5 mm, then turn table position (CAN driving unit) should be altered so that the gap between coil outer and can inner is around 5 mm.
- If the department relative humidity variation is very high, then corresponding correction to be made for checking the wrapping of sliver (sliver weight). Otherwise, there will be unwanted changes in the draw frame which will affect the count C.V. % of yarn.

7.31 Autolevelling:

- Intensity of levelling and timing of correction are two important parameters in autolevellers.
- Intensity of levelling indicates the amount of correction i.e. if 12% variation is fed to the draw frame the draft should vary 12%, so that the sliver weight is constant.
- Timing of correction indicates that if a thick place is sensed at scanning roller, the correction should take place exactly when this thick place reaches the correction point (levelling point).
- If intensity of levelling selected is wrong, then 1 meter C.V. % of sliver will be high.
- Most of the modern autolevellers can correct 25% feed variation. It is a general practice to feed 12% variation both in plus and minus side to check A%. This is called as sliver test. The A% should not be more than 0.75%. A% is calculated as follows:

  If number of slivers fed to draw frame is N, Check the output sliver weight with "N", "N+1", "N-1" slivers. Then

  A% = ((gms/mt(N-1) - gms/mt(N))/ gms/mt(N)) x 100

  A% = ((gms/mt(N+1) - gms/mt(N))/ gms/mt(N)) x 100

7.32 Causes of Different Defects

7.32.1 Lapping on Top Rollers

- Ambient Conditions
- Rubber Quality
- Top Clearer and Bottom Roller Clearing

7.32.2 Improper Coiling

- Too much Sliver Filled
- Improper Coil Tension
- Dirty Coiler Wheel

7.32.3 Fuzzy Sliver

- Improper Surface of Coiler
- Too much Sliver Filled
- Improper Handling and Storage

7.32.4 Sliver Unevenness

- Improper Quality of Feed Sliver
- Bad Piecing
- Setting of Rollers
- Improper Draft Distribution
- Eccentric Bottom or Top Roller
- Improper Trumpet
- Defective Spring
- Too Large Coiling
- Large Coil Tension
- Dirty Coiler Tube

8 SIMPLEX

8.1 Bottom Roller Vibration

There should be no roller vibration. Roller vibration causes variation in the drafted material. It should be checked at regular intervals and corrected immediately.

8.2 Clearance between Clearer Assembly and Roller Stand

There should be no clearance between clearer assembly and roller stand as it affects the life of drafting rollers due to the weight of clearer assembly imposed on rollers. It is observed very often in the mills. Therefore, it should be ensured that top arm cover should touch with roller stand.

8.3 CANS Arrangement

CANS behind the Simplex should not be changed randomly. In this practice it is not possible to remove the roving joints. Also, it causes more stoppages and reduces the efficiency of the machine. It is better to adopt group creeling in Speed Frame, because every piecing of sliver will result in a thin and thick place. Also, if the group creeling is done horizontally, it is difficult to remove the sliver joint. Therefore, it is preferable to have the CANS arrangement vertically in 24 or 30 or 40 or 60 CANS group arrangement (as feasible). This will result in easy removal of sliver joints. Other advantage of this practice to increase the efficiency of Simplex if there is tight production margin between Simplex and Drawing.

An important consideration in this regard is that the CANS in the group should finish at the same time. If doff position is not same, it produces too much useable waste and sliver joint can not be removed. For reducing useable waste and for removing sliver joints properly, finisher CANS doff position should be same.

8.4 Sliver Passage on the Creel

Correct sliver passage should be followed which does not results in sliver crossing. Sliver crossing increases the hairiness and affects the evenness of sliver as well. To avoid sliver crossing arrangement of slivers should be same on all the machines which most of the times is different on all the machines. Same arrangement should be made and operators should be trained to follow this arrangement.

8.5 Sliver Joining

Sliver joining should be done properly. The following procedure may be followed:

- take out 2-3 cm of sliver
- overlap the both ends
- rub twice (one time in each direction)

8.6 Roving Joint

Roving should not be joined on the break, instead it should be coiled. Because, roving joint is a bigger fault than yarn joint. This will reduce the intensity of fault.

8.7 Sliver Pieces in the CANS

It is quite common that after joining the slivers, operator keep the sliver pieces inside the CANS. These pieces continuously touch and may go along the sliver during unwinding and affect the sliver quality. It is suggested that operators should be provided with begs so that the pieces which they take off during joining can be placed in it.

8.8 Spacer

Proper spacer should be selected depending on the hank of material. Spacers should be as small as possible, to improve yarn quality. Also, it should be ensured that same spacer should be used on the same hank of input and output material. If slubs and roving breaks due to undrafted is more, it would be better to use a bigger spacer instead of increasing the break draft and break draft zone setting to an abnormal level. In addition to this, it should be ensured that spacer is performing its intended purpose. It should touch the tensor bar. Sometimes, it is observed that spacer lies on the spare apron. This will increase the space and affects the quality of roving i.e. increase the unevenness. There should be a

regular checking system to avoid this fault. This can also be controlled by not passing the spare apron from the tensor bar.

8.9 Twist Cap

Twist caps on the spindles should be checked and replaced on regular intervals, if required as these affect the productivity of the machines by requiring higher twist multiplier. Also, the height of the caps has to be adjusted so that the angle at which roving is leaving the drafting zone remains same for first and second bobbin row.

8.10 Number of Roving Turns on Presser

Sometimes number of turns on presser is found different on the same machine. It is advised that number of roving turns on presser should be selected properly and followed as well. It should be same throughout the machine for same tension in the roving. Otherwise, it will affect the package size.

8.11 Collector and Roving Guides

The roving guides and collectors should be checked at regular intervals. These should move freely so that, it does not cause any stretch to the roving. Cut or damaged collectors should be replaced.

8.12 Cleaning of Drafting Section

A schedule for drafting section cleaning should be in place. “Cloth Pullis” should not be used for cleaning. Care must be taken while cleaning so that waste should not go along with the material. Fluff lapping on the bottom roller neck should be avoided. Because of fluff lapping on bottom roller neck collector moves up and down and touches with the top roller. This will increase the unevenness.

8.13 Empty Bobbins

Empty bobbins should not be placed under the machine. This is a common practice in the industry that empty bobbin are placed on the floor which causes bobbin to become dirty. Use trolleys for supplying empty bobbins on the machine while doffing.

8.14 Handling and Storage of Bobbins

Handling and storage of bobbins should be given due consideration as it has an impact on the quality. While handling or storing, avoid rubbing and harsh handling. Use proper trolleys for transporting the bobbins. For storage, use proper storage racks. Plastic curtain may be used to cover the stored bobbins.

8.15 Top and Bottom Roller Clearers

Bottom and top clearers should rotate and should touch the top and bottom roller properly. Otherwise, drafting zone become dirtier. Use revolving clearer in preference to flat clearers. It is also observed that sometimes top clearer combs do not touch with clearers which affect the cleaning of clearers. It is advised that combs should touch with clearer to get better cleaning of clearer and to improve the quality. Clearers should be checked at regular intervals and nonfunctional clearers should be repaired or replaced if required.

8.16 Rubber Cots and Aprons

Rubber cots and apron play an important role for producing good quality product. There should be no cuts marks on the rubber cots and aprons. It should be checked and prevented. It is better to use good quality apron and rubber cots, since the quantity produced by one apron and top roller at Simplex is very high as compared to Ring Frame. If the apron breaks and top roller damages are under control, it is always better to use the best apron and rubber cots available in the market. One should not think about cost saving in this regard. Cost saving for

apron and cots can be considered for ring frames. Buffing should be done once in 3 months and the top roller shore hardness should be around 80 to 85 degrees. After buffing, it is better to treat with acid or some special liquids which are being supplied to reduce lapping

8.17 Creel Rollers

Keep creel rollers running freely. Polish the creel rollers and guides to prevent excessive stretch at top and bottom of the roving bobbin. Stationary creel rollers increase the tension of sliver and produce thin places at weaker spots.

Sometimes it is also observed that creel roller bearing is found out of case due to sliver coiling inside. It is advised that cleaning of creel roller bearing should be done properly to avoid sliver coiling. It is beneficial from cost point of view as sliver coiling reduces the life of bearing.

8.18 Simplex Speed

While processing cotton combed material, flyer speed is very critical. When the bobbin diameter is big, because of the centrifugal tension, surface cuts will increase. i.e. roving breaks may occur at presser or in strand that have just been wound on the top surface of the package. To avoid this problem, it is better to use inverter drive system, to reduce the flyer speed, when the bobbin diameter is big. Otherwise the overall speed should be less for the entire doff, this will reduce the production of speed frame. Sometimes, higher twist will also reduce the surface cuts.

8.19 Roving Tension

Regulate the tension and there should be minimum tension variation through the bobbin built. Roving tension can be of three types

- Roving tension at the starting. It depends upon the bare bobbin diameter and the Cone Drum belt position.
- Roving tension during build-up. It depends upon the Ratchet wheel and lifter wheel. The difference between peripheral speeds of flyer and bobbin should be same and it should be slightly more than the length delivered by the front roller.
- Roving tension during up and down movement of the bobbin rail should be same. It depends upon the half tooth movement of the ratchet. If it is not exactly half tooth, then the tension will be different during up and down movement of the bobbin rail. To ensure this, ratchet adjustment bolt should be in the centre of two adjacent teeth of ratchet wheel otherwise, it causes uneven tension on the cope side of roving bobbins.
- With modern machines, cone drum is removed. Bobbin speed, bobbin rail speed and flyer speed is determined by the computer depending upon the tension settings. In some machines, it can be programmed and the tension sensor helps to control a bit. In some makes, the tension setting totally depends upon the sensing by sensors. The sensing accuracy depends upon the twist cap type, twist cape fixing, oil on top of twist cap etc. If only one roving tension is different due to various other reasons, then the entire machine tension will be altered. This is very dangerous. Enough care should be taken to avoid this problem.
- If lifter wheel is changed, then tension during build up will also change, the ratchet has to be selected accordingly. For a particular roving hank, ratchet wheel depends on Lifter wheel also.
- If the roving tension is more, then the stretch on the roving will be more, thin places will be more. But it is better to increase the TPI little bit and increase the roving tension so that the bobbin hanks capacity will increase, roving damages are less, and creel stretch in the ring frame will also be less, because of higher TPI in the roving.

8.20 Test Running of the Machine

It is observed that in some mills during test running of the machine after overhauling it was run without any pressure on the bottom rollers. It is quite dangerous to run in that way. It should be run such that some pressure arms should be placed on the bottom rollers to avoid any possible damage.

8.21 Less Number of Belts

Number of belts at the main Simplex motor should be as per required. It is observed that in some mills less number of belts were being used which affects drafting due to the slippage and also increases load on the motor. It is suggested that total number of required belts should be used on the machine.

8.22 Roving Doff

Roving doff should be set according to the sliver length in the CAN. Otherwise, it increases useable waste and affects the quality results. It is advised that roving doff should be adjusted such that as can finishes, bobbins also becomes full.

8.23 CAN's String Tension

Different tension of CAN's spring increases the tension of sliver and causes touching of sliver from one CAN to the sliver of adjacent CAN. It also affects the position of CAN plate. It is advised that tension of springs should be same so that sliver of one CAN should not be touched with the sliver of adjacent CAN or provide some space between the CANS of different string tension.

8.24 Sliver Guides

Sliver guides should be available on the machine and also used as well. Otherwise, it will create hairiness in the sliver.

8.25 Rail Movement

Jerk in the movement of rail affects the tension of roving and increases thick, thin places. This problem can be corrected by removing (adjusting) weight from the Simplex machine.

8.26 Bobbin Drive Wheel Clearance

If there is no clearance in bobbin drive and driven wheels, it affects the life of bobbin due to hard drive and increases the tension on the coils of roving. It is suggested that there must be some clearance between drive and driven wheels to correct this fault.

8.27 Eccentric Top Rollers

Eccentric top roller produces thick and thin places in the roving. It is advised that eccentric top rollers should be replaced and a schedule should be prepared for checking top rollers on daily basis.

8.28 Horizontal Distance between CANS

Horizontal distance between the CANS in some mills is found to be more which makes the creel length large. Although it makes the working more easy but from quality point of view it is not correct. Because it causes more tension in the sliver. It is advised that the horizontal distance between the CANS should be reduced to get better quality results.

8.29 Flyer Position

Setting of front and back Flyer should be same. It is commonly observed that this setting is not same which creates difficulty during doffing and increases the load on operators. It is advised to correct the flyer position to get better efficiency.

8.30 Placement of Cradle on Tensor Bar

Cradle should touch the tensor bar. If it is not touching to tensor bar, it affects the drafting process. To get even drafting and better quality results this should be avoided.

8.31 Centre to Centre Alignment

Sometimes centre to centre alignment is not found between top and bottom rollers which affect the quality results due to weak nipping point. To control this problem, top and bottom rollers should be aligned centre to centre to get good results.

8.32 Inside of Flyer

Damaged flyer inside surface causes breakage of roving. It is suggested that flyer inside damaged surface should be made smooth by using water paper.

8.33 Eccentric Spindles & Bobbin

Eccentric spindles and bobbin affect the strength (twist) due to speed variation. It is suggested that eccentric spindle and bobbins should be replaced to avoid this problem.

8.34 Roving Doff Meter

It is observed that in some mills roving doff meters are not available or nonfunctional. Without roving doff meter, it is difficult to get same amount of roving doff compared to that machine having doff meter. Roving doff meter will also help to improve production efficiency and control useable waste (roving & pneumafil in ring).

8.35 Noise at Starting Position

In some mills, Simplex is being used without inverters. As Simplex machine get started, big noise occurs because machine gets high speed at start. This causes belt slippage and affects quality results. Every time machine starts it will create jerk and at that point, it will cause unevenness in the roving which will be get multiplied in the ring. It is suggested that invertors should be used as this improves the quality of roving and improves the production as well.

8.36 Causes of Ends Down in Simplex

- Broken or slippage of twist or other wheels
- Deep meshing of gear or damaged gear
- Loose or Broken cone drum
- Loose bobbin shaft or spindle shaft
- Damaged rubber cots, aprons or guides
- Less twist in roving
- Dirty flyer or damaged presser
- Too low humidity
- Cut in roving

9 RING

9.1 Spindle Tape Setting

It was found that in all spinning units, spindle tape was not adjusted properly. This improper adjustment causes more spindle slippage and results in twist variation and hence weak yarn. The spindle tape should be adjusted properly such that yellow side of tape should not touch with tin pulley and jockey pulley surface i.e. on tin pulley and jockey pulley green side should be in contact and yellow side should be on top. However, on spindle yellow side will be in contact and green side on front as usual. This will reduce the slippage and improve the single yarn strength. It is a good practice to change spindle tapes once in 24 months at

least. Worn out spindle tapes will result in TPI variations which is detrimental to yarn quality.

9.2 Roving Passage on Creel

Roving passage on the creel should be followed properly such that there will be less tension on the roving. Roving should pass from the roving rod, otherwise, whenever roving breaks or finishes it will fall directly on the drafting zone and results in yarn breakage. Similarly, there should not be any crossing of roving. Operators should be trained to follow the correct passage.

9.3 Front Bottom Rollers Vibration

It is the common problem in spinning that front bottom rollers show vibration. Roller vibration causes thick and thin places in the yarn. This vibration occurs due to eccentric or bent roller and/or damaged bearing. It is advisable to check the roller vibration on regular intervals as convenient and prepare a record of roller vibration and replace the damaged bearings or if roller is bent it should be corrected.

9.4 Distance between top Apron and Front Top Roller

Roller settings play an important role for producing good quality yarn. It is a common observation that distance between the front top roller and top apron is found either too wide or too less (sometimes even both found touching). This will deteriorate the yarn quality. This distance should be 1-2 mm for better yarn quality. Also adjustment of apron roller over the middle roller should be proper. If it is some millimeters up to the middle steel rollers then, it produces long thick places. To avoid this, it is advised that apron roller should be adjusted properly.

9.5 Creel Adjustment

Keeping in view the observations in different mills, following are the some guidelines for proper creel adjustment:

- Use most practical creeling method which facilitates the roving movement without any stretch or rubbing to roving. Sometimes, it is observed that roving hanger's position on both sides of machine is not proper. Roving touches the vertical support of creel continuously and causes accumulation of waste. This waste increases the tension on roving and also causes waste accumulated to go with roving. It is advised that inner hanger should feed first spindle and outer hanger fed second spindle to control this problem.
- For combed material the creel height should be as low as possible in ring frame.
- Very long creel heights in ring frame, lower roving T.M. and heavier roving package will result in many long thin places in the yarn.(especially in combed hosiery counts)
- Normally 6 row creels are used in modern ring frames. Six row creels will accommodate more spare rovings compared to 5 row creels. Spare rovings will improve the operator's efficiency.
- Use roving caps to prevent the fluff and dust accumulation on the roving.
- Bobbin hangers should move freely and smoothly. Jam bobbin hangers create long thin places and increase the tension on the roving. To control this fault, jam hangers should be cleaned and poor condition hangers should be replaced.

9.6 Roving Empty Bobbins

It is quite common that empty roving bobbins are placed on the weighing arms that not only create difficulty to see the drafting zone but also it may touch with the roving. Therefore, empty bobbins should be placed on the hangers while, replacing with the full one. Also, full bobbin should not be placed on the weighing arm as it results in more pressure on the top roller as well as gets material damaged.

9.7 Roving Guide

Roving guides should be selected carefully as it should not cause any stretch to roving. Cleaning of roving guides is also very important as sometimes, it becomes blocked with fluff and results in false draft to roving i.e. increases the C. V. % of the yarn. Positioning of roving guide is also very important which also affect the yarn quality. It is advisable to set the roving guide at correct position and train the operator to ensure the cleaning of roving guide.

9.8 Ring Frame Cleaning

Ring frame cleaning is of utmost importance for producing good quality yarn. The following will improve the ring cleanliness:

- Keep blowers running and in good operating condition.
- Have separate personnel for cleaning in each shift.
- Use picker gun for cleaning
- Make proper cleaning schedule such that drafting section must be cleaned once in each shift. While, hangers, rail part and jockey pulley part also cleaned on appropriate intervals.
- Use top and bottom roller clearers (duffus) and keep them in good condition. Also, have a proper cleaning schedule for clearers
- In case of long ring frames where every machine has blower itself, too much fluff is found below the machine due to air turbulence. For improved cleaning, it is advised to stop the lower nozzle of the blower which blows the air opposite to the direction of tin pulley rotation.

9.9 Doffing

Following are the guidelines for proper doffing at ring:

- Use light weight trolleys for doffing
- Keep the trolleys in good operating condition. Clean the wheels periodically.

- Method of doffing should be such that doffer takes out the full bobbin with one hand and puts the empty bobbin with the other hand simultaneously. Sometimes, it is observed that one person takes out the full bobbin while other puts in the empty one. This method is not correct as winding operator find difficulty in getting the yarn end
- Yarn break at the doffing should be checked regularly as it tends to increase more fluff and pneumafil.
- Due to improper insertion of bobbins after doffing bad winding results. This not only requires the labor time to remove it from the bobbin but increase the hard waste as well. It is advised to train the doffer and piecers to avoid this.
- Blower should be reversed during doffing because during doffing doffer may hit the blower

9.10 Lapping

The basic reasons for lapping in the case of processing synthetic fibre are:

- End breaks
- Pneumafil suction
- rubber cots type
- fibre fineness
- oil content (electrostatic charges)
- department temperature and humidity

- Almost all the lapping originates after an end break. If a mill has an abnormally high lapping problem the first thing to do is to control the end breaks, after doffing, during speed change and during the maximum speed by optimizing the process parameters.
- If the pressure applied on the roller is more, then lapping tendency will be more. Hence fine and longer fibres will have more tendencies for lapping because of high top roller pressure required to overcome the drafting resistance.

- If the pneumafil suction is less, the lapping tendency will be more both on top and bottom roller. But the pneumafil suction depends on the fan diameter, fan type, fan speed, duct design, length of the machine, profile of the suction tube etc. If any one of the above can be modified and the suction can be improved, it is better to do that to reduce the lapping.
- The closer the setting between the suction nozzle and the bottom roller, the higher the suction efficiency and lower the lapping propensity.
- With Softer rubber cots lapping tendency will be more due to more surface contact.
- The minutest pores, pinholes in the rubber cots or impurities in the cots can cause lapping. Therefore the quality of buffing and the cots treatment after buffing is very important. Acid treatment is good for synthetic fibres
- Lapping tendency on the top roll increases with increasing relative humidity.
- Lapping should be removed by the skilled person only.

9.11 End Break

If spindle speed is high for cotton counts, every end break will result in more fluff in the department due to the free end of the yarn getting cut by the traveler. If the number of openings of return air system for a ring frame is less and the exhaust air volume is not sufficient enough, then fly liberation from an end break will increase the end breaks and thereby will lead to multiple breaks. End break due to a fly entering the traveller will get struck with the traveller and will result in heavier traveller weight and that particular spindle will continue to work badly.

9.12 Tail End Yarn Cutter

There are some mills that have developed and used the tail end yarn cutter. It is a good practice to use it. However, it is suggested that current tail end yarn cutter

should be such that it can cut all the tail end yarns and also, it should only move in one direction that is, in the direction of spindle rotation.

9.13 Eccentric Top Rollers

Eccentric top roller produces thick and thin places in the yarn. It is advised that eccentric top rollers should be replaced and a schedule should be prepared for checking top rollers on daily basis. Another important point is to check the side seal of top rollers. Side seal of top rollers sometimes is found missing. It will cause top roller to run without grease and hence reduces the life of the roller.

9.14 Overhauling and Grinding Schedule

Schedule of machine overhauling and front rubber cots grinding should match to get good machine efficiency and long life of top rollers.

9.15 Coils for Magazine Insertion

Two or three coils are found on full bobbin for magazine insertion. Two or three coils are insufficient for yarn insertion in magazine. The operator unwinds more coils for yarn insertion in magazine that increases hard waste. To control hard waste it is suggested that at least four or five coils should be made for insertion in magazine to reduce hard waste.

9.16 Different Hardness Rubber Cots

It is observed in some mills that different hardness rubber cots are used. It causes variation in quality results. It is advised that rubber cots of same hardness should be used to get better results. It is also suggested that rubber cots of 70 shore hardness are economical than the rubber cots of 65 shore hardness for cotton.

9.17 Pneumafil Percentage

Pneumafil percentage should be calculated daily for monitoring. It is observed that record of pneumafil weight is mostly available but no record of pneumafil percentage. From weight report of pneumafil, it is difficult to find out that pneumafil is within our standard limit or not. Therefore, it is advised to calculate the pneumafil percentage daily from pneumafil weight report to monitor and control it.

9.18 Heavy Bottom Rollers

Bottom rollers should move freely when moved by hand. Heavy bottom roller affects bearing life; takes more power and require more lubrication. It is suggested that the bottom rollers and roller stand should be adjusted so that the rollers run smoothly.

9.19 Spotted Steel Rollers

If there are too much spots on steel rollers, it affects evenness and imperfections of yarn. It is advised that there should be a record of spotted rollers. If back steel rollers are in better condition than the front steel rollers, interchange them.

9.20 Grease Nipples

Sometimes, it is observed that front rollers grease nipples are not available which makes it difficult to grease the bearings of steel rollers and results in reducing their life. It is suggested that grease nipples should be checked and replaced if required.

9.21 Multi Color Bobbins

It is not a good practice to use multi color bobbins on same frame. It makes difficult for operator to distinguish between the colors and thus more chance of

producing mixed count. It is advised to try to use single color bobbins on one frame.

9.22 Top Arm Pressure Color

Sometimes it is observed that different color pressure is found on the same machine that affects the drafting and rubber cots life. It is suggested that only recommended pressure for top arm should be used.

9.23 Roller Slides

Roller slides of steel rollers and tensor (nose) bar should be checked and if it is found broken should be replaced. Because it is difficult to hold steel roller and apron bar with broken slide thus affecting quality results.

9.24 Blower Movement

In ring frames usually two machines are installed in one line and normally one machine is overhauled at one time. It is observed that blower movement is stopped on machine being overhauled and second machine is running without blower. It is difficult to remove fluff on machine running without blower which affects the quality of yarn. It is suggested that blower should be moved on running machine by placing shifter between two machines.

9.25 Yarn Joint

If yarn is joined from upper side, it causes long thick place. It is difficult to remove this long thick place in Auto Cone. It is advised that yarn should be joined from lower side to avoid this problem. Operators should be trained for correct joining of yarn.

9.26 Waste inside Aprons

Waste inside the apron causes slippage of apron that directly affects C.V. % of yarn. It is advised that waste inside the aprons should be removed to get better C.V. % of yarn.

9.27 Jumping in Spindles

Jumping in spindles should be checked on daily basis. If jumping in spindles is found, it directly affects yarn strength. Jumping in spindles occurs either due to the improper grip of spindle hook or shortage of spindle oil.

9.28 Snail Wire Gauge

Improper snail wire gauge causes hairiness in the yarn. Because yarn strikes to one side of bobbin tip and hence becomes hairy & slightly weak. It is advised to check and adjust snail wire gauge to get good quality of yarn.

9.29 Position of Balloon Control Ring

Sometimes it is observed that balloon control rings are not concentric with spindle. This deteriorates the yarn quality. It is suggested that gauge should be checked whenever machine is overhauled.

9.30 Eccentric Bobbins

Eccentric bobbins should not be used as it affects strength (twist) due to speed variation. It is suggested to check eccentric bobbins and replace them immediately.

9.31 Machine Safe Guards

Sometimes, safe guards are missing on machines. Safe guards are used for the safety of machine body. It is advised that bolts should be available on machines other wise after some time safe guards would be useless.

9.32 Factors Affecting Yarn Strength

- Eccentric Spindle
- No oil in spindle bolster
- Loose spindle tape
- Low twist in roving
- Unsuitable break draft
- Roller settings
- Raw material characteristics

10 AUTOCONE

10.1 Operator Training

Mostly, operator inserts only one bobbin in the magazine at a time. Operator should be trained to insert three or four bobbins in the magazine at a time by taking out less than five coils. In this way not only the productivity can be increased but also operator fatigue will be less.

10.2 Splice Strength

Check splice strength and splice profile daily and adjust accordingly. The splice strength should be more than 90 % of the yarn strength. It is suggested that maintenance staff should have splice meter to check strength daily so that abnormal splice spindles could be corrected timely.

10.3 Handling of Cones

Handling of yarn cones should be given due importance for maintaining the quality of yarn. It is quite common that workers try to carry more cones which results in yarn quality deterioration. Worker should be trained to handle the cones properly as it is the final product ready to pack and ship for customer.

10.4 Separation for Different Counts

The following guideline should be followed for avoiding mixing of counts at the auto cone:

- Separator should be used for the separation of two counts on Auto cone machine. This will reduce the chances of producing mixed count.
- Bobbin with same type of colors (e.g. maroon or red) should not be used on same machine.
- Use stopper to stop the trolley of one count from entering to the other count section on the same machine.

10.5 Air Pressure Gauge

It is observed that there is no marking of required pressure on the pressure gauge. Required air pressure marking on the gauges helps to point out any pressure deviation from the required pressure.

10.6 Tenser Disc

Tenser Disc should also be checked regularly because it is found that tension washers sometimes are not moving. It was advised to check it in routine and repair/replace accordingly.

11 GENERAL

11.1 Handling & Storage of Bales

Spinning mills have sufficient inventory of bales, therefore, it was observed that many mills store the bales in open areas. Bales are exposed to the outside environment. Following are the disadvantages of storing the bales outside:

- Consistent exposure to the sunlight causes deterioration of quality of the cotton i.e. affects the color of cotton and strength as well.

- Bales get dirty when stored outside and needs more opening and cleaning at subsequent stages that will not only increase load on the machines but also reduce the yield.
- In case of rain, if bales are not properly covered, bales get wet, the chances of fungus growth increase along with more moisture content in the bales which will increase the processing difficulties.

It is also observed that while unloading, bales are handled very roughly. This mishandling damages the fibres. Since, raw material is most important cost factor in spinning therefore; it is recommended that bales should not be stored outside in order to protect them from being deteriorated. If need to be stored outside then, bales should be covered properly. Secondly, bales must be handled properly. Workers should be trained to avoid the deterioration of fibre quality.

11.2 Machine Covers

It is observed in many mills that machine covers at different machines were not available or not being used for various reasons. It is advised that machine covers should be placed at the machines which are quite necessary from safety point of view. Also, it affects the machine performance as well.

11.3 Fire Extinguishing Apparatus

Fire extinguishers/ buckets in many mills were found in poor condition. Buckets were found empty while extinguishers were not being checked regularly. It is advised to check the fire extinguishing apparatus on regular intervals to avoid any possible loss in case of emergency also it should be positioned properly, so that it can be found and accessed easily whenever needed.

11.4 Floor Condition

Floor condition in some mills is not good. It is difficult to move the CANS/trolleys that may result in CAN/trolley wheel damage. It is advised to give due consideration to this aspect. Floor should be as smooth as possible. It will improve the cleanliness condition of the department and results in better working environment.

11.5 Use of Compressor Air

Compressed air should only be used for machine cleaning and it must be ensured that during cleaning waste should not get mixed with material. Because sometimes it is observed that compressor air is being used for floor cleaning which is the wastage of money. Only cloth or broom should be used for that purpose.

11.6 Water Level in Water Cleaner

In some mills, water level was found to be high in the water cleaner of A/C. Due to this, water can not be cleaned which will cause choking of nozzles. It was advised to reduce the water level in the water cleaner below the water filtering tray for better working of the A/C system. There is also a continuous water change system for improved working.

11.7 Wrapping Drum Position

During wrapping, if wrapping drum position is lower than the position of sliver CAN, it affects the wrapping results as sliver coils rub with each other during unwinding. It is advised that wrapping drum position should be above the position of sliver CAN.

11.8 Graphical Representation

It has been observed that many mills do not use the graphical representation of sliver grain, unevenness, C.V.% etc. Sometimes C.V percentage is good but trend is towards the higher side or lower side so it is difficult to judge the trend without graph. It is advisable to use the control chart to monitor the trend. In this way sliver grain, unevenness can be controlled more effectively.

11.9 SOP

Standard Operating Procedures for all the operations should be in place. This will ensure that any operation will be performed in the same way by all operatives. The management is responsible for making and implementing these procedures. These procedures will provide guidelines to the workers as how to perform a certain task correctly.

11.10 Employment Training

Organizations must make full use of its employees- its most valuable resource. Employees actually performing the operations often have the best idea for improving them. Human resource is as essential an aspect of processes as technology. Organization must rely on their employees to anticipate possible problems, develop new product, increase productivity and quality to remain competitive. In order to make it possible on-job training is one of the useful tools. Teaching new work methods to experienced workers or training new employees in current practices helps to achieve our goal. Mangers too need to develop new skills not only those directly relating to their own duties but also those needed to teach their sub ordinates.

Systematic training involves the training of a person in: -

- Basic knowledge
- Correct methods

Without these defective production cannot be prevented. It is vital that all faults and defects that are likely to arise in any job should be taught to all trainees

during their training. An operative must be able to recognize these faults and take action on them, that is, to report, correct or prevent them and where possible, to prevent their recurrence.

11.10.1 Guidelines for Effective Training:

- Firstly, choose your training provider very carefully.
- If it is an external trainer do check on their course content and structure, check their price, reputation, and standard of trainer.
- Make sure that trainer can provide some form of follow-up coaching support service. In case of external trainer, you may have to pay extra for this but it can be very worthwhile. It could be face to face coaching, or telephone coaching, or simply an "open-door" support line whereby delegates if they have queries or need help with materials, can simply telephone or mail the provider, who in turn will provide support by relevant means.
- Avoid those training programs where trainer comes in, deliver the training, hand over glossy folders and disappears! No follow up!
- In addition to the training provider on-going support, the managers who put their staff on training courses have a duty to support them, before, during and after the training. An effective manager will sit down with employees and coach them to identify what they are going to learn from the training. These learning objectives should be documented and once the training is over, then the manager should be sitting down with the employees and coaching them to self-analyze how they fared against the objectives that they set themselves.
- Whether or not the Training Provider provides on-going or follow up support, the manager has in this case to act as a coach and mentor and ensure that employees get both the benefit of on-going training and also the follow-up support and challenge from their manager.
- If Training Providers do not provide adequate follow-up support and also that company managers do not take time to sit down with their employees to

evaluate learning objectives and then review these objectives with a view to effective implementation of new skills into the workplace. Then, training is just the waste of money.

11.11 Use of Statistical Techniques

The use of statistical techniques can improve the quality. Manufacturers can choose from a variety of tools to improve the quality of their processes. The trick is knowing which tools to use for each situation and increasing the sophistication of the tools in the repertoire. Seven simple tools can be used by any professional to ease the quality improvement process: flowcharts, check sheets, Pareto diagrams, cause and effect diagrams, histograms, scatter diagrams, and control charts.

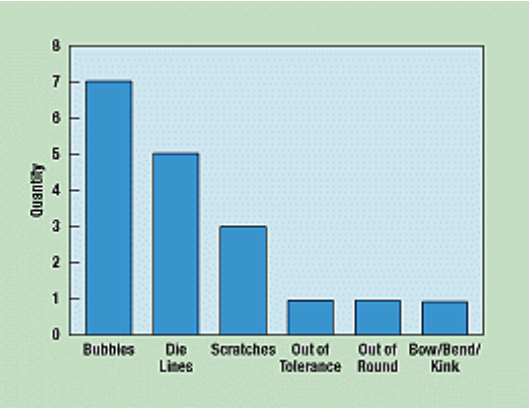
The concept behind the seven basic tools came from **Kaoru Ishikawa**, a renowned quality expert from Japan. According to Ishikawa, 95% of quality-related problems can be resolved with these basic tools. The key to successful problem resolution is the ability to identify the problem, use the appropriate tools based on the nature of the problem, and communicate the solution quickly to others. Inexperienced personnel might do best by starting with the Pareto chart and the cause and effect diagram before tackling the use of the other tools. Those two tools are used most widely by quality improvement teams.

The following is the brief detail of seven basic quality improvement tools:

11.11.1 PARETO DIAGRAMS

The Pareto diagram is named after Vilfredo Pareto, a 19th-century Italian economist who postulated that a large share of wealth is owned by a small percentage of the population. This basic principle translates well into quality problems—most quality problems result from a small number of causes. Quality

experts often refer to the principle as the 80-20 rule; that is, 80% of problems are caused by 20% of the potential sources.



A Pareto diagram puts data in a hierarchical order (as shown in Figure), which allows the most significant problems to be corrected first. The Pareto analysis technique is used primarily to identify and evaluate nonconformities, although it can summarize all types of data. It is perhaps the diagram most often used in management presentations.

As in the Figure, By rearranging random data, a Pareto diagram identifies and ranks nonconformities in the quality process in descending order.

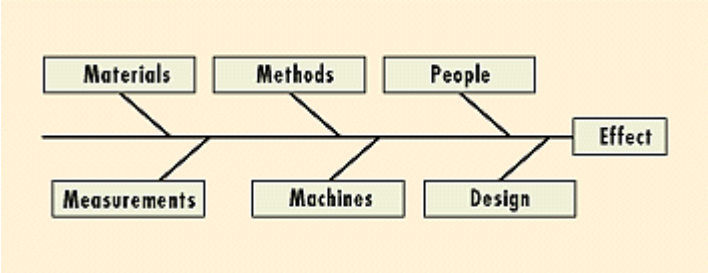
To create a Pareto diagram, the operator collects random data, regroups the categories in order of frequency, and creates a bar graph based on the results.

11.11.2 CAUSE AND EFFECT DIAGRAMS

The cause and effect diagram is sometimes called an Ishikawa diagram after its inventor. It is also known as a fish bone diagram because of its shape. A cause and effect diagram describes a relationship between variables. The undesirable outcome is shown as effect, and related causes are shown as leading to, or potentially leading to, the said effect. This popular tool has one severe limitation, however, in that users can overlook important, complex interactions between

causes. Thus, if a problem is caused by a combination of factors, it is difficult to use this tool to depict and solve it.

A fish bone diagram displays all contributing factors and their relationships to the outcome to identify areas where data should be collected and analyzed. The major areas of potential causes are shown as the main bones, e.g., materials, methods, people, measurement, machines, and design (as shown in Figure). Later, the sub areas are depicted. Thorough analysis of each cause can eliminate causes one by one, and the most probable root cause can be selected for corrective action. Quantitative information can also be used to prioritize means for improvement, whether it be to machine, design, or operator.



Fish bone diagrams display the various possible causes of the final effect. Further analysis can prioritize them.

11.11.3 HISTOGRAMS

The histogram plots data in a frequency distribution table. What distinguishes the histogram from a check sheet is that its data are grouped into rows so that the identity of individual values is lost. Commonly used to present quality improvement data, histograms work best with small amounts of data that vary considerably. When used in process capability studies, histograms can display specification limits to show what portion of the data does not meet the specifications.

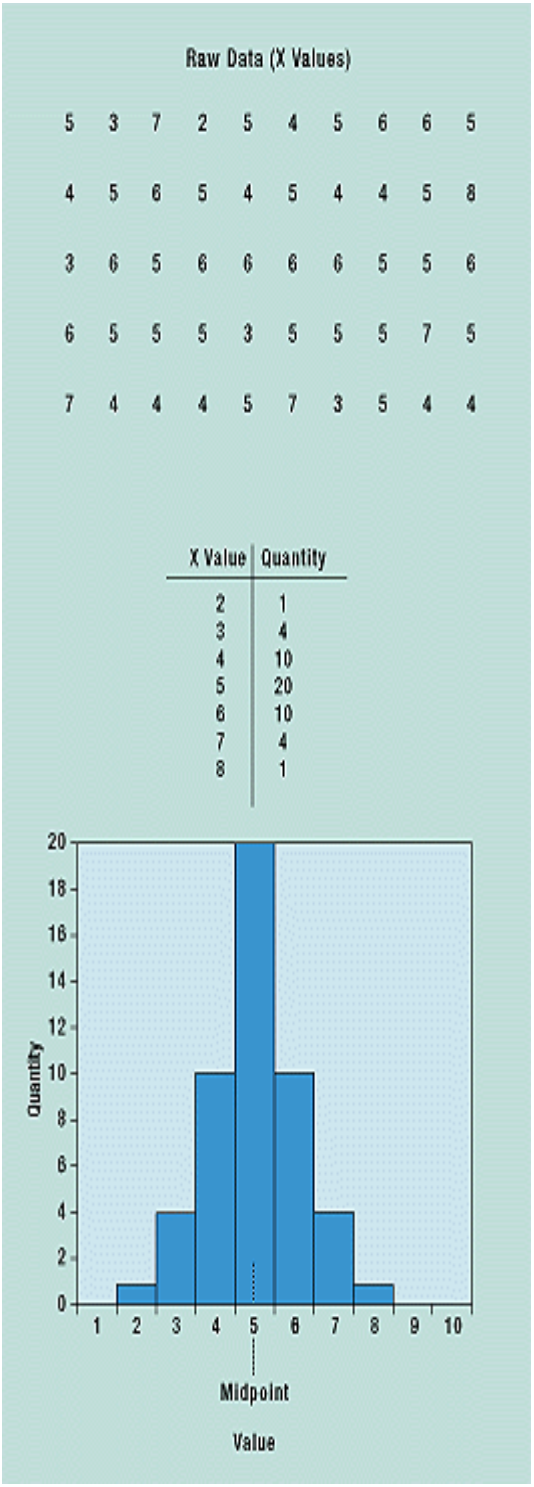


Figure. A histogram is an easy way to see the distribution of the data, its average.

After the raw data are collected, they are grouped in value and frequency and plotted in a graphical form (as shown in Figure). A histogram's shape shows the nature of the distribution of the data, as well as central tendency (average) and variability. Specification limits can be used to display the capability of the process.

11.11.4 CONTROL CHARTS

A control chart displays statistically determined upper and lower limits drawn on either side of a process average. This chart shows if the collected data are within upper and lower limits previously determined through statistical calculations of raw data from earlier trials.

The construction of a control chart is based on statistical principles and statistical distributions, particularly the normal distribution. When used in conjunction with a manufacturing process, such charts can indicate trends and signal when a process is out of control. The center line of a control chart represents an estimate of the process mean; the upper and lower critical limits are also indicated. The process results are monitored over time and should remain within the control limits; if they do not, an investigation is conducted for the causes and corrective action taken. A control chart helps determine variability so it can be reduced as much as is economically justifiable. In preparing a control chart, the mean upper control limit (UCL) and lower control limit (LCL) of an approved process and its data are calculated. A blank control chart with mean UCL and LCL with no data points is created; data points are added as they are statistically calculated from the raw data.Following Figure is based on 25 samples or subgroups. For each sample, which in this case consisted of five rods, measurements are taken of a quality characteristic (in this example, length). These data are then grouped in table form (as shown in the figure) and the average and range from each subgroup are calculated, as are the grand average and average of all ranges. These figures are used to calculate UCL and LCL. For the control chart in the example, the formula is $\pm A_2R$, where A_2 is a constant determined by the table of constants for variable

control charts. The constant is based on the subgroup sample size, which is five in this example.

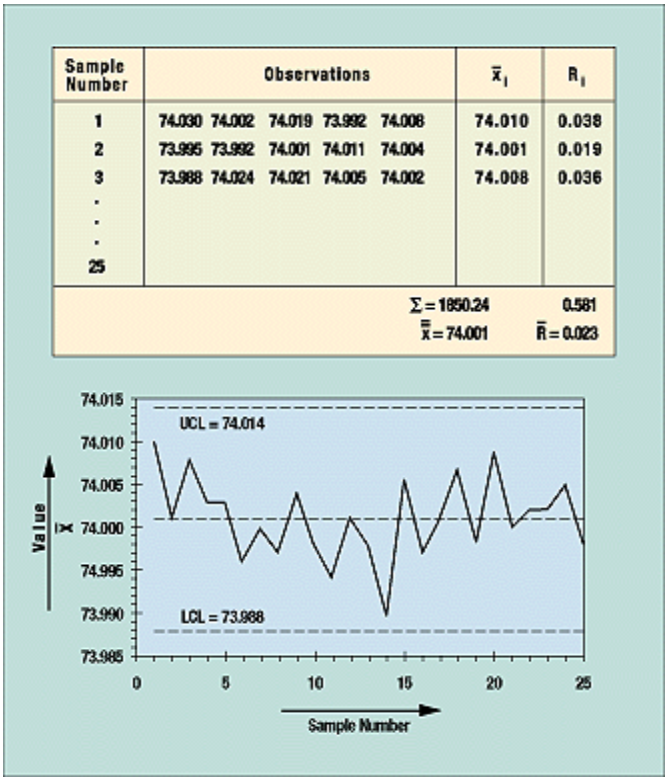


Figure. Data points that fall outside the upper and lower control limits lead to investigation and correction of the process.

11.11.5 CONCLUSION

Many people in the manufacturing industry are undoubtedly familiar with many of these tools and know their application, advantages, and limitations. However, manufacturers must ensure that these tools are in place and being used to their full advantage as part of their quality system procedures. Flowcharts and check sheets are most valuable in identifying problems, whereas cause and effect diagrams, histograms, scatter diagrams, and control charts are used for problem analysis. Pareto diagrams are effective for both areas. By properly using these tools, the problem-solving process can be more efficient and more effective.