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Handbook on Cotton Spinning Industry

B. Purushothama

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Preface

Cotton textile industry, although the oldest in the world, the technology is improving very fast coupled with automation and sophisticated controls. The monotonous heavy and risky works done by humans are gradually being handed over to machines. With the development of computers, networks and PLC controls the management of the machineries and the processes are also being handed over to the machinery or systems. The dependency on supervisor and jobber to look after the works done by workers is gradually reducing. However, someone has to supervise the working of the machines and also the process on a continuous basis. This may be done by the workers working on the machines, the quality investigators, and managers or even by the managing director or the owner himself. The activities to be done by such functions are referred as supervisory functions. The word 'Supervisor' covers all the people who do the work of supervision either full time or part time, knowingly or unknowingly, and whatever may be the designation they enjoy.

This book tries to educate the people on the purpose, functions, activities and the care to be taken at different processes of a cotton spinning mill. The language is kept as simple as possible, so that everyone can read and refer this without getting bored. I hope the industry shall get benefited by this book. Apart from dealing the technology related activities for cotton spinning, other related aspects like monitoring humidity, assuring safety, maintenance practices, manpower planning, waste management and marketing practices are also dealt with.

This is only a handbook and does not deal in detail of each of the activity explained. A list of references is given for the readers to refer the points in detail.

Purushothama

Foreword

Cotton spinning is one of the oldest industries. It was the key promoter of the industrial revolution. The spinning jenny invented by James Hargreaves in 1764 was the machine to trigger the revolution. The single spindle spinning wheel was replaced by spinning jenny, with 4 spindles working at a time giving 4 times production compared to a spinning wheel. Different industries were born after this revolution, however, even after 4 centuries, the cotton spinning industry is remaining as the biggest industry and has spread all over the world. Cotton spinning is done in all forms of industries, i.e. the cottage industry, rural industry, urban industry, organized industry, decentralized industry. It is highly labour oriented at some places whereas highly automated at some other places. The economy of the country in number of cases is depending on the success and failure of the industry.

The spinning of yarns is done either in standalone spinning mills or in composite mills which have vertical integration with fabric forming machines like spinning or knitting. The spun yarn is also supplied to non-fabric applications like ropes, industrial belts, rubber aprons, tyre cords, twines, shoe laces, braids, lace works, and so on. Yarns are manufactured with different linear densities and twist combinations and also with special effects as needed by customers. The yarns may be supplied as single, double, multifold or cabled yarns. They may be spun using a single fibre component or with double or multiple fibre components to get specific effects.

The technology and systems are changing very fast, and the industry is adapting to the change. There are innumerable types of raw materials, machines and processes, and products. They all can be grouped depending on the principle involved and the end product. Knowingly or unknowingly each mill has developed its own method and norms of working and is conservative while adapting a new system or method. The industry has grown and the spinning capacity and productions are more than the demand. Hence there is big competition between mills and between different sectors of spinning. The mills are struggling to survive and the profit margin is very low or sometimes negative. Incompetent mills get closed, but at the same time new mills are coming up with latest technology and automations.

In spite of having number of engineering colleges giving education for textile technology, the number of students opting for textiles is reducing gradually, and many colleges are forced to close down. Further, the graduates coming out of colleges are not ready to work in the production areas of spinning mills, and hence the mills are forced to appoint less qualified people and train them for the specific activities of their mill. Hence the competitiveness and innovations are lacking among the technical staff working.

It is not only the problem of getting technically qualified staff for a spinning mill; even getting the workers for production activities is very difficult. People prefer working in hotels, travel agents, tour guides, real estate agents, brokers, cab driving, hospitals, security services, etc., but are not ready to work in the production area of a spinning mill as the work in monotonous and less challenging, and one cannot show his abilities.

The technical staff and the workmen prefer to work in the units those are stable, able to pay handsome remunerations and have a system that can ease their working life. Making industry strong and stable needs involvement of technicians and workers wholeheartedly along with the management in all the activities. They need to be guided by competent authorities in a systematic way so that they can be motivated, understand the purpose of each of the activities, and know what is expected and what is not expected. They need to have the knowledge required for making each process a success, the points to be controlled and checked in each process, the responsibility and authorities of each individual in making the process a success, the activities which are imperative and those which should not be done, the normal problems and the actions needed to be taken and the data and formulae used for assessing the performance, apart from exact requirement of customer for the product being produced, and the appropriate procedure to be adapted for production.

The spinning mills also face problems of uncertain prices of raw materials and the yarn selling prices dictated by yarn merchants. We can see the yarn prices remaining stagnant for over a decade in spite of increase in prices at all other places. There is a need to explore alternate end uses for the yarns being produced so that they can find a market.

The Textile Exports Promotion Council of India (TEXPROCIL) observes Indian cotton industry with 47 Million Spindles and 0.75 Million Open-End rotors, as the world's second largest spinning capacity, commanding a share of the global cotton yarn market. India is currently (year 2014) producing over 4700 Mn kg of spun yarn of which over 3400 Mn kg is cotton yarn. Cotton yarn accounts for nearly 73% of total spun yarn production. As on today Indian spinning industry is the most modern and efficient in the world. Zellweger

Uster has published separate quality statistics for Indian mills, which is much superior to world statistics. India produces a comprehensive range of yarns for every conveyable end use –non-spun, ring-spun or open-end, combed or carded, basic, compact, mélange or fancy. India's 1943 spinning mills produce them all for requirements ranging from a fine Ne 200 count to a coarse Ne 2 count.

Cotton yarns are available as greige, bleached, mercerized, gassed, twisted, dyed or an endless range of fashion yarns like mélange, stretch, blends, high twist, fancy, and so on to meet the different applications in fashion, clothing, home textiles, hosiery, agricultural applications, medical applications, technical applications and industrial fabrics. There is varied range of mills and systems to meet every customer requirement whether large or small, regular or customized, premium or basic. Constant induction of state-of-the-art technologies like compact spinning, using the most advanced yarn processing technology and high-precision process controls tools like electronic cleaners, autolevellers, contamination detectors, metal detectors, splicers, two-for-one twisters and auto-conersalong with adaption of good quality management systems and moving towards Total Quality Management give the mills a competitive advantage.

Today, Indian yarn is widely accepted in International markets as they meet the needs of importers with unmatched efficiency and economy. However, in the present competitive environment one cannot be complacent. One has to work hard to maintain and further improve the position.

The success of a spinning mill depends on number of factors like selection of appropriate raw materials at competitive price, adapting appropriate technology for the product being produced, the working performance in production area, the quality of the products produced, the cost of operations, the cohesive team work, the innovative products launched, the customer orientation, the human resource management, the supply chain management, managing the legal and regulatory requirements, and so on. It is not possible to deal with all subjects in a handbook, and also all are not supposed to know or work at all the places. This book is trying to help the technical staff working in a spinning mill or the students willing to work in a spinning mill. Therefore, this book is limited to the activities of shop floor technical staff.

Ring-spinning is the most common spinning method used in organized industry sector world over. Other systems include air-jet and open-end spinning. This book mainly deals with ring spinning system and open-end spinning using rotor. The air-jet being relatively new, much information is not available and hence no comments or suggestions are made.

The first two chapters explain the roles and responsibilities of supervisor and jobber, in other words one looking after technical operations and other controlling the workers on shop floor. The subsequent chapters explain the activities in the sequence normally followed. At the end the maintenance practices, manpower planning, safety issues, marketing and control are explained.

The activities of human resource management are not discussed in this book. Similarly the activities of project preparation, procuring raw materials, testing the materials, godown management, store management and administrations are not discussed. This book is limited for the shop floor production activities.

As explained in preface, no specific technology is explained, but making use of available technology by using common sense and a systematic approach is given more weight.

1
Supervisor: Textile industry

1.1 Purpose of supervision

Supervision is done to ensure that the machines and process are working as per requirement and the output quality is obtained as desired. With developments in technology, more and more automation coupled with on-line monitoring and control systems; everyone has to work as a supervisor in a spinning mill. It is necessary to continuously observe the machines and materials and take immediate action whenever something is found out of order. However, there is a practice of designating some technically knowledgeable person, who can also mix with people and guide them to do the correct works as supervisors or managers. A supervisor may be a male or female, however, in practice the supervisors are addressed as male.

A supervisor is the manager of his/her section and has the target of achieving the sectional and departmental objectives by planning, coordinating, implementing and controlling the activities. He/she is a mediator between the top management and bottom line workers. The purpose of supervisors is as follows:

(a) To oversee the operations in specified area to ensure them being conducted in a planned and prescribed way in achieving the objectives of the organizations, while adhering to applicable norms, legal and regulatory requirements.

(b) Planning the activities and implementing them with the help of the subordinates.

(c) Guiding the people under him/her to achieve their targets effectively.

(d) Supervisors play a crucial role in daily management. They are the people involved in the design and establishment of the process, coordinating with the people on the shop floor and make them understand, implement the process, monitor and correct them.

(e) To ensure safe working of the machines, materials and men while targeting for the optimum productivity, required quality and least possible wastages.

1.2 What is expected from a supervisor?

The management's expectations from a supervisor are getting required production as planned, reducing the defective per cent in the products, reducing the generation of waste, improving the productivity, development of new products, fixation of work norms, maintaining discipline and harmony in work place, maintaining records as required, ensuring safety at work place including safety of machines, materials, men and surroundings, reporting the activities to superiors and provide information to top management in a prescribed form and handing over the section to next shift in a clean and orderly manner with proper instructions.

1.3 What supervisor should do?

(a) Understanding the activities to be done in detail with the purpose, methods and procedures to be adapted, the resources to be used (materials, machines, men, infrastructure, etc.), the quality to be achieved and the deadlines for completing the tasks.

(b) Understanding the present status and planning the activities in his shift, allotting the works to subordinates and coordinating for effective implementation.

(c) Taking periodic rounds and observing the works of each machine and person and taking suitable actions to correct the deviations found if any. He/she should be able to feel the differences in sound, temperature, dust level, vibrations, etc. and sense the process going out of norms.

(d) Recording the activities and reporting to top management as needed.

(e) Adhering to procedures established that are technical based, developed with rational thinking, tested by trials and approved by top management.

A supervisor in general has to do the following activities:

(i) Understanding the requirement of a customer.

(ii) Understanding the company capabilities.

(iii) Understanding the legal and regulatory requirements of the process.

(iv) Designing the product.

(v) Designing the process.

(vi) Deciding the measuring and monitoring of process.

(vii) Working out the quality plans.

(viii) Working out the production programme.

(ix) Planning for the raw materials, spares, consumables.

(x) Procuring required material in time.

(xi) Planning the maintenance activities.

(xii) Tuning the machines as per the process design.

1.4 What supervisor should not do?

A supervisor should not involve in or encourage gossips which can mislead people, should not use his/her powers to get his/her personal works done, should not favour anyone blindly without analyzing the facts and figures, should not criticize the acts of top management in front of juniors; but can discuss the pros and cons and make presentation to top from the interest of the organization, should not encourage any type of quarrels, disputes or misunderstandings that can break the team working within the organization.

1.5 Routine and special activities

The works of a supervisor in an organization can be grouped as "Routine" and "Special" activities. The routine is supposed to be done regularly without any deviation. The works include the recording of attendance, production, data of machine-wise production, quality, wastes, speed, efficiency losses, etc., labelling the products, housekeeping activities, scouring of machines, replacement of lubricants, replacement of consumable parts like ring travellers, aprons, and so on.

The special activities require creativity and thinking and the jobs are non-repetitive in nature; for example, modifications on the existing machines, modification in existing systems, launching of new products, special trainings given for staff and workmen, fixing of new standards, etc. The technicians normally like special jobs so that they can show their capabilities; unfortunately, they forget that unless the routine works are done systematically, the special works do not give results in large-scale productions, and in maintaining the systems. Therefore, the special activities should always ensure that the routines are not disturbed.

The routine activities are the backbone of any successful organization, and the rigidity in following the systems give the result, of course, when the process is designed logically. A well-designed and followed routine work ensures the stability of the organization, and assures the quality and productivity all the time.

1.6 Routine activities of production supervisor

(a) Taking round of the allocated work area before the start of the shift and observing the working.

(b) Taking charge from the previous shift supervisor with details of work in progress and works to be done further.

(c) Understanding the production plan and allocating the machines for different activities.

(d) Understanding the machines allotted for various mixings and products and deciding on the changes to be done as needed.

(e) Checking the quality of materials being produced by taking rounds and informing the concerned maintenance personnel for correcting in case of poor quality or deviation.

(f) Allocating the workers on the machines considering their skills and workloads agreed.

(g) Checking the productions periodically and taking action if found low.

(h) Working out the changes to be made for product mix and giving instructions.

(i) Monitoring the humidity and temperature as per requirement by coordinating with the concerned engineering operator.

(j) Checking the conditions of accessories and accepting only the suitable ones.

(k) Checking the colour codification and ensuring there is no confusion or chances of mix-ups.

(l) Checking the sweeping wastes for preventing good materials going in the wastes.

(m) Counselling a habitually absenting worker and referring to HRD (Human Resource Department) if needed.

(n) Counselling and influencing low performers, i.e. less producing workers to produce as per norms.

(o) Recording the stoppages and working out the production loss due to stoppages.

(p) Recording the activities in the log book (Report Book) before handing over charge to next shift supervisor.

(q) Ensuring use of safety gadgets like caps, masks, gloves and shoes by all concerned and also by self as per the work requirement.

(r) Verifying the safety stop motions provided and getting them attended in time.

(s) Maintaining records of production, summarizing and submitting to management. It is now a practice to enter the data in computer system, which form a part of MIS (Management Information System).

(t) Participating actively in mock drill for firefighting and first aid and get prepared to handle any such events.

1.7 Knowledge required for production supervisor

(a) Importance and functions of various materials, machines, mechanisms and infrastructure in the section.

(b) Production balancing – Importance and methodology for different product combinations.

(c) Role of humidity and temperature in maintaining quality and productivity.

(d) Workloads, work allocation and standard working conditions appropriate to the section.

(e) Calculation of production and efficiency, the industry norms and factors affecting productivity.

(f) Colour codification and its importance.

(g) Roles and responsibilities of a supervisor.

(h) Basic supervisory skills – Listening and observing, communicating, counselling, taking charge, reporting and motivating.

(i) General management knowledge – Managing subordinates, coordinating with workshop, coordinating with electrical department, coordinating with stores and production and coordinating with HRD.

(j) Standing orders and discipline in working.

(k) Quality precautions to be taken while working.

(l) Importance of cleanliness and personal safety.

(m) Firefighting and first aid.

(n) Safety gadgets used in the factory and the workplace.

(o) Safety precautions to be taken while working.

1.8 Routine activities of maintenance supervisor

(a) Taking round of the work area before the start of the shift and observing the working. Taking charge from the previous shift supervisor.

(b) Noting down the machines stopped for repairs and the type of problem.

(c) Understanding the quality complaints in the machines.

(d) Understanding the works done till now and the works pending in the machines stopped for repairs or for maintenance works or modifications.

(e) Understanding the production plan and preparing maintenance plan and allocating people for different activities.

(f) Understanding the machines allotted for various mixings/counts/sorts and deciding on the parameters to be checked while doing maintenance.

(g) Verifying the stock of various spares, accessories and lubricants and working out the indenting plan and placing indents.

(h) Referring the machinery catalogues and identifying the correct spares needed.

(i) Checking the quality of materials received at stores, like machine parts, bearings, maintenance tools, belts, brushes, spanners and other tools, etc.

(j) Allocating the workers for different tasks considering their knowledge, skills, maturity and workloads agreed.

(k) Checking the maintenance activities in all machines allotted to him/her.

(l) Referring to process parameters and working out the changes to be made for change in hank/count/sort or product mix and getting the changes made by the concerned maintenance workers.

(m) Checking the conditions of machine parts while they are being cleaned, scoured or overhauled and getting the worn-out parts replaced. The supervisor should prepare checklists depending on the type of machines and the purpose for which it is being used. Check the activities against the checklist.

(n) Counselling habitually absenting workers and referring to HRD if needed.

(o) Counselling and influencing a poor performing worker to work as per norms.

(p) Monitoring the stoppages due to breakdowns and analyzing the reasons for breakdowns and taking precautionary measures.

(q) Monitoring the mounting activities in cards, comber half laps, various beaters, cot mounting, buffing of rubber rollers.

(r) Conducting the tool audits, i.e. the tools used for maintenance like spanners, top arm gauge, lubricating and flushing pumps, buffing machines, mounting machines, etc.

(s) Conducting or taking part in maintenance audits for verifying the adherence to schedules and procedures, quality of maintenance work done and analyzing the effectiveness of maintenance.

(t) Recording the activities in the log book (Report Book) and updating the Machine History book. The reports may be in hard copies or in soft copies as per the requirement of the management and the systems implemented.

(u) Ensuring the use of safety gadgets like aprons, helmets/caps, masks, gloves and shoes by all maintenance workers.

(v) Verifying the safety stop motions and getting them attended.

(w) Participating actively in the mock drill for firefighting and first aid and guiding the workmen.

1.9 Knowledge required for maintenance supervisor

(a) Importance and functions of various machines, mechanisms and settings used in machines.

(b) Planning maintenance activities and preparing date-wise plans for maintenance and replacement of parts considering their life.

(c) Role of humidity and temperature in maintaining quality and productivity. Maintenance supervisor should have basic knowledge of operating a humidification plant.

(d) Workloads, work allocation and standard working conditions for maintenance operatives.

(e) Calculation of maintenance efficiency, time spent for maintenance, men employed, cost of maintenance, costs of spares consumption, mean time between breakdowns and the industry norms.

(f) Factors affecting maintenance.

(g) Roles and responsibilities of a maintenance supervisor.

(h) Basic supervisory skills – Listening and observing, communicating, counselling, taking charge, reporting and motivating.

(i) General management knowledge of managing subordinates, coordinating with workshop, electrical department, stores and production.

(j) Standing orders and discipline in working.

(k) Precautions to be taken while working.

(l) Importance of cleanliness and personal safety.

(m) Firefighting and first aid.

(n) Safety precautions and gadgets to be used in factory.

1.10 Control points and check points

It is essential for a supervisor to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare their own "Control Points and Check Points" and display them in the work area so that the supervisors refer and follow.

Control Points	**Check Points**
Production/Maintenance as per schedule	• Allocation of machinery for different product mix like count/sort/lot/contract against the production planning done. • Production required for completing the running lot. • Speeds: actual vs programmed. • Stoppages and their reasons. • Idle spindles/drums or any part of machine and their reasons. • Breakages and efficiency. • Supply of back stuff. • Maintenance schedule and actual maintenance works done.
Cost control	• Utilization of machines for production. • Men employment, productive and non-productive. • Waste generation. • In process stocks. • Avoiding working of non-productive machines/parts.

	• Avoiding good material in wastes. • Consumption of stores items. • Power cost per unit production. • Consumption of steam per unit production. • Consumption of colours, chemicals and accessories per unit production.
Quality	• Quality of input materials. • Quality of material in process. • Quality of materials produced at each stage. • Complaints received from customers/next process, the analysis of complaints, their root causes and actions taken. • Documentation of activities and changes. • Proper identification of material at all stages. • Handling and storage systems.
Administration	• Men employment as per norms and designations. • Timings of working. • Discipline in work. • Instructions verified and implemented. • Timely submitting of reports. • Clear instruction to next shift/process. • Condition and use of safety gadgets provided.

1.11 Normal problems in supervision

(a) The pressure of producing the required quantity in time as per the agreed quality irrespective of the odd situations faced due to various factors relating to inadequate communications, labour management, power shortage, maintenance lapses and non-availability of critical parts, poor quality of raw material, changes in climatic conditions and sudden changes in customer requirements, and so on.

(b) The supervisors have no right to give an excuse or comment on poor quality of raw materials, but to give results under all circumstances by foreseeing the problems in advance and taking precautionary measures.

(c) Continuous demand from the top for increasing production, improvement in quality, reduction in wastes and reduction in costs.

(d) Daily problems like short of people for working, non-receipt of material in time, frequent changes in styles/product mix, pressure of despatch and employee grievances.

1.12 Dos and don’ts for supervisor

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

1.12.1 Dos

(a) Read the log book and understand the activities being done and to be done. Do not hesitate to ask and clarify if you are not clear on any instruction or a part of an instruction.

(b) Take round of the complete work area and understand the working condition and work to be done.

(c) Give clear instructions to the jobber and other workers, and confirm that they have understood your instructions.

(d) Take periodic rounds and ensure that activities are done as planned. In case of any deviation get it rectified.

(e) Record all activities and outcomes and report as required.

(f) Take round with the next shift supervisor and explain the activities and instructions.

(g) Report the activities to your superior before leaving the office.

1.12.2 Don’ts

(a) Do not assume anything if the instructions are not clear to you.

(b) Do not use rash words (abusive words) while dealing any problem, and see that no problem is created because of your behaviour.

(c) Do not leave the work spot in case the next shift supervisor did not come in time. Inform your superior and take instructions.

(d) Do not exaggerate or hide anything while reporting to your bosses or giving instructions to subordinates.

(e) Do not use the names of your boss or top management for getting the works done; instead insist that the work is to be done as per the stated procedures and norms of work.

(f) Do not claim or take credit for the work done by your subordinates; instead give credit to the people or team for the good work done although you were the key initiator for that work.

(g) Do not decide on colour code by yourself; it should be decided in team with users and suppliers.

(h) Do not draw or produce more than the ordered quantity.

(i) Do not engage people in the shift unless you have confirmed orders.

1.13 Responsibilities of a supervisor

(a) Completing the assigned jobs and achieving the production with quality as agreed upon besides maintaining the discipline, housekeeping and team working.

(b) Ensuring that all the programmed machines are kept working.

(c) Getting the machines started in time and achieving maximum utilization.

(d) Ensuring clean working area all the time.

(e) Ensuring all materials and records are kept in their respective place.

(f) Verifying the lot numbers of materials received before taking for working.

(g) Checking and adhering to the colour codes as decided.

(h) Taking corrective actions like getting the settings corrected while limiting him to his authorities.

(i) Getting the wastes collected from each machine and putting in designated places and disposing/reusing after documenting.

(j) Providing the materials of required quality in time to next process as per the requirement of next process.

(k) Ensuring safe handling of the materials and preventing wastes and poor quality due to poor handling practices.

(l) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(m) Reporting to HRD in case of accidents and filling the accident reports in time.

(n) Helping section in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

1.14 Authorities of a supervisor

(a) Questioning the jobber and workers when the work done is not satisfactory.

(b) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(c) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(d) Reusing or reprocessing of wastes and informing higher authorities regarding the quantity used.

(e) Recommending leave and/or permission to the subordinates in the section.

(f) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(g) Rejecting poor quality materials received to prevent poor quality of final product.

(h) Discarding damaged accessories like cans, spring plates, bobbins, lap spools, cots, aprons, etc. with proper documenting and accounting.

1.15 Minimum competency requirements for supervisor

For doing any job, the person doing that job should have required minimum competence in terms of Education, Subject knowledge, Maturity (Experience), Skills, Training, Physique, Mental ability and Aptitude.

1.15.1 Knowledge and education needed for supervisor

(a) Should have degree/diploma/certificate course with basic textile technology and with details of area/system for which he is being considered as a supervisor. People without a formal technical education but have acquired good technical knowledge while working can be certified by a competent authority.

(b) Able to understand the activities, machines installed, materials working, mixing and hanks, counts, quality, production and efficiency.

(c) Able to read and understand the communications from the top as well as from the workers.

(d) Able to read and understand the instructions given in operation manuals of machines, documented work procedures and manuals of the company.

(e) Able to enter data in computers and analyze the reports generated by systems.

1.15.2 Maturity/experience needed for a supervisor

(a) Previous experience of 1 year in similar type of machines and system as junior supervisor.

(b) Minimum 5 years as a junior supervisor in case of ITI/MES certified or ATA diploma holders (i.e. those not undergone a full time formal technical education).

(c) Mature enough to understand the quality and production problems of the area being supervised and to take directions to correct them.

1.15.3 Skills required for a supervisor

(a) Able to identify any deviation in working like quality, performance, housekeeping and in feelings of workmen regarding the works.

(b) Able to take forward all as a team.

(c) Able to guide his workers.

(d) Able to communicate the requirements and problems.

(e) Sharp in detecting faults.

(f) Punctual in attending the works and problems.

(g) Meticulous in following each step of the procedures.

1.15.4 Trainings required for supervisor

(a) Technical training for managing the machines installed for quality, maintenance and operations.

(b) Production planning and management.

(c) Data entry into computer systems, taking out reports from systems and presenting the data to management.

(d) Team building and leadership.

(e) Reporting and communication.

(f) Cost of poor quality and effects of poor quality.

(g) Roles and responsibilities of supervisor.

1.15.5 Physical competency required for supervisor

(a) Physically fit to stand and take rounds in the section continuously for 10–12 h. Although the normal shift works for 8 h, the supervisor should be able to work without getting tired for some more hours.

(b) Good eye sight: Able to see the defects/deviations while taking rounds.

(c) Good in hearing: Able to detect malfunctioning of parts by the change in sound.

(d) Good in identifying the smell of materials getting heated up or getting burnt, parts rubbing, belts wearing out, etc.

1.16 Behaviour expected from a supervisor

(a) Being patient even when others are aggressive.

(b) Being polite while talking.

(c) Listening to the grievances.

(d) Not provoking by using bad languages.

(e) Being firm in getting the work done.

(f) Tackling the mistakes done but do not blame the person.

2
Jobber

2.1 Who is a jobber?

Jobber is a senior worker, nominated by management as a leader of workforce in a section to implement the policies and procedures by taking leadership and guiding the workers under him. Jobbers are more prominent in labour-oriented processes. He is a link between management (supervisor) and the workers. Jobber gets the post by his seniority as well as by his ability to guide and manage the workforce by his skills of leadership, communication, negotiation, commanding, following up, reporting and demonstrating as a role model. Jobbers are respected by the workers and management as they are practical in approach, understand workers problem and have proved their loyalty to the company by long service. Jobber is the first level supervisor. In other industries like engineering, they are called as foreman.

2.2 Purpose of a jobber

(a) To understand the requirement of management by discussing with the supervisor and translating it into action by the help of workers working under him.

(b) To oversee the operations in a specified area allotted to ensure that they are being conducted in a planned way to achieve the objectives of the section, while adhering to prescribed norms, legal and regulatory requirements.

(c) Planning the activities in the section allotted and implementing them with the help of the workers working under him.

(d) Guiding the people working to achieve their targets effectively.

(e) Understanding the grievances and problems of workers and explaining them to management through supervisor and helping to solve those problems.

2.3 What is expected from a jobber?

(a) Getting planned production by supervising the working of machines and workmen.

(b) Coordinating with the jobbers of supplier section and getting the required materials for production in time.

(c) Coordinating with the jobber of next operation and getting the requirements from him and arranging to supply the materials.

(d) Identifying the poor performers and guiding them to produce as per norms.

(e) Monitoring the workers attendance and counselling those habitually absenting.

(f) Counselling the workers in case of short of hands and making them to come for work either for overtime or as regular worker.

(g) Maintaining discipline and harmony in work place.

(h) Maintaining housekeeping.

2.4 What jobber should do?

(a) Understanding the activities to be done in detail with their purpose, procedures to be adapted, the resources to be used, (materials, machines, men, infrastructure, etc.) and the deadlines for completing the tasks by discussing with the outgoing jobber and the supervisor.

(b) Understanding the situation and planning the workers for the activities to be done in his shift, allotting the works and coordinating for effective implementation.

(c) Taking periodic rounds and observing the works of each machine and person, and taking suitable actions to correct the deviations found if any by coordinating with the workers and the maintenance staff.

(d) Identifying the low performers and those following bad work practices and coaching them to improve their performance and follow standard work practices.

(e) Helping supervisor in recording the activities and for reporting to top management.

(f) Adhering to procedures that are approved by top management.

(g) A jobber in general has to do the following activities:

  (i) Work as a bridge between supervisor and workers and get the works done by workers as per the guidelines of the management.

(ii) Working as a role model and guiding workers to do their works effectively.

(iii) Maintaining discipline in the section and taking forward workers as a team.

2.5 What jobber should not do?

(a) Should not involve or encourage in gossips which can mislead people.

(b) Should not use his powers to get his personal works done by the workers.

(c) Should not favour anyone blindly without analyzing the facts and figures.

(d) Should not criticize the acts of top management in front of workers, but can discuss the pros and cons and make presentation from the interest of the organization.

(e) Should not encourage any type of quarrels, disputes, or misunderstandings that can break the team working within the organization.

2.6 Routine activities of a jobber

(a) Taking round of the work area along with the jobber of outgoing shift before the start of shift and observing the working.

(b) Taking charge from the previous shift jobber with details of work in progress and works to be done further.

(c) Understanding the production plan and allocating the workers on machines for different activities.

(d) Understanding the machines allotted for various mixings and products and following up for the materials required.

(e) Verifying the availability of empty bobbins, empty cans, etc. of specified colour combination as per the decided colour codes for the materials being worked, and informing the supervisor in case of any problem.

(f) Adhering strictly to the colour codification agreed.

(g) Checking the quality of materials by taking rounds and informing the supervisor and concerned maintenance personnel for correcting in case of poor quality.

(h) Allocating works to workers considering their skills and workloads agreed.

(i) Checking the productions periodically and taking action where it is low.

(j) Following up and making the changes as instructed by supervisor for product mix and giving instructions to workers for its working.

(k) Observing the humidity and temperature and coordinating with the concerned engineering operator in case of variations and poor working.

(l) Checking the conditions of accessories and taking only the suitable ones.

(m) Adhering to colour codification and ensuring no confusion or chances of mix-ups.

(n) Checking the sweeping wastes for preventing good materials going in the wastes.

(o) Counselling a habitually absenting worker and referring to supervisor if needed.

(p) Counselling, guiding and influencing low performers to perform as per norms.

(q) Recording the stoppages and giving to supervisor for further action.

(r) Ensuring use of safety gadgets like caps, masks, gloves and shoes by all concerned and also by self as per the work requirement.

(s) Ensuring use of waist bags for collecting wastes generated and depositing them in the designated bin, and not allowing any wastes to be thrown on floor.

(t) Checking the wastes collected, labelling them and sending to waste yard after recording its weight at the end of each shift.

(u) Verifying the safety stop motions provided and getting them attended in time.

(v) Participating actively in mock drill for firefighting and first aid and get prepared to handle any such events.

2.7 Knowledge required for jobber

(a) Importance and functions of various materials, machines, mechanisms and infrastructure in the section.

(b) Humidity and temperature required for the section for quality and productivity.

(c) Workloads, work allocation and standard working conditions appropriate.

(d) Colour codification and its importance.

(e) Roles and responsibilities of a jobber.

(f) Basic skills of leadership, listening, observing, communicating, counselling, taking charge, motivating and reporting.

(g) Standing orders and discipline in working.

(h) Quality precautions to be taken while working.

(i) Importance of cleanliness and personal safety.

(j) Firefighting and first aid.

(k) Safety gadgets used in the factory and the workplace.

(l) Safety precautions to be taken while working.

2.8 Control points and check points

It is essential for a jobber to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare their own "Control Points and Check Points" and display them in the work area in local language, so that the jobbers can refer and follow.

Table 2.1 Control points and check points

Control Points	**Check Points**
Production as per schedule	• Allocation of machinery for different count/sort/lot/contract against the production planning done. • Production required in each lot/contract for completing the running lot. • Stoppages and their reasons. • Idle spindles/drums or any part of machine and their reasons. • Breakages and efficiency. • Supply of back stuff. • Supply of empties – Clean empties without any damage.

Cost control	• Full utilization of machines working for production. • Men employment, productive and non-productive. • Production of each worker in his section. • Waste generation – Man wise and machine wise. • In process stocks – Cleaning of unused materials. • Avoiding working of non-productive machines/parts. • Avoiding good material in wastes.
Quality	• Quality of input materials. • Quality of material in process and the materials produced. • Actions suggested for complaints received from customers and/or next process. • Proper identification of material at all stages. • Handling and storage systems and damages in handling. • Housekeeping.
Administration	• Men reporting for work and their competence. • Men employment as per norms and designations. • Timings of working. • Discipline in work. • Instructions verified and implemented. • Clear instruction to workers.

2.9 Normal problems faced by jobbers

(a) Running the allocated machines by allotting suitable persons in time in spite of problems like short of workers and workers of different competence.

(b) The pressure of producing the required quantity in time of quality materials irrespective of the odd situations they face.

(c) Continuous demand from the top for increasing production, improvement in quality, reduction in wastes and reduction in costs whereas workers have their own demands. He has to motivate the workers and take them together forward.

(d) Daily problems like short of workmen, non-receipt of material in time, frequent changes in styles/product mix, pressure of despatch and employee grievances.

(e) Convincing the workers about the good intentions of the management in the activities being done at the mills.

2.10 Dos and don'ts for jobber

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

2.10.1 Dos

(a) Discuss with the supervisor and understand the activities being done and to be done. Do not hesitate to ask and clarify if you are not clear on any instruction or part of an instruction.

(b) Take round of the complete work area allotted to you and understand the working condition and work to be done.

(c) Give clear instructions to the workers, and confirm that they have understood the instructions.

(d) Explain the workers regarding the importance of doing the work allotted and ensure that the workers are convinced about the objective and quality requirement.

(e) Take continuous rounds and ensure that activities are done as planned. In case of any deviation get it rectified.

(f) Observe each worker for the work methods followed and correct the erring workers.

(g) Observe all activities and outcomes and report as required to the supervisor.

(h) Take round with the next shift jobber and explain the activities and instructions.

(i) Report the activities to your supervisor before leaving the office.

2.10.2 Don'ts

(a) Do not assume anything if the instructions given to you are not clear. Ask the supervisor and get it clarified.

(b) Do not use rash (abusive) words while dealing with any problem, and see that no problem is created because of your behaviour.

(c) Do not leave the work spot in case the next shift jobber or acting jobber did not come in time. Inform the supervisor and take the instructions.

(d) Do not exaggerate or hide anything while reporting to your bosses or giving instructions to workers.

(e) Do not use the names of your boss or top management for getting the works done; instead insist that the work is to be done as per the stated procedures and norms.

(f) Do not claim or take credit for the work done by your subordinates; instead give credit to the people or team for the good work done although you were the key initiator for that work.

(g) Do not draw more material or produce more than the ordered quantity.

2.11 Responsibilities of a jobber

(a) Completing the assigned jobs and achieving the production with quality besides maintaining the discipline, housekeeping and team working.

(b) Ensuring that all the programmed machines are kept working.

(c) Getting the machines started in time and achieving maximum utilization.

(d) Getting the required back materials for working in time and ensuring that all machines are supplied with required material.

(e) Ensuring clean working area and good housekeeping all the time.

(f) Ensuring that all materials and records are kept in their respective places.

(g) Verifying the lot numbers of materials received before taking for working.

(h) Checking and adhering to the colour codes as decided.

(i) Getting the wastes collected from each machine and putting in designated places and disposing or reusing after documenting.

(j) Providing the materials of required quality in time to next process as needed.

(k) Ensuring safe handling of the materials and preventing wastes and poor quality due to poor handling practices.

(l) Maintaining discipline in the section and informing the higher authorities.

(m) Reporting to supervisor in case of an accident and helping supervisor in filling the accident reports in time.

(n) Helping section in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

2.12 Authorities of a jobber

(a) Questioning the workers when the work done is not satisfactory.

(b) Taking a worker to supervisor in case of serious lapse in discipline.

(c) Allotting jobs to workers considering their skills and the requirements.

(d) Stopping the production in case of any deviations found in the quality and informing the supervisor for necessary corrective actions.

(e) Rejecting the materials received in case of poor quality.

(f) Discarding damaged accessories like cans, spring plates, bobbins, lap spools, cots, aprons, etc. with proper documenting and accounting after showing to supervisor.

2.13 Minimum competency requirements for jobber

The person doing a job should be competent having required Education, Subject knowledge, Maturity (Experience), Skills, Training, Physique and Mental ability or Aptitude for the job.

2.13.1 Knowledge and education needed for jobber

(a) Should be able to read and write in the local language (the language spoken/understood by majority of workmen).

(b) Should be able to read instructions coming from management.

(c) Able to understand the activities, machines installed, materials working, mixing and hanks, counts, quality, production and efficiency in his section.

(d) Able to understand the worker's grievances and reporting it in writing suitably on behalf of worker if needed.

(e) Able to read and understand the work instructions displayed in the department and explaining it to workers under him.

2.13.2 Maturity/experience needed for a jobber

(a) Work experience of minimum 5 years in similar work system.

(b) Mature enough to understand the quality and production problems of the area he is working and take directions to correct them.

(c) Mature enough to understand the genuine grievances and fake grievances and forwarding only genuine grievances to supervisor.

2.13.3 Skills required for a jobber

(a) Identifying deviation in working like quality, performance, housekeeping and in feelings of workmen and reporting the same to supervisor in time for taking action.

(b) Able to take forward all his workers as a team.

(c) Able to guide his workers and demonstrate the way of working.

(d) Able to communicate the requirements and problems.

(e) Sharp in detecting faults.

(f) Punctual in attending the works and problems.

(g) Meticulous in following each step of the work instructions and procedures.

2.13.4 Trainings required for jobber

(a) Team building and leadership.

(b) Concepts of quality circles.

(c) Concepts of Kaizen (continuous improvement).

(d) Reporting and communication.

(e) Cost of poor quality and effects of poor quality.

(f) Roles and responsibilities of jobber

2.13.5 Physical competency required for jobber

(a) Physically fit to stand and take rounds in the section continuously for 10–12h and do heavy physical works when needed, although shift is of 8 h.

(b) Eye sight – Should be able to see the defects and deviations while taking rounds.

(c) Hearing – Should be able to detect malfunctioning of parts by the change in sound.

(d) Good in identifying the smell of materials getting heated up or getting burnt, parts rubbing, belts wearing out, etc.

(e) Touch sensation – Should be able to feel increase in temperature, increase in vibrations, etc. by touching and feeling.

2.14 Behaviours expected from a jobber

(a) Being patient and understanding the problems rather than arguing with the people when others are aggressive.

(b) Being polite while talking not only to superiors but also to fellow workmen.

(c) Listening to the grievances and representing effectively the genuine ones.

(d) Not provoking anyone by using bad languages.

(e) Being firm in getting the work done and continuously following up for the same.

3
Mixing

3.1 Purpose of mixing

To mix cottons from different lots to get the required quality parameters for enabling spinning of yarn with specified technical parameters, while ensuring lowest possible cost and have consistency in yarn quality in a long run.

3.2 What is expected from a good mixing?

Achieving required yarn quality at lowest possible cost, consistency in yarn quality for a long run and stability in mixing cost over a period of time are expected from a good mixing.

3.3 What mixing should do?

(a) Selecting cottons from different lots considering their quality and clean cotton cost to get the required average quality and maintaining the lowest possible cost.

(b) Taking one bale each from maximum possible number of lots and preparing a mixing representing all lots to ensure consistent quality and cost for a long run.

(c) Opening the bales and plucking cottons from each bale uniformly in smallest possible tufts and avoiding harsh beating at blow room.

(d) Preparing a homogeneous mix of cottons from all the bales taken for mixing.

(e) Removing the bale covers, steel hoops or wires and delivering to designated scrap point or area for disposal.

(f) Removing the visible dirty cottons and contaminations while making mixing.

(g) Allowing the mixing for conditioning in case of stack mixing.

3.4 What mixing should not do?

(a) Taking more bales from a lot at a time.

(b) Putting unopened big lumps from bales into mixing.

(c) Taking more cottons from some bales and less cottons from some other bales.

(d) Opening the bales without noting the bale numbers, lot numbers and their weight.

(e) Taking some other lot of cotton than specified.

3.5 Routine activities in cotton mixing area

(a) Referring to the cotton test report, availability of different cotton lots, number of bales in each lot and deciding a mixing strategy to get the lowest possible cost and long-term stability in mixing costs.

(b) Indenting and getting the required cotton bales for the mixing.

(c) Allocating the place for different bales on floor.

(d) Cleaning the floor and removing the cotton traces of earlier mixing.

(e) Laying cotton bales at demarcated place.

(f) Removing bale covering cloths, metal hoops, steel wires, etc., and delivering them to waste yard after cleaning and segregation.

(g) Taking out small tufts of cotton from each bale uniformly and preparing a homogenous stack in case of stack mixing.

(h) Keeping the accounts of bales received, weight of each bales, the bales in stock and submitting for costing.

3.6 Knowledge required for making mixing

(a) Effect of various cotton parameters like span lengths, uniformity ratio, bundle strength, elongation at break, maturity coefficient, Rd and +b values, trash content, type of trash, nep content, etc., on the yarn properties.

(b) Availability of cottons not only in the company but in the market to plan the procurement of cotton and mixing components to have long-term stability.

(c) The procurement costs and the expected clean cotton cost of all component cottons in a mixing.

(d) The constraints in the mixing area like the maximum number of bales that could be accommodated in a mixing, the maximum number of bales in a lot that could be accommodated in the cotton godown, etc.

3.7 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area so that the people on the spot refer and follow.

3.7.1 Control points in cotton mixing

(a) Selection of bales considering the parameters like length, strength, fineness, colour, trash, maturity, neps, etc., and their variations to meet the quality requirements of the yarn proposed.

(b) The proportion of different components in the mixing considering their properties, cost, age and stocks.

(c) The quantity of mixing to be done at a time.

(d) Time for issuing mixing in time.

(e) Thorough opening and homogeneous mixing.

(f) Maximum tuft size allowed in the mixing.

(g) The proportion and type of useable soft wastes to be added in the mixing.

(h) Deciding the addition of spin-finish, hygroscopic and antistatic agents, tinting colours, etc., depending on the materials being used.

(i) Adequate conditioning of mixing before feeding to the blow room.

(j) The work allocation for employees.

(k) Disposal of bale packing materials like bale cover cloth, bale hoops or wires.

3.7.2 Check points in cotton mixing

3.7.2.1 Material related

(a) The lot numbers of the bales received and the mixing plan.

(b) The position of the bales kept and the mixing plan.

3.7.2.2 Machine related

(a) Setting of the bale plucker to get the required tuft size.

(b) Condition of the mixing bale openers.

(c) Setting and working of the sensors in mixers.

3.7.2.3 Setting related

(a) The requirement of temperature and humidity.

(b) Setting the spray when antistatic or cotton spray oil is used.

3.7.2.4 Performance related

(a) Whether the antistatic agent/spin finish/tint, etc., are prepared properly as per plan and applied uniformly?

(b) Whether the layers of opened material are put properly in the stack to have a homogeneous mixing?

(c) Whether the required time is allowed for conditioning?

(d) Whether the men employed are as per plan?

(e) Whether the required quantity of mixing is prepared?

(f) Whether the usable wastes are received with proper identification?

3.7.2.5 Documentation related

(a) Cotton lot number, bale number and weight of bale.

(b) Date and time of preparation of mixing.

3.7.2.6 Work practice related

(a) Cleaning the floor properly before laying the mixing.

(b) Keeping the bales in their designated place as per mixing floor plan.

(c) Whether bales are opened gently?

(d) Keeping bale cover cloth and bale hoops removed at designated place.

(e) Cleaning the surface of bales before opening.

(f) Whether cotton bales are opened and broken into smallest tufts as explained?

(g) Whether the contaminations are removed by proper checking?

(h) Whether the identification board is updated?

(i) Checking and cleaning of wastes before adding in the mixing.

(j) Maintaining uniform quantity of useable wastes added in all mixings.

3.7.2.7 Log book related

(a) Instructions for preparing mixing.

(b) Stock of mixings in the end of the shift.

3.7.2.8 M.I.S. related

(a) Cotton lot number, name of cotton variety and the station.

(b) Cotton bale numbers.

(c) Weight of each bale.

(d) Bales remaining in each lot at the end of shift.

(e) Production in kilograms in each mixing.

(f) Wastes collected and added in mixing.

3.7.2.9 General

(a) Free access to electrical control panels and fire extinguishers.

(b) Whether fire extinguishers are in working position and in their allocated places.

(c) Keeping the fire exit doors free and the passages not blocked.

(d) Check whether the men employed are adequately trained.

(e) The workers using safety gadgets like masks and headgear while working.

3.8 Normal problems in mixing

Some of the normal problems in mixing are discussed below.

3.8.1 Wrong issue of cotton bale for mixing

Some of the reasons for issue of wrong bale are as follows:

(a) While issuing the cotton bales, a bale from adjacent stack is issued.

(b) Bales are not kept properly in allocated position in godown as per the lot numbers.

(c) Display boards of cotton lots are got displaced while removing cotton bales.

(d) Insufficient free place between stacks makes it difficult to identify the particular stack.

3.8.2 Quick running out of a bale whereas other bales are still big

Reasons for quick running out of a bale are as follows:

(a) Bales of different weights and density.

(b) One worker is not opening the bales properly and taking bigger lumps at a time whereas others are taking small lumps out.

(c) Varying density of the bales received.

3.8.3 Non availability of workers for mixing

Reasons for non-availability of workers are as follows:

(a) Mixing is a monotonous job without any challenge and does not require any formal education and hence illiterate people are normally employed. As education levels have increased, the people are not willing to come and work at mixing.

(b) Mixing generates lot of dust and hence people do not like to work in mixing.

(c) As more opportunities are available outside, people do not prefer working in a cotton mixing area.

3.8.4 Uncontrolled addition of soft wastes

(a) The reusable soft wastes are generated due to poor working in spinning preparatory. Instead of analyzing the root of problem, the management insists on reduction of soft wastes and actions are taken on the staff for higher wastes. In such cases, the workers and staff bring the wastes to mixing room and throw on running mixing without accounting.

(b) Some mills, as a policy, consume all the soft wastes produced in the same day irrespective of the actual productions or the quantity of mixing.

(c) Uncontrolled addition of soft wastes results in higher breakages, lower strength of yarn and higher neps and imperfections.

3.8.5 Unopened sliver wastes dumped in the mixing yard

The sliver wastes are to be opened by hand before adding to cotton mixing. Sometimes, the workers just throw the sliver wastes that are having longer lengths of slivers. This shall result in breakdowns of lattices.

3.8.6 Improper additions of cotton spray oil

Cotton spray oil is used in stack mixings during dry seasons to reduce static generation. Improper spraying results in wet cotton at some places, and can lead to jamming and breakdowns in blow room.

3.8.7 Improper conditioning of mixing stack

It is essential to keep the mixing stack for conditioning to make the moisture content uniform at all places. However, in number of cases, it is found that the mixing is not allowed to get conditioned, but used in blow room, resulting in uneven lap preparation.

3.8.8 Not cleaning of sides of bales before mixing

The sides of the bales shall normally have mud, oil stains, rust particles and broken pieces of hessian. If it is not cleaned by hand before opening the bales, it results in contaminations and stains.

3.8.9 Wet and matted bales received

Wet and matted bales are due to water falling on bales during transportation or in storage.

(a) Ensure that there is no leakage in bale storage area.

(b) Cover the bales with tarpaulin if they are stored in open area.

(c) Do not open the wet bales, but send it back to cotton godown, and ask for replacement.

3.8.10 Too much contamination in cotton bales

Too much contamination like yellow fibres, foreign materials, seeds, etc., is seen after the bale is opened. Do not use such bales.

(a) Segregate the contaminations, if possible, by engaging extra person and use the good portion.

(b) If segregation is not possible send the bale back to cotton godown.

(c) Note down the bale number and the cotton lot and inform the cotton godown and the person in charge of cotton purchase.

3.9 Dos and Don'ts for mixing

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

3.9.1 Dos

(a) Verify the cotton lot and bales before opening.

(b) Record the cotton lot, bale number and the position of that bale in the mixing area.

(c) Clean the mixing area well before opening the bales.

(d) Open the bale gently without causing any injury to the persons at work.

(e) Collect bale coverings, hoops, wires, etc., and send these wastes to the concerned waste yard.

(f) Collect visible contaminations while opening the bales and mixing.

(g) Open the bales and take as small a tuft as possible while making stack mixing.

(h) Ensure spreading of cottons from each bale uniformly in layers in stack mixing.

(i) Ensure taking uniform quantity of cotton from each bale while making stack mixing.

(j) Allow the mixing to get conditioned in case of stack mixing.

(k) Control the soft wastes added into the mixing.

(l) Open the soft wastes thoroughly and spread all over the mixing in different layers.

(m) Update the mixing display board immediately after preparing each stack mixing.

3.9.2 Don'ts

(a) Do not take more bales from a single cotton lot.

(b) Do not take big lumps and put in stack.

(c) Do not put all soft wastes at one place in the mixing.

(d) Do not vary the percent of soft wastes added into the mixing.

(e) Do not put unopened sliver wastes in the mixing.

(f) Do not put roving wastes in the mixing.

(g) Do not use buckets or mugs to put cotton spray oil; use a spray pump.

(h) Do not allow anyone to sit or sleep on the mixings.

(i) Do not allow any slippers, clothes or other materials to be kept near the mixing.

3.10 Responsibilities of supervisor in mixing

(a) Ensuring that mixings are prepared in time as per the requirement of spinning.

(b) Ensuring that only the specified cotton lots are used in mixing.

(c) Keeping account of the mixings made and the soft wastes added into mixing.

(d) Ensuring that the tufts are made as small as possible while making stack mixing.

(e) Updating the display boards immediately after making mixing.

(f) Ensuring that the bale covers, hoops, wires, etc., removed from bales and are collected and handed over to waste yard.

(g) Maintaining mixing area clean all the time.

(h) Maintaining discipline among the people working at mixing.

3.11 Authorities of supervisor in mixing

(a) Questioning the jobber (Mukaddam) and workers when the work done is not satisfactory like large tuft sizes, some bales finishing early, mixing area not cleaned, mixing board not updated, keeping bales obstructing the walking ways, not cleaning the bale sides, not properly removing the bale hoops and hessian, etc.

(b) Authorized to send memo to HRD in case of serious lapse in discipline by any of the employee working under him like sleeping on the mixing bin, spitting in the working area, teasing a fellow worker, etc.

(c) Authorized for recommending leave and/or permission to the subordinates.

(d) Authorized to reject the cotton bale if found with too much contaminations, water damages and mix ups.

4
Blow room

4.1 Purpose of blow room

(a) Opening and cleaning the cotton thoroughly and making a homogenous mix of all components of mixing and making it suitable for feeding to cards either in the form of laps or directly through chutes.

(b) Cleaning and removing the trash from cotton as much as possible without rupturing the fibres.

4.2 What blow room should do?

(a) Opening the baled fibres into small tufts to allow foreign matter to be separated from the fibres and preparing the material easy for carding.

(b) Cleaning the fibres by removing the foreign matters like seeds, seed coats, leafy matters, sand, dust, metal particles, etc.

(c) Mixing thoroughly different component fibres to get a homogenous blending.

(d) Preparing a uniform sheet of fibres and preparing lap for feeding to cards.

(e) To feed cards with chute arrangement uniformly as per their requirement.

4.3 What blow room should not do?

(a) The fibres should not be over-beaten or over-treated to look rolled or stringy.

(b) Good spinnable fibres should not go in waste.

(c) Blow room should not increase/generate fibre neps.

(d) The fibres should not get contaminated with any oil or oily substance.

(e) In case of laps, the layers should not stick while unwinding at cards.

4.4 General activities of a blow room

(a) Breaking the cotton tufts and making it smaller by the action of beating either by holding the fibres or in a loose form in air and tearing the tufts apart by use of sharp pins and saw tooth wires, and making the trash loose so that they can be removed.

(b) Removing the trash by beating and passing the cotton over sharp grid bars.

(c) Removing the metal pieces by passing the cotton over magnets.

(d) Removing heavy particles like stones by using gravity traps.

(e) Extracting micro dusts from cotton by using strong air currents and filtering over perforated screens.

(f) Conveying cotton from one machine to another within blow room by use of pneumatics or lattices.

(g) Collecting the trash by suitable means, conveying out and compressing them for easy disposal.

(h) Filtering the air let out by using rotary screens.

4.5 Knowledge required for working blow room

(a) Role of opening points and cleaning points.

(b) Selection of cleaning points depending on the cotton properties.

(c) Increasing or decreasing the intensity of opening/beating.

(d) Grid bars setting required for different types of cottons and trash contents.

(e) Synchronizing the working of machines in blow room.

(f) Waste evacuation, compressing and disposal.

(g) Safety precautions while working blow room.

4.6 Control points and check points

One needs to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area so that the people on spot refer and follow.

4.6.1 Control points in blow room

(a) Selection of opening and cleaning points and their sequence as per the mixing and the trash content in cotton.

(b) Selection of process parameters like speed, setting, hank of material delivered, length of lap, the calendar and rack pressure in scutchers, etc., to get optimum cleaning as well as required production.

(c) Evolving and implementation of maintenance schedules.

(d) Engaging trained workmen.

(e) Deciding the work allocation per employee.

(f) Providing and maintaining safety gadgets as required.

(g) Deciding the frequency and systems for waste evacuation and transportation.

(h) Suitable identification systems for wastes and good material delivered.

4.6.2 Check points in blow room

4.6.2.1 Material related

(a) Adequate conditioning of mixing in case of stack mixing.

(b) Mixing board should be correct of mixing being used.

(c) Lump size fed. If found very big, get it opened before feeding.

4.6.2.2 Machine related

(a) Whether all the cleaning and opening points required are in working order?

(b) Whether the bypasses are done as per plan?

(c) Whether the beaters, pins, saw tooth beaters are sharp and in good condition?

4.6.2.3 Setting related

(a) Synchronization of working of machines suiting the quality requirement.

(b) Speeds of the beaters, fans, feed rollers, etc., and the plan.

(c) Settings as decided suiting the cotton being worked.

(d) The temperature and humidity are as per requirement.

4.6.2.4 Performance related

(a) Check the droppings for presence of good cottons.

(b) Whether the hank of lap or the weight per meter of delivered material sheet is as per plan and is uniform?

(c) Whether neps generation and fibre rupture are within control?

4.6.2.5 Documentation related

(a) Mixings worked on each blow room line.

(b) Production in each line in each mixing.

(c) Stoppages with their reasons.

4.6.2.6 Work practice related

(a) Cleaning of the lines as per plans, and before changing the mixings.

(b) Workmen following safety regulations regularly.

(c) Removing wastes in time and labelling properly.

4.6.2.7 Log book related

(a) Instructions for running blow room.

(b) Stock of mixings in the end of the shift.

4.6.2.8 M.I.S. related

(a) Mixing

(b) Production in kilograms in each blow room line.

(c) Wastes collected and compressed (kg)

4.6.2.9 General

(a) No material is blocking access to electrical control panels and fire extinguishers.

(b) All fire extinguishers should be in working position and in their allocated places.

(c) The fire exit doors should be free and the passages are not blocked.

(d) Whether the men employed are adequately trained?

4.7 Normal problems in blow room

Following are some of the normal problems in blow room. The possible reasons for the problems are discussed below.

4.7.1 Low cleaning efficiency

The normal reasons for low cleaning efficiency are lower extraction of wastes than required considering the trash content, high rate of feeding, the beater speeds are lesser than required, low space between the grid bars, improper setting of the air-inlets under the grid, the grip of the feed roller is less, sharpness of the beaters not enough, improper synchronization of the machine working, back draught because of not cleaning the wastes under the machines.

Consider the following actions to improve cleaning efficiency.

(a) Check the waste percent in each beater by conducting a controlled study and identify where the wastes are less than normal. Check for good cotton content in the waste. If there is no good cotton content in waste, increase waste.

(b) Check the beater speeds and increase if they are lower than recommended.

(c) Check and correct beater to feed plate settings. Reduce the feed roll to beater gauge.

(d) Increase the spacing between adjacent grid bars in steps till obtaining optimum cleaning with optimum blow room wastes.

(e) Increase the condenser speed but maintain the pressure by keeping the windows in pipe closed.

(f) Close slightly the air-inlets under grid bars towards the cotton entry side, and open those on delivery side for increasing the wastes.

(g) Reduce fan speeds by 100 to 200 RPM, while ensuring that cottons are not getting jammed.

(h) Check the grip of feed roller on the cotton between feed roller and pedals and correct the pedals pressure by adjusting the fulcrum.

(i) Check whether there is any back draft due to gutter (waste collection unit) not cleaned properly.

(j) Ensure periodic removal of wastes from each machine; increase the frequency if needed.

(k) Improve condition of beaters.

(l) Increase the number of beating points, if fewer than optimum.

(m) Avoid excessive humidity in blow room.

4.7.2 High generation of neps and fibre rupture

Blunt beaters, burrs in grid bars, bent pins on beater, poor condition of spiked lattice, higher beater speeds, lower fan speed, feed roller to beater setting too close, rough surface of conveying pipes, rough surface of vanes of transport fans, rough surface of covers where fibres come in contact, sharp bends in conveying pipes, more number of bends in conveyor pipes, more number of fans and beating points, and excessive feed are main reasons.

If materials return back to beaters neps shall generate; hence check the setting of leather flaps, stripper knife, etc. Excessive of soft wastes fed, and cottons with more immature fibres are major reasons for neps in opened material.

The following actions are recommended:

(a) Replace the leather of flap beater if edges are torn out or have many cuts.

(b) Check and adjust the stripper knife to beater settings.

(c) Remove burrs and rust on grid bars.

(d) Smooth the rough surface inside the trunk.

(e) Reduce length of conveyor pipe lines and eliminate sharp bends.

(f) Sharpen the beater edges and remove burs on it.

(g) Increase speed of fan following the beater by 100–200 RPM.

(h) Straighten out bent nails and remove broken nails, if any, on the beaters.

(i) Reduce reprocessing of once opened material.

4.7.3 High variability in the delivered hank

The normal reasons for high variability in delivered hank are improper levels in the hoppers and improper action of feed regulators, viz. cone drums, pedals, photocells, direct driving gear motors.

Following actions are recommended:

(a) Watch the reserve box and find out whether the level of cotton in the box goes below the minimum level. If it is going below the minimum level, increase the feed.

(b) Check and ensure that the level indicating system, may be photo cell or electronic devices are performing properly.

(c) Check and ensure that the feed controls in blow room machineries like swing doors, solenoids, micro switches, relays, etc., are functioning properly.

(d) Check and ensure proper working of cone drum belts and PIV drives used for regulating the feed to the beaters.

(e) In case of chute feeding take the following actions:

  (i) Adjust the chute width.

  (ii) Maintain the proportion of the running time and idle time of the feeding machine at about 90% and 10%, respectively.

  (iii) The feed roller in any chute feed should be run for the maximum possible time.

  (iv) Adjust the differential pressure switch in such a way that as soon as the material is filled in the chute, the feeding machine is switched off.

  (v) Clean the material and dust accumulation on perforated sheet.

4.7.4 Formation of cat's tail

If material movement is less and cottons are over beaten, we get this defect. To avoid cat's tail take following action.

(i) Sharpen beater edges.

(ii) Increase fan speeds.
(iii) Increase the air-inlet below the grid bar area of cotton entry.
(iv) Close the striping knife and beater setting.
(v) Straighten bent knife if any.
(vi) Avoid chocking of materials in beaters by increasing fan speeds.
(vii) Do not use excess cotton-spray oil, water, etc., in mixing.

4.7.5 Conical lap

Conical laps are due to, either higher quantity of cottons coming on one side of the lap, or due to unequal calendar and rack pressures in scutchers. Following actions are recommended:

(i) Make the opening between consecutive grid bars uniform.
(ii) Ensure equal opening of air-inlets under grid bars.
(iii) Replace torn leather lining at the cage.
(iv) Clean the cage thoroughly with emery paper.
(v) Make pressure on lap spindle uniform on both the sides.
(vi) Make calendar roller and rack pressure uniform on both the sides.
(vii) Ensure uniform suction at the sides of cage.
(viii) Remove the pedals and clean thoroughly, and check the pedals where it rests on fulcrum and also pedal fulcrum bar.

4.7.6 Lap licking

Lap licking can be due to excessive addition of soft wastes in mixing, higher rack pressures, lower compacting of laps, improper deposition of the material on the cage across the width, and excessive dampness in cotton. In case of polyesters, this problem shall be mainly due to static charges and higher bulk of fibres.

The problem of lap licking can be reduced by increasing the pressure on calendar rollers, reducing the pressure on racks, increasing the quantity of antistatic, use of roving ends or lap fingers behind the calendar roller nip, blocking of top cage and by reducing the lap length, reducing fan and beater speeds and maintaining relative humidity at 50%–55%.

4.7.7 Patchy lap

Patchy lap is a result of unopened tufts. The normal reasons are the tension between the calendar roller and the shell roller being too high, too low fan speed at cages, damaged grid bars, less opening of cotton flocks and dust accumulation between the pedals affecting adversely the sensitivity of pedal levers.

Following actions are suggested:

(a) Ensure that the mixing is opened thoroughly, and increase opening points if feasible.

(b) Check tuft size at the delivery of each beater, and adjust the setting between feed roller and beaters, reduce the gauge between evener roller and inclined lattice, clean the cages, and increase effective suction at cages.

4.7.8 Holes in lap

Holes in the lap can be due to different reasons. Check the cages for damage and reduce tension draft.

4.7.9 Soft laps or bulged laps

Lower calendar pressure, lower tension draft, high proportion of soft wastes added and low relative humidity makes the laps soft. Increase the calendar roller pressure and adjust the rack pressure.

4.7.10 Ragged lap selvedge

Ragged lap selvedges are mainly due to uneven spots at the edges. Check for the rough spots on the sides of the feed plates, leather linings for the cages, and keep the edges of the scutcher clean.

4.7.11 Heavy or light laps

The possible reasons are improper feed due to:

(i) Photo cell/sensor problems, improper functioning of feed regulating motion in scutcher like improper shifting of cone drum belt, improper shifting of discs in PIV drive.

(ii) Worn out parts in feed regulating motion like links, cone drum belts, PIV chain, cone drum bearing, etc.

(iii) Improper synchronization of back machines.

Check lever movement and fulcrum and adjust the same. Stop the scutcher and restart it only after all reserve boxes and chambers in mixing are full.

4.7.12 Double lap observed in carding

Improper folding at the start of the lap due to improper functioning of folding mechanism is the main reason. Adjust the functioning of lap folding device.

4.7.13 Rich droppings

Normally the lint% should be less than 40% in the waste under any beater. The normal reasons for rich droppings are as follows:

(a) Too close grid bar setting to beater with high beater speed gives more waste.

(b) Too wide feed roll to beater setting.

(c) Inadequate weighing of feed roller leading to plucking of materials in lumps.

(d) Angle between grids is too open.

(e) Waste plate setting is high.

(f) Using of short waste plates.

4.7.14 Ineffective suction in ducts

The reasons for ineffective suction in ducts are as follows:

(a) Air leakages.

(b) Low fan speed. Belt slippage or a loose belt is the main reason for low fan speed.

(c) High resistance to air flow due to choke ups.

(d) Too long pipe lines and sharp bends.

(e) Wrong direction of rotation of the fan.

4.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

4.8.1 Dos

(a) Verify and understand the mixing and critical quality requirements in each section.

(b) Verify the input materials in detail and compare with the plan.

(c) Verify the bypass and the openers/beaters to be worked.

(d) Verify the calculations and assumptions before implementing.

(e) Stick to colour codes and other identification system agreed between sections.

(f) Monitor and control the wastes generated mixing wise and machine wise.

(g) Check for proper removal of wastes from time to time.

(h) Check the working of safety systems and stop motions before starting the machines.

(i) Cover the laps in stock if it is not likely to be used immediately.

(j) Remove the fuse in the control panel when the machine is stopped for cleaning or checking.

4.8.2 Don'ts

(a) Do not process a mixing if found not conditioned or wet at some places.

(b) Do not open any door in blow room while it is working.

(c) Do not allow the machine to work if driving belts are found loose.

(d) Do not decide on colour code by yourself.

(e) Do not draw or produce more than the required quantity.

(f) Do not allow unauthorized persons to touch or come near the machinery.

(g) Do not use bent lap rods.

(h) Do not use the grid bars those are found blunt or damaged.

(i) Do not run the machine if safety systems are not working properly.

4.9 Responsibilities of supervisor in blow room

(a) Ensuring that mixings are worked as per the requirement of spinning.

(b) Selecting opening and beating points as per the cotton and the trash content.

(c) Ensuring thorough opening of cotton tufts, cleaning and uniform feeding to cards.

(d) Ensuring proper extraction of wastes, compressing and letting out filtered air.

(e) Ensuring that the bale covers, hoops, wires, etc., removed from bales are collected and handed over to waste yard.

(f) Maintaining blow room area clean all the time.

(g) Maintaining discipline among the people working.

(h) Following up with engineering and ensuring that all firefighting accessories in blow room are always kept in good working condition.

4.10 Authorities of supervisor in blow room

(a) Stopping the production in case of malfunctioning of machinery like frequent jamming, producing cat's tails, white cottons falling in dropping, sound coming from any of the moving parts, burning smell observed, and so on.

(b) Questioning the jobber and workers when the work is not satisfactory like less number of laps produced, insufficient feeding to carding, machines stopping for more time at the time of changeovers, and so on.

(c) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(d) Authorized for recommending leave and/or permission to his subordinates.

(e) Rejecting the cotton bale found with too much contaminations, water damages or mix ups.

4.11 Applicable formulae

$$\text{Cleaning efficiency}\,(\%) = \frac{(\%)\text{ Trash in mixing} - (\%)\text{ Trash in delivered material}}{(\%)\text{ Trash in mixing}} \times 100$$

Guidelines for fixing norms for blow room droppings: Check the trash content in cotton fed and set blow room to remove 1% more droppings. Removing more droppings shall add to lint loss.

5
Carding

5.1 Purpose of carding

The purpose of carding is opening thoroughly the cotton received from blow room and individualizing the fibres by carding action, and then converting the carded cotton web into a sliver form, coiling and delivering it in cans for next process.

5.2 What carding should do?

(a) Individualize the fibres in the materials fed from blow room.

(b) Clean the fibres by removing the foreign matter as waste.

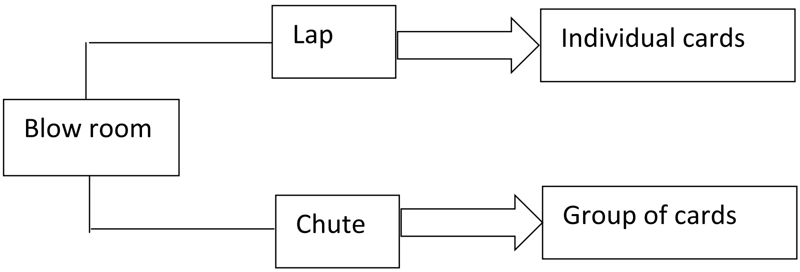
(c) Remove the neps present in the materials fed.

(d) Producing a continuous uniform carded sliver of required hank.

(e) Coiling the slivers produced and delivering in cans for the next process.

5.3 What carding should not do?

Carding should not break the fibres, increase neps, drop spinnable fibres in the droppings or wastes, bunch off fibres that can form slubs or allow the dust particles to enter the working area.



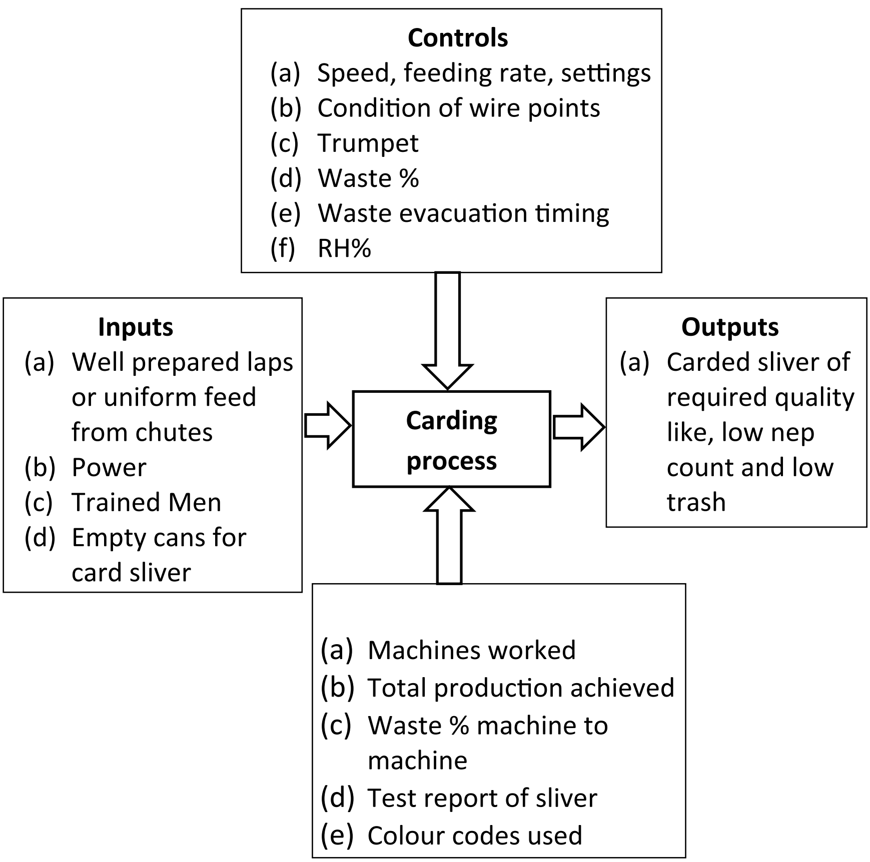


Figure 5.1 Process of caring.

5.4 General activities of carding

(a) Receiving the cotton from blow room either in the form of laps or in loose form through chutes. Laps can be fed to individual cards irrespective of their position in the carding section, whereas in case of chute feeding a group of cards shall be fed.

(b) Transporting of laps shall be manual, whereas in case of chutes, the opened cotton is pneumatically transported from blow room to cards and their feed is regulated by suitable sensors and pressure switches.

(c) Processing the cotton in the machine and producing slivers of required hank. Cottons are thoroughly opened because of carding action.

(d) Periodic removal of wastes for carding and sending them to waste section.

(e) Providing the card cans to next process, i.e. combers or draw frames.

(f) Periodic cleaning and setting of machines to get the required quality.

(g) Periodic mounting, grinding and maintenance activities.

5.5 Knowledge required for running carding

(a) The knowledge about carding wire points and their suitability for different cottons and fibres.

(b) The speeds and settings required for different mixings.

(c) Safety precautions for running carding machines.

(d) Role of humidity and temperature on carding performance.

(e) Monitoring and maintaining required temperature and humidity.

5.6 Control points and check points

It is necessary to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the people on the spot refer and follow.

5.6.1 Control points in carding

(a) Selection of process parameters, viz. card clothing, speeds, settings, drafts and hank.

(b) Preparing and maintaining the schedules for preventive maintenance like setting, grinding, mounting, etc.

(c) Maintaining the required temperature and humidity.

(d) Following suitable colour codification and channelization.

(e) The work allocation per employee.

(f) The frequency and systems for waste evacuation and their disposal.

(g) Designing and providing safety gadgets.

(h) Engaging trained workmen.

5.6.2 Check points in carding

5.6.2.1 Material related

(a) Allocation of cards to different mixings and hanks as per the plan.

(b) Quality of laps fed; required mixing, good quality without licking.

(c) Uniformity of feed to cards in case of chute feed system.

5.6.2.2 Machine related

(a) Matching of the wire points on the cards with the requirement of the mixing.

(b) Condition of the machines.

(c) Condition and cleanliness of card wire points.

(d) Working of stop motions.

(e) Quality and condition of the cans and springs used.

5.6.2.3 Setting related

(a) The settings done against the specified.

(b) The wheels put and the requirement.

(c) Whether any sound is coming when a bare card is worked?

5.6.2.4 Performance related

(a) The quality of web without neps, holes and ragged or bunched selvedges.

(b) The breakages and their reasons.

(c) The hank of sliver produced and plan.

(d) Sliver uniformity and U%.

(e) The production obtained against the targets.

(f) Cleaning efficiency of the card.

(g) The neps removal efficiency.

(h) The trash and neps in sliver and the norms.

(i) Whether the fibre rupture is within tolerable limits?

5.6.2.5 Documentation related

(a) Cards worked in the shift on different mixings.

(b) Production of each card (laps consumed per shift or the hank reading).

5.6.2.6 Work practice related

(a) Removing of wastes in time.

(b) The temperature and humidity maintained and the requirement.

(c) Whether the tenters carry out the work as specified?

(d) Whether the machines and the materials are labelled properly for identification?

(e) Removing of wastes from spring bottom before feeding cans to cards.

5.6.2.7 Log book related

(a) Number of cards worked on different mixings.

(b) Production achieved in each mixing.

5.6.2.8 M.I.S. related

(a) Card numbers worked.

(b) Total men employed in carding.

(c) Mixing worked – card wise.

(d) Production achieved in each card.

5.6.2.9 General

(a) No material blocking access to electrical control panels and fire extinguishers.

(b) The fire extinguishers in working position and in their allocated places.

(c) The fire exit doors should be free and the passages are not blocked.
(d) Whether the men employed are adequately trained?
(e) Housekeeping.
(f) Colour codification practiced.
(g) Stock of laps and carded materials.

5.7 Normal problems in carding

5.7.1 Patchy web

Patchy web may be due to loading on the cylinder, damaged or pressed wire points, waste accumulation below cylinder undercasing or defective undercasing. The following actions can be taken to solve the problem.

(a) Grind the flats and cylinder. In case of major damages replace the wires.
(b) Correct the settings between cylinder and flats, cylinder and back plate.
(c) Improve feed roller grip.

5.7.2 Singles

Singles are due to lap licking, less feed in chutes, part of carded web getting sucked by the waste extractor, damaged doffer wire and direct air currents hitting the web.

5.7.3 Sagging web

Sagging webs may be due to insufficient tension draft, very high humidity, worn out key in the calendar roller gears, heavy material fed to card and inadequate calendar roller pressure. Increase tension draft between doffer and calendar roller. For excessive sagging reduce doffer speed, maintain RH between 50% and 60%.

5.7.4 High card waste

High wastes are due to bad undercasings, high flat speed, wide front plate setting, close setting of flats, high pressure in suction unit and fibres getting ruptured.

5.7.5 Low nep-removal efficiency

Normal reasons for low nep-removal efficiency are blunt wire points, wide setting between feed plate and lickerin, uneven settings, burrs in front plate or in back plate, flats in poor condition, improper flat setting, poor transfer of fibres between cylinder and doffer wires, loading on cylinder or flats, and card wires of coarse type. To reduce neps, following actions may be taken.

(a) Ensure that the cylinder speed is high, appropriate to the type of card.

(b) Select proper wire points and ensure that they are sharp and in level.

(c) Ensure that the flat and cylinder settings are as close as practicable.

(d) Keep all surfaces like back plate, front plate, cylinder undercasing, etc., which come in contact with fibres smooth. The smoothness can be achieved by periodic polishing with '00' emery paper, and then applying a paste of French chalk and turpentine, allowing it to dry and the rubbing again with clean, non-oily hard waste.

(e) Make hank finer and increase the doffer speed to maintain production rate.

(f) Ensure proper gauge between cylinder and doffer.

(g) Prevent cylinder loading by ensuring uniform and light feeding.

5.7.6 Higher U% of sliver

Worn out parts, eccentric movement in coiler calendar or table calendar rollers, uneven feed, waste accumulation in material patch, improper settings and loading of fibres on cylinder and flats, too high tension draft, worn out clothing, improper size of trumpet for the hank being worked, improper transfer of fibres between cylinder and doffer wires, good fibres sucked in suction box and improper working of autolevellers are some of the reasons for higher U% of card sliver.

(a) Check the eccentricity, wobbling, worn-out gears, gears meshing too deep, oblonged bores of gears, loose keys, loose key ways, insufficient tightening of gears of table and coiler calendar rollers, and rectify the defects.

(b) Check the condition of trumpet and if it is damaged/oblonged/burred, replace it with a new one. Try bigger diameter of trumpet.

5.7.7 Bulky sliver

Slivers become bulky by use of trumpet of a very large size and lower calendar pressure.

5.7.8 Higher breaks

Causes for higher breakages of web and sliver are small trumpet, worn out trumpet, uneven sliver with bunches of fibres, worn out gears, damaged clothing, air currents disturbing the web, autolevellers not set properly, worn out gears, improper temperature and humidity, high tension-draft, poor transfer of fibres between cylinder and doffer wires and short of feed from blow room in case of chute feed cards. To reduce tension draft between doffer and calendar roller in steps till the defect is controlled. Install barriers for air movement especially near the web. Install apron-doff system for collecting web and converting it into a sliver. Check and improve the mechanical condition of the machine, especially of table calendar roller.

5.7.9 Snow balls

Small round balls are found in web. To avoid this, the horizontal portion of the cylinder casing should be sharply bent downwards.

5.7.10 Hole in web

Damaged, especially pressed wire points on doffer are the main reason for holes in the web. This can happen due to any foreign matter like metal pieces, coir, leather or wet and entangled cotton lumps getting fed along with sliver. Locate the damaged wire portion on doffer and replace the damaged portion skillfully with new wire and then level it with the rest of the doffer wire points.

5.7.11 Ragged selvedges

This problem is due to nonalignment of feed to the cylinder. Centre the lap in card width by putting wooden packing of equal thickness in the gap between the lap and lap stands at both the ends of lap. This is necessary when the gap between the lap and the lap stand is more than 5 cm. Also set the selvedge guide to give a quarter fold to the lap on either side. Extend selvedge guides, in the form of aluminium strip, acting on the lap right from the lap stand up to feed roller.

5.7.12 Fluff generation at cylinder sides

This problem is normally seen in old cards. Reduce the gap between the cylinder and cylinder framing to 34/1000 evenly on all sides. If the card design permits put flannel lining on the inside portion of the side curve framing.

5.7.13 Undercasing side fly at cylinder

The reasons for side fly at cylinder undercasing are squaring of cylinder undercasing not done correctly, scratches on undercasing, gauge not slightly looser in the middle of the undercasing compared to the left and right side edges, improper setting of undercasing tongue and poor condition of cylinder and doffer wires.

5.7.14 Feed roller lapping

The normal reasons for feed roller lapping are suction clearer/pneumafil box choked, very close setting between the feed roller and lickerin, worn out feed roller and feed roller wire, poor condition of rubber flap on the feed roller, rubber flap not touching the roller and improper loading of feed roller.

5.7.15 Fibre ruptures

A very tight flat gauge and too narrow settings of feed plate to lickerin are normal reasons for fibre rupture in carding.

5.7.16 Poor cleaning efficiency

The reasons for poor cleaning efficiency in a card are poor condition of wire points, improper flat settings, poor transfer of fibres between cylinder and doffer wires, flats getting loaded because of improper cleaning by Phillipson roller, improper gauge between lickerin to feed roller, improper cylinder to doffer gauge and improper humidity conditions.

5.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

5.8.1 Dos

(a) Verify and understand the mixing, hank, critical quality requirements and the quantity of slivers to be produced in each mixing.

(b) Verify the input materials for its quality and compare with the requirements.

(c) Verify the calculations and assumptions before implementing.

(d) Stick to colour codes and other identification system agreed between sections.

(e) Maintain uniform process parameters on machines running for a given mixing.

(f) Work for maximum utilization and efficiency for which men are engaged.

(g) Monitor and control the wastes generated mixing wise and machine wise.

(h) Check the problems in working of cards and their quality.

(i) Keep a watch on the web quality. Clean the sides of the doffer and cylinder with a broom stick periodically to get good quality of web.

(j) Check for proper removal of wastes from time to time.

(k) Check the working of safety systems and stop motions.

(l) Cover the materials in stock if it is not likely to be used immediately.

(m) Ensure that the wastes below the springs are removed before the empty cans are used in the machines.

5.8.2 Don'ts

(a) Do not decide on colour code by yourself. Discuss with user department.

(b) Do not keep laps on card creel for a long time as it leads to bending of lap rods.

(c) Do not draw or produce more than the ordered quantity.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not allow tilting of slivers in cans or pressing of slivers.

(f) Do not open the machine covers when the machine is in use.

(g) Do not clean the machines with compressed air when machines are working.

(h) Do not use compressed air to cleaning self or anybody.

(i) Do not run the card if the web quality is bad, i.e. more neppy, many holes in the web, bunches in selvedge, etc.

5.9 Responsibilities of supervisor in carding

(a) Completing the assigned jobs and achieving the carding production with sliver quality besides maintaining the discipline, housekeeping and team working.

(b) Ensuring working of all programmed machines including maintenance activities.

(c) Getting the machines started in time and achieving maximum utilization.

(d) Ensuring clean working area all the time in carding section.

(e) Ensuring all materials and records are kept in their respective place.

(f) Verifying the cotton mixing before taking for carding.

(g) Checking and adhering to the colour codes as decided.

(h) Taking corrective actions like getting the settings corrected in case of poor web quality, less cleaning efficiency and higher neps.

(i) Monitoring waste evacuation and ensuring the wastes collected from each machine are put in designated places and disposed after documenting.

(j) Ensuring safe handling of the materials and preventing sliver wastes and poor quality due to handling.

(k) Supplying materials in time to next user department, viz. drawing and combing.

(l) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(m) Reporting to HRD in case of any accidents and filling the accident reports in time.

(n) Helping spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

5.10 Authorities of supervisor in carding

(a) Questioning the jobber and workers when the production is low, housekeeping is poor or the quality of work is not satisfactory.

(b) Sending memo to HRD in case of lapse in discipline by any employee.

(c) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(f) Rejecting a lap if found uneven or having licking problem.

(g) Rejecting bad quality materials like lap bits and uneven card sliver and sending to mixing with proper recording.

(h) Discarding damaged cans, spring plates, aprons, etc., with proper documenting and accounting.

5.11 Some hints for getting better performance

(a) A high cylinder speed as permissible by considering the mechanical conditions is always beneficial for all types of fibres.

(b) Higher flat speeds remove more neps and fused fibres from man-made fibres and some trash remaining after lickerin action and neps from cottons.

(c) Higher flat speeds increase flat wastes.

(d) Decide specifications of wires for cylinder, doffer and flats by the fibre length, fineness, type of fibre, and the speeds in which the cards are supposed to work.

(e) Increase crush roll pressure for trashy cotton mixings. The lapping might increase when crush roll pressure is increased; in such case increase the tension draft and set the scraper blade more close.

(f) Fine and long fibres require more number of wire points on cylinder. Such fibres are more prone for generation of neps.

(g) For synthetic fibres, use rigid tops for flats to reduce the flat wastes.

(h) Use lickerin undercasing with small size perforations or without perforations for synthetic fibres to reduce good fibre loss at lickerin.

(i) Use of negative rake angle for lickerin is recommended for manmade fibres whereas for cotton positive rake angle wires are needed.

5.12 Some formulae

$$\text{Cleaning efficiency (\%)} = \frac{\text{(\%) Trash in lap} - \text{(\%) Trash in sliver}}{\text{(\%) Trash in lap}} \times 100$$

$$\text{Neps removal efficiency (\%)} = \frac{\text{Neps per gram fed} - \text{Neps per gram in sliver}}{\text{Neps per gram fed}} \times 100$$

6
Combing

6.1 Purpose of combing

The purpose of combing is removing the short fibres (fibres having length lesser than a specified minimum) in the sliver and improving the mean length, removing the neps and sticky trash along with the short fibres and converting the combed cotton into a sliver form, coiling and delivering it in cans for next process.

6.2 What combing should do?

(a) Remove short fibres below a pre-selected length and thereby reduce length variations in the cotton mixings and improve mean length.

(b) Improve fibre parallelization and fibre to fibre separation and minimize fibre entanglement and disorientation.

(c) Remove neps and foreign matters from the cotton.

6.3 What combing should not do?

The process of combing should not cause loss of fibres longer than the pre-selected length, result in fibre breakages, permit fibres shorter than the pre-selected length in the combed sliver, introduce periodic irregularities in sliver due to piecing waves or repetitive web defects or disturb the fibre parallelization by introducing defects such as wild piecing or air disturbances in the web.

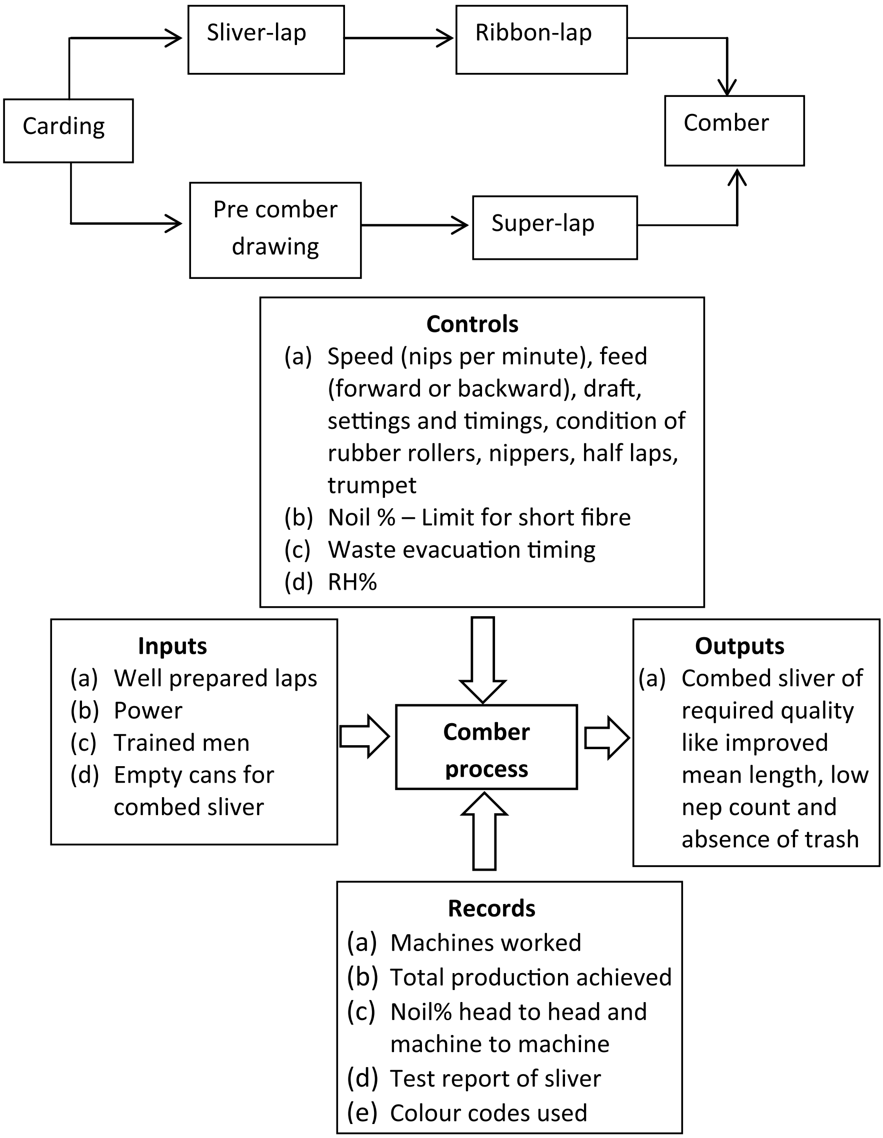


Figure 6.1 Process of combing.

6.4 General activities of combing

(a) Receiving the cotton sliver from cards.

(b) Preparing suitable laps for feeding to combers by combining multiple slivers and rolling them on a spool. For this a process of Sliver-lap and Ribbon-lap or Drawing and Super-lap may be used.

(c) Feeding the laps to the combers.

(d) Nipping the lap, combing and removing short fibres and hooks.

(e) Piecing the combed web and making a continuous sliver.

(f) Collecting the removed short fibres (comber noils) and sending to waste department for further action.

(g) Providing the combed sliver cans to next process, i.e. draw frames.

(h) Periodic cleaning and setting of machines to get the required quality of combing.

6.5 Knowledge required for running combing

(a) The knowledge about lap preparation and combing machine operations, the functions of various mechanisms, half laps and their suitability for different cottons.

(b) The feeds and settings with timings required for different lengths of cotton and level of noil extraction.

(c) Selection of trumpets depending on the hank of sliver.

(d) Safety precautions for running combing machines.

(e) Role of humidity and temperature on combing performance.

(f) Monitoring and maintaining required temperature and humidity.

6.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area so that the people on spot refer and follow.

6.6.1 Control points in combing

(a) Selection of process parameters, viz. hank of feeding lap, type of half-laps, speeds, settings, drafts and delivery hank, percentage of noil to be extracted, type of feed to be employed, length of feed per nip, maximum fibre length accepted in noil, etc.

(b) Deciding and maintaining the schedules for preventive maintenance like half-lap mounting, setting, brush mounting, buffing, etc.

(c) Engaging trained workmen.

(d) Maintaining the required temperature and humidity.

(e) Designing and providing safety gadgets.

(f) Deciding and following suitable colour codification and channelization.

(g) Deciding the work allocation for employees.

(h) Deciding frequency and systems for waste evacuation and their disposal and implementing them.

6.6.2 Check points in combing

6.6.2.1 Material related

(a) The mixing and hanks of lap fed and the plan.

(b) Quality of laps fed; good quality without licking problem.

6.6.2.2 Machine related

(a) Condition of the machines, for example, gripping by nipper, surface of detaching rollers, pressure on detaching rollers and on drafting rollers, smoothness of sliver table, condition of trumpets.

(b) Whether half-lap points are sharp and clean?

(c) Working of stop motions.

(d) The surface of detaching rollers and drafting rollers.

(e) Condition of bristles on the brush roller.

6.6.2.3 Setting related

(a) The settings done and the specified.

(b) The wheels put and the requirement.

(c) Size and quality of the trumpets.

6.6.2.4 Performance related

(a) The noils extracted and the norms.

(b) Head to head variation in noil%.

(c) The hank of sliver produced and the plan.

(d) Check whether the sliver is uniform and U% is within norms.

(e) Whether the quality of web is good without piecing marks?

(f) Increase in mean length of sliver.

(g) Whether the breakages are in control and what are the reasons for breaks?

(h) The production obtained and the targets.

(i) The neps removal efficiency and the requirement.

(j) Whether the neps in sliver are within control?

6.6.2.5 Documentation related

(a) The machines worked in the shift on different mixings and hanks.

(b) Machine wise production in hanks and kilogram.

(c) Machine wise noil collected in case of manual collection system.

(d) Total noil collected in shift in case of automatic noil extraction.

6.6.2.6 Work practice related

(a) Removing of the noils in time.

(b) Tenters carrying out the work as specified.

(c) Whether the machines and the materials are labelled properly for identification?

(d) Quality of the cans and springs used.

(e) Removing of the wastes from spring bottom before feeding to machines.

(f) Maintaining the temperature and humidity as per requirement.

6.6.2.7 Log book related

(a) Instructions for changing mixings and hanks.

(b) Stoppages with reasons and actions taken.

(c) Report on working in the shift.

6.6.2.8 M.I.S. related

(a) Machine number

(b) Mixing

(c) Hanks
(d) Production in kilograms – Derived from hanks produced
(e) Noil removed
(f) Men employed

6.6.2.9 General

(a) Housekeeping.
(b) Colour codification practiced.
(c) Stock of laps and combed materials.

6.7 Normal problems in combing

6.7.1 Problems due to lap preparation

6.7.1.1 Lap licking on combers

Normal reasons for lap licking are high total draft in combing preparation, excessive rack pressure during wind up, excessive tension draft between the lap rollers, more than 5 lakhs (500,000) fibres in batt cross section, higher delivery speed and insufficient pressure on calendar rollers.

6.7.1.2 Uneven laps

Uneven laps are mainly due to folding of slivers while feeding, improper functioning of stop motions, very low draft during lap preparation, inadequate pressure on drafting rollers, and worn-out bearings.

6.7.2 Normal problems in combing

6.7.2.1 Inadequate removal of short fibres and neps

Inadequate removal of short fibres are due to lesser distance set between nipper and detaching rollers, and poor condition of needle points in comber half lap. Following actions are suggested.

(a) Check head to head and comber to comber noil percent variations, and the individual heads for web defects, such as uncombed portions due to slippage under feed roller, slippage of fibres under detaching rollers, plucking of fibres by half lap from nipper grip, web disturbance due to air currents due to defects in brush or in aspirator.

(b) Check the machines thoroughly for bent and hooked needles on half lap and top comb, broken needles, nipper grip, feed roller grip, condition of detaching roller cots, condition of the gears driving bottom detaching rollers and damaged air seals in the aspirator box.

6.7.2.2 Short-term unevenness

Prominent piecing waves, drafting waves, uneven fibre control due to worn out top roller cots in draw box, ineffective loading of top rollers, eccentric rollers in drafting and/or detaching field, too small diameter of top roller, uneven load on top rollers, play in draw box drive, high or low tension draft, dirty working parts like lap tension roller, nipper, fluted roller, table top rollers, fleece guide, trumpets, half lap needles, etc., non-uniform or inadequate nipper grip, higher gap between nipper and half lap, unicomb (half lap) set too much backwards, too wide setting in drafting and improper settings are the main reasons for short-term variations in a combed sliver. Check U% and make use of spectrogram diagram to identify the source of the problem.

Piecing waves possess a periodicity with the wave length corresponding to one combing cycle. Check the machine for

(i) Correctness of detaching roller timing.

(ii) Play in drive between two detaching rollers.

(iii) Web defects repeating in every combing cycle.

(iv) Higher tension drafts between detaching rollers and table calendar roller.

(v) Improper setting of sliver guides on table which gives phasing of piecing waves.

(vi) Play in drive between detaching rollers and draw box and draw box and coiler.

6.7.2.3 Hank variations

Single, double or uneven working of sliver on table due to improper selection of tension draft, rough surface of the sliver table, variation in the feeding lap, lap licking while unwinding, etc. are main reasons for variation in hank. If between comber variations are high, check the combers for variations in lap roller feed per nip, draft wheels on draw box, tension drafts at tables, draw box and coiler, and noil level variations.

6.7.2.4 Higher sliver breaks at coiler

Sliver guides with rough surfaces, coiler calendar rollers having eccentricity or jerky motion, high tension draft, improper balancing of sliver stop motion working on gravity principle, worn out gears, excess parallelization of fibres in the sliver, improper condensation are the main reasons for sliver breaks. Check whether tension draft between draw box calendar roller and coiler calendar roller is too high causing stretching of sliver, or too low causing slackening of sliver. Check balancing of sliver break stop-motion and ensure that it presses against the sliver very lightly.

6.7.2.5 Frequent coiler tube choke-ups

If the coiler tubes are loaded with wax and trash, the sliver gets chocked. Clean the coiler tube with a rough rope. If cans are over filled, or the can spring is forcing the sliver to coiler plate, the choke up shall take place.

6.7.2.6 Web breakages at draw box

Burrs or accumulation of wax/trash particles at trumpet, too much spreading of web, defects in gear wheels, improper tension drafts are the main reasons for breakages in the draw box zone. In cases where the top rollers are buffed badly, the cottons shall stick to top rollers and lap.

6.7.2.7 Breakages at sliver table

Waxy and rough surfaces of the table, improper tension drafts and piecing waves are the main reasons for breakages on the sliver table. Improper selection of trumpet for the hank in process results in frequent fall of trumpet either forward or backward and results in stoppage of machine.

6.7.2.8 Breakages on comber heads

The main reasons for breaks at comber heads are a tight or slack web, improper positioning of web trays, unclean web trays, burrs in calendar trumpets, improper calendar trumpet (heavy or light), improper functioning of clearer rollers in detaching section, piecing waves, and the trumpets set too away from the nip of calendar rollers.

6.7.2.9 Detaching roller lapping

Rough or waxy surfaces on top roller cots, improper functioning of clearer rollers, too wide a setting of web guides are normal reasons for lapping on detaching rollers. Where the detaching top rollers tend to bend at the centre because of loading at both the ends, taper buffing is recommended.

6.7.2.10 Excessive lap licking and splitting

The main reasons for lap licking and splitting are improper tension drafts and roller setting, excessive draft in the lap former, uneven lap and tight winding while lap preparation.

6.7.2.11 Bulged laps

Bulged laps are normally due to inadequate pressure on calendar rollers and on the rack heads. Increasing the pressure on calendar roller shall be more helpful as it can reduce lap licking also.

6.7.2.12 Laps with damaged edges

Laps with damaged edges are normally due to flanges holding the lap tight while lap is built.

6.7.2.13 Effect of humidity

Combers are very sensitive to changes in temperature and humidity, and hence it is essential to maintain the required temperature and humidity. In many cases the bad working is attributed to fluctuations in temperature and humidity.

6.7.2.14 Head to head variation

The reasons for high head to head variation in waste percent are as follows.

(a) Insufficient draft in lap preparation.

(b) Bad mechanical condition of lap making machine like bent weighting hooks, defective top rollers and variation in top roller pressure.

(c) Bad condition of comber machine parts like brush, half lap, top comb, etc.

(d) Difference in top comb penetration from head to head.

(e) Poor nipper grip and bent nipper on some of the heads.

(f) Difference in ratchet gear, count change gears and tension change gears between combers working on given mixing.

6.7.2.15 Low neps removal efficiency

The normal reasons for low neps removal efficiency in combers are insufficient penetration of top comb, too wide gap between unicomb and nipper, excessive lap weight, insufficient total draft in lap preparation, uncleaned unicomb or half lap, unicomb not moving backwards to the required extent, poor condition of brushes and improper setting of brushes.

6.8 Dos and don’ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

6.8.1 Dos

(a) Verify and understand the mixing, hank, critical quality requirements, and the quantity to be produced in combers.

(b) Verify the input laps and compare with the plan given.

(c) Verify the calculations and assumptions before implementing.

(d) Check the settings and timings after every maintenance activity.

(e) Check the quality of laps fed for transverse unevenness, longitudinal unevenness, and selvedge quality.

(f) Stick to colour codes and other identification system agreed between sections.

(g) Maintain uniform process parameters on all machines for a given mixing and hank.

(h) Work for getting maximum utilization and efficiency for which men are engaged.

(i) Monitor and control generation of noils.

(j) Monitor the noils generated head wise, machine wise and mixing wise.

(k) Periodically clean the top combs if automatic cleaning system is not installed.

(l) Check individual heads for web defects such as uncombed portions, slippage of fibres under detaching rollers, uneven web due to plucking of fibres by half lap from nipper grip, web disturbance by air currents, defects in brush or aspirators, nep-bars, piecing waves etc.

(m) Periodically check nipper grip by using 3 paper strips of less than 0.1 mm thick across the width of the nipper.

(n) Periodically check feed roller grip.

(o) Check bottom detaching roller assembly for wear of bearing, key ways and gears.

(p) Check aspirators for damaged air seals.

(q) Monitor and maintain temperature and humidity as per the requirement.

(r) Check personally the problems in working rather than depending on a third person.

(s) Check for proper removal of wastes from time to time.

(t) Check the working of safety systems and stop motions before starting the machines.

(u) Cover the materials in stock if it is not likely to be used immediately.

(v) Ensure that the wastes below the springs are removed before the empty cans are used in the machines.

6.8.2 Don'ts

(a) Do not allow bent and hooked needles in half lap and top comb.

(b) Do not run the comber bare without cotton as it will damage the nippers.

(c) Do not undertake cleaning when machine is working.

(d) Do not decide on colour code by yourself.

(e) Do not draw or produce more than the ordered quantity.

(f) Do not engage people in the shift unless you have confirmed orders.

(g) Do not allow tilting of slivers in cans or pressing slivers by hand.

(h) Do not allow the use of knives for cleaning lapping on rubber rollers.

(i) Do not allow any parts or other materials to be kept on sliver table in combers.

6.9 Responsibilities of supervisor in combing

(a) Completing the assigned jobs and achieving the comber production with quality besides maintaining discipline, housekeeping and team working.

(b) Ensuring that all the programmed combers and lap formers are kept working.

(c) Checking and ensuring that the amount of material balance at various stages is sufficient to run the machines without stoppages.

(d) Checking at random all stop motions and ensuring them in working order.

(e) Verifying and ensuring that all changes are made as planned while changing mixing or hank or changing the noil% on any machine.

(f) Ensuring that feeding laps are provided to combers in time.

(g) Ensuring that the temperature and humidity are maintained as needed.

(h) Ensuring that workers are attending to breakages and stoppages in time and starting the machines without undue delay.

(i) Getting the machines started in time after cleaning or repairs and achieving maximum utilization.

(j) Ensuring clean working area all the time in comber preparation and combing areas.

(k) Ensuring that all materials and records are kept in their respective place.

(l) Checking and adhering to the colour codes as decided.

(m) Taking corrective actions like getting the settings corrected while limiting him to the authorities given to him.

(n) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(o) Providing the combed sliver cans of required mixing and hanks in time to draw frame section as per the requirement of the spinning machines.

(p) Ensuring safe handling of the materials and preventing sliver wastes and poor quality due to handling.

(q) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(r) Reporting to HRD in case of any accidents and filling the accident reports in time.

(s) Helping spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

(t) Identifying poor performing machines and getting them attended by the help of maintenance person.

6.10 Authorities of supervisor in combing

(a) Questioning the jobber and workers when the work done is not satisfactory.

(b) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(c) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the sliver quality and informing the superiors for necessary corrective actions.

(f) Rejecting bad quality materials like card or draw frame sliver, comber laps, combed sliver and sending to mixing with proper recording.

(g) Authorized to discard damaged cans, spring plates, bobbins, lap spools, cots, aprons, etc., with proper documenting and accounting.

6.11 Some hints for better performance

(a) Always keep a watch on humidity and temperature as it affects the working.

(b) Keep a watch on stop motions at lap formers and ensure that no singles or doubles are present in the laps.

(c) Verify the trumpets at each head and ensure that they are as per the requirement of the hank, and are in good condition.

(d) Keep a watch on the brush roller and ensure that the brush is always clean and is cleaning the half lap perfectly without allowing any cotton to roll back.

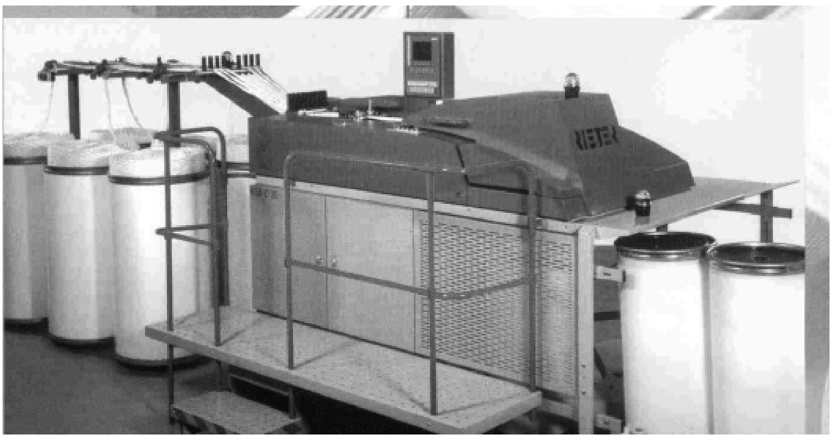
6.12 Applicable formulae

$$\text{Short fibre removal }(\%) = \frac{\text{Short fibres in the lap }(\%) - \text{Short fibres in the sliver }(\%)}{\text{Short fibres in the lap }(\%)} \times 100$$

$$\text{Improvement in mean length }(\%) = \frac{\text{Mean length of sliver }(\text{mm}) - \text{Mean length in lap }(\text{mm})}{\text{Mean length in the lap }(\text{mm})} \times 100$$

$$\text{Nep removal }(\%) = \frac{\text{Neps per gram in the lap} - \text{Neps per gram in the sliver}}{\text{Neps per gram in the lap}} \times 100$$

7
Draw frames



7.1 Purpose of draw frames

To make the fibres straight and parallel to the sliver axis by drafting and making the sliver uniform by combining number of slivers. Autolevellers help making sliver more uniform.

7.2 What draw frames should do?

(a) Parallelize the crisscrossed fibres and align them to the axis of the sliver through the process of drafting.

(b) Remove the hooks in the fibres and straighten them by sliding them over one another during drafting.

(c) Improve the regularity of sliver by doubling number of slivers and drafting together. Where autolevellers are used, sensing the sliver density and adjusting the total draft to ensure consistent delivered hank.

(d) Thoroughly mix different types of fibres so as to give a homogenous blending.

(e) Lay the sliver in cans with uniform coils forming a clear central hole.

(f) Provide cans to next process in time.

7.3 What drawing should not do?

The draw frame should not

(i) Produce sliver of different hanks within the machine or from machine to machine for the same material.

(ii) Produce any cuts in the sliver.

(iii) Takeout good fibres as suction wastes.

(iv) Run when any of the feed slivers runs out or breaks or fails to reach the delivery rollers due to any reason.

7.4 General activities of drawing

(a) Receiving the sliver from carding or combers.

(b) Combining number of slivers and drafting them to straighten the fibres and reducing the short-term variations.

(c) Monitoring the sliver linear density and adjusting the drafts suitably by using autolevellers and ensuring sliver with least possible variations in sliver hank.

(d) Processing the slivers in draw frames for more than one time to improve the regularity and homogeneity of blends depending on the type of materials.

(e) Providing the drawn cans to next process either lap preparation for combers, next passage of draw frames or finished slivers to speed frames or open end spinning as needed.

(f) Periodic cleaning and setting of machines to get the required quality of drawn sliver.

(g) Periodic mounting and buffing activities of rubber cots.

Draw frames are used in different combinations and sequences as shown below.

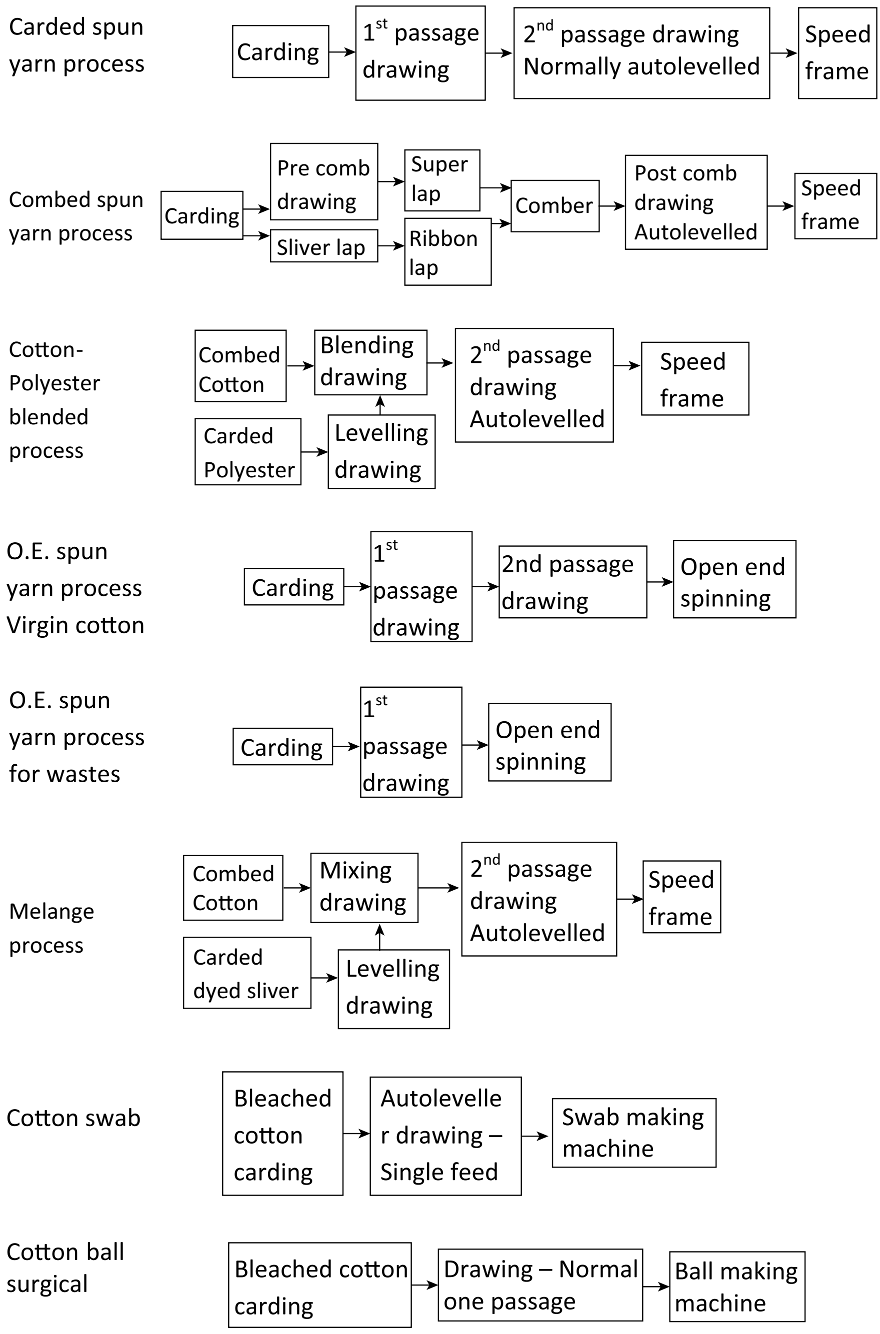


Figure 7.1 Different combinations and sequences of draw frames.

7.5 Knowledge required for running draw frames

(a) The knowledge about drafting systems, settings and their suitability for different types of slivers, viz. carded, combed, blending, levelling, etc., of cottons and man-made fibres.

(b) The knowledge of quality requirements of draw frame sliver as per the process, viz. breaker drawing, drawing for comber lap preparation, breaker draw frame, levelling draw frame, post comb drawing, finisher draw frame for feeding to open end machines and speed frames.

(c) Functioning of autolevellers and setting them considering the fibre and hank.

(d) Importance of stop motions and their maintenance.

(e) The speeds and settings required for different fibres and mixings.

(f) Safety precautions for running draw frame machines.

(g) Role of humidity and temperature on draw frame performance.

(h) Monitoring and maintaining the required temperature and humidity.

7.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the people on spot refer and follow.

7.6.1 Control points in draw frames

(a) Deciding the process parameters, viz. settings, draft, number of doublings, speed, hank, size of trumpet, length of sliver in can, pressure on the drafting rollers, type of cots and limits for monitoring sliver levelling, etc.

(b) Deciding number of draw frame passages for the type of materials in process.

(c) The colour codification and channelization.

(d) Deciding the position of feed slivers in case of blending.

(e) Engaging trained workmen.

(f) Evolving and implementing maintenance schedules.
(g) Deriving and providing required humidity and temperature.
(h) Deciding the work allocation to the employees.

7.6.2 Check points in draw frames

7.6.2.1 Material related

(a) Quality of the slivers fed, i.e. having good coils without entanglements.
(b) Mixing and hank as per requirement.
(c) The can creeling arrangement matching with the requirement of the blending.

7.6.2.2 Machine related

(a) The condition of the machine parts like bottom drafting rollers, top roller cots, end bushes, saddles, hosepipes, springs, belts, bearings, etc.
(b) Functioning of all stop motions properly and without delay.
(c) The voltage variations for autoleveller draw frames.
(d) The size of trumpets for the hank and smooth inner surface.
(e) The surface of the sliver passage in the creel for smoothness.
(f) The size of scanning rollers adopted for the feed hank.
(g) The quality of cans and springs.

7.6.2.3 Setting related

(a) The settings and the requirement.
(b) The wheels put and the calculations.
(c) Setting of the scanning rollers as per the hank of slivers fed.

7.6.2.4 Performance related

(a) The hank of sliver produced and the variations.
(b) The machine speed and the production against planned.
(c) The production obtained and the targets.
(d) Whether there is any overlapping of slivers in the feed?
(e) The sliver test A% for autolevelled material.

(f) Whether the coiling is proper?

(g) The breakages and their reasons.

7.6.2.5 Documentation related

(a) Materials working in different draw frames.

(b) Hanks produced in each draw frame.

7.6.2.6 Work practice related

(a) Condition of the cans and springs.

(b) Following of the colour codification and channelization as per plan.

(c) Whether the quality of cans and springs are as specified?

(d) Cleaning of the cans before putting in the machine.

(e) Removing of the wastes from spring bottom before feeding cans.

(f) Removing the wastes in time.

(g) Labelling the machines and the materials properly for identification.

7.6.2.7 Log book related

(a) Instructions given for changing mixings.

(b) Stoppages and the reasons.

(c) Changes made in the shift.

(d) Maintenance activities done.

7.6.2.8 M.I.S. related

(a) Draw frame number.

(b) Mixing and hank.

(c) Hanks produced.

(d) Stoppages with reasons.

(e) Men employed.

7.6.2.9 General

(a) Whether the workmen employed are adequately trained?

(b) Whether the temperature and humidity are maintained as per plan?

(c) The machine allocation to different mixings and hanks as per the plan.

(d) Whether the tenters carry out the work as specified?

7.7 Normal problems in draw frames

7.7.1 Improper sliver hank

(a) Check the hank of input slivers and ensure they are as per plan. If the hank of input slivers is heavy or light, adjust the pinion while starting the machine with new slivers.

(b) Check the draft wheels and ensure that the wheels are put to get the required draft.

(c) Check the functioning of autolevellers by sliver test method, (i.e. A%) and ensure that the input voltage is as per norms.

(d) Check the pressure on top rollers and ensure them to be as per norms. If the pressure is less, the drafting shall not be proper.

7.7.2 Uneven sliver

Normal reasons for higher U% in draw frame slivers are improper roller settings, improper total draft, overriding of slivers from the creel, eccentricity of drafting rollers, poor condition of top rollers, undersized cots, incorrect setting of pressure bar, incorrect trumpets, damaged trumpets, very high tension draft, autolevellers not set properly, worn out belts, gears and bearings and inadequate top roller pressure

Following actions are recommended

(a) Check the condition of top and bottom rollers, setting of rollers, the pressure on the top rollers, the condition of the end bushes of the top rollers, worn out or loose wheels, and ensure even feed material.

(b) Make use of Uster Spectrogram for identifying the source of the problem, and take suitable corrective action.

(c) Ensure that the slivers do not hit the can surface while getting filled.

(d) A bad quality spring in the can makes the sliver tilt and spoils the same.

7.7.3 Singles

Stop motion failures are the main reason for singles in draw frame as a can run-out is not noticed by the tenter. A very high suction power of Pneumafil sucks good fibres and can result in singles. The singles for a short length can also be due to partial lapping on rollers.

7.7.4 Cuts in sliver

Cuts in sliver are mainly due the settings not matching to the fibre staple length. Cuts can also be due to eccentric rollers, worn out end bushes, eccentric coiler shaft drive, and grooved calendar rollers.

7.7.5 Good fibres in suction waste

Too close a setting of suction nozzle and a very powerful suction are the reasons for good fibres going in suction waste. Increase the gap between the suction point and the top roller, or reduce the speed of suction fan.

7.7.6 Improper coiling

Non-centring of can and eccentric bottom plate are the normal reasons for improper coiling. The speed of the can and coilers are to be synchronized to have the required spacing of coils in the can. If can is damaged and not sitting properly or oblong can result in improper coiling and coils falling down to the side.

7.7.7 Higher breakages

Higher breakages can be due to many reasons.

(a) Check the hank and uniformity of sliver; if sliver is not uniform it shall have weak places resulting in breaks or thick places resulting in chocking.

(b) The sliver condensation, if not proper, shall result in breaks.

(c) Condition of gears plays an important role in good working. Worn out teeth, loose keys or key ways results in breakages of sliver.

(d) The tension draft is very important; a lower draft results in chocking in coiler tube, whereas a higher draft results in stretching of sliver resulting in break.

(e) Ensure smooth surface which comes in contact with sliver/web.

(f) Ensure the temperature and humidity to be as per requirement.

(g) Check for the surface of cots, if it is rough, it is likely to lap.

(h) If the top roller pressure is very high, there shall be lapping on top rollers.

7.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

7.8.1 Dos

(a) Verify and understand the mixing, hank, process, passage, critical quality requirements, and the quantity to be produced in each machine.

(b) Verify the input materials in detail and compare with the plan given.

(c) Verify the calculations and assumptions before implementing.

(d) Stick to colour codes and other identification system agreed between sections.

(e) Check the surface of top rollers; reject in case of any cut marks or channels.

(f) Check the pressure on top rollers.

(g) Check the setting of clearer strips on the top rollers.

(h) Periodically verify the working of autolevellers by conducting "A%" test, i.e. checking the hank by feeding one extra sliver and one sliver less.

(i) Maintain uniform process parameters on all machines for a given mixing and hank.

(j) Work for getting maximum utilization and efficiency for which men are engaged.

(k) Monitor and control the wastes generated mixing wise and machine wise.

(l) Check personally the problems in working and do not depend on a third person.

(m) Ensure removal of wastes from time to time in case of manual waste removal.

(n) Check the working of safety systems and stop motions before starting the machines.

(o) Cover the materials in stock if it is not likely to be used immediately.

(p) Get the wastes below the springs removed before the empty cans are put.

7.8.2 Don'ts

(a) Do not decide on colour code by yourself.

(b) Do not draw or produce more than the ordered quantity.

(c) Do not engage people in the shift unless you have confirmed orders.

(d) Do not tilt slivers in cans or press slivers by hand.

(e) Do not cut the slivers by hand and distribute sliver to more cans to run more heads.

(f) Do not keep the draw frame cans in the passages where there is strong air current.

(g) Do not allow the use of knives for cleaning lapping on rubber rollers.

(h) Do not allow any parts or other materials to be kept on sliver tables of draw frames.

7.9 Responsibilities of supervisor in draw frames

(a) Assessing the material position and recording any excess or shortage of any particular mixing material at the back or front of the draw frames.

(b) Checking and maintaining the general working of draw frames and also checking the working of drawing material in next process.

(c) Checking air pressure periodically where pneumatics is used.

(d) Completing the assigned jobs and achieving the draw frame production with quality besides maintaining the discipline, housekeeping and team working.

(e) Ensuring that all the programmed draw frames are kept working, unless there is excess stock calling for stoppage of machines.

(f) Getting the machines started in time after cleaning, repairs or changeovers and achieving maximum utilization.

(g) Ensuring clean working area and good housekeeping all the time.

(h) Ensuring all materials and records are kept in their respective place.

(i) Verifying the mixing, hank and passages of the cans before taking them.

(j) Checking and adhering to the colour codes as decided and displaying them prominently.

(k) Taking corrective actions like getting the settings corrected while limiting to the authorities given to him.

(l) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(m) Providing the draw frame cans of required mixing and hanks in time to next section as per the requirement of the user.

(n) Ensuring safe handling of the materials and preventing sliver wastes and poor quality due to handling.

(o) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(p) Reporting to HRD in case of any accidents and filling the accident reports in time.

(q) Helping spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

7.10 Authorities of supervisor in draw frames

(a) Questioning the jobber and workers for low production, poor housekeeping and unsatisfactory work.

(b) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(c) Allotting or change jobs to workers considering their skills and the requirements of the department.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(f) Rejecting the poor quality sliver cans received with entanglements, disturbed sliver surface, wrong identification and mix ups.

(g) Rejecting bad quality draw frame sliver and arranging for sending to mixing with proper recording.

(h) Discarding damaged cans, spring plates, cots, etc., after proper documenting and accounting.

7.11 Some hints for better performance

(a) Always keep a watch on humidity and temperature as it affects the working.

(b) Keep a watch on stop motions and ensure that no singles or doubles are fed to drafting. Ensure machine stopping before a broken sliver entering drafting zone.

(c) Verify the trumpets size as per the hank, and ensure in good condition.

(d) Keep a watch on the surface of the top rollers and pressure on top rollers.

7.12 Applicable formulae

$$\begin{array}{c}\text{Production per delivery}\\ \text{per shift in kgs}\end{array} = \frac{\begin{array}{c}(\text{Front roller speed in YPM} \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency \%})\end{array}}{\text{Hank of sliver } \times 840 \times 100 \times 2.2}$$

$$\text{Production per Machine per shift in kgs} = \frac{\begin{array}{c}(\text{Hank reading}\\ \times \text{Number of deliveries})\end{array}}{\text{Hank of sliver} \times 2.2}$$

$$\text{Mechanical draft} = \frac{\text{Surface speed of delivery roller}}{\text{Surface speed of feed roller}}$$

$$\text{Actual draft} = \frac{\text{Hank delivered}}{\text{Hank fed}}$$

8
Speed frames

8.1 Purpose of speed frames

(a) Drafting and attenuating draw frame sliver to required hank and making it suitable for spinning the yarn of required count.

(b) Introducing a small twist in the drafted rove and making it strong enough to withstand the tension of unwinding at ring frames.

(c) Winding the drafted and twisted rove on bobbins and making it suitable for handling and feeding to ring frames.

8.2 What speed frames should do?

(a) Attenuate the sliver to the hank required, so that it can help in producing the required count of yarn.

(b) Imparting small twist in the attenuated rove to give it required strength for unwinding from the bobbin while not resisting the break draft in spinning.

(c) Winding the produced rove on a bobbin with uniform tension, so that it can be unwound in spinning without any stretch.

(d) Deliver the speed frame bobbins in time to ring spinning as per the requirement of spinning.

8.3 What speed frames should not do?

(i) Produce uneven rove.

(ii) Produce hard rove resisting drafting and producing undrafted ends while spinning.

(iii) Produce soft bobbins resulting in breakage of rove while unwinding.

(iv) Produce sloughed off bobbins.

(v) Produce hank variations between bobbins in the same machine.

(vi) Produce hank variations within bobbin because of improper stretch or condensation, poor drafting or any other reason.

8.4 General activities of speed frames

(a) Receiving the drawn sliver of required mixing and hank in cans from draw frames as per the programme.

(b) Drafting the sliver, introducing a small twist and producing rove of required hank and winding them on suitable bobbins.

(c) Doffing the bobbins once they are full by stopping the machines.

(d) Providing the bobbins to spinning as needed.

(e) Periodic cleaning and setting of machines to get the required quality of roving bobbins.

8.5 Knowledge required for running speed frames

(a) The knowledge about mechanisms in speed frames and their functions.

(b) Various drafting systems available and their suitability for different cottons, man-made fibres and blends of various types.

(c) Different models of speed frames.

(d) The suitability of lift and flyer diameter for different materials and hanks.

(e) Controlling tension and uniform build of bobbins.

(f) The speeds and settings required for different mixings and hanks.

(g) Safety precautions for running speed frame machines.

(h) Role of humidity and temperature on speed frame performance.

(i) Monitoring and maintaining required temperature and humidity.

8.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the people on spot refer and follow.

8.6.1 Control points in speed frames

(a) Process parameters like setting of drafting rollers, top arm settings, top arm pressure, spindle speeds, draft, condensers and spacers, hank of rove, twist multiplier.

(b) Deciding package parameters like coils per inch, taper, lift and diameter, weight, etc., depending on the hank and the material.

(c) Deciding on colour codification and channelization.

(d) Engaging trained workmen.

(e) Evolving maintenance schedules and implementing.

(f) Deciding and providing required temperature and humidity.

(g) Deciding the work allocation for employees.

8.6.2 Check points in speed frames

8.6.2.1 Material related

(a) Quality of the slivers in cans fed, i.e. without entanglements and over parallelization.

(b) Availability of sufficient cans to run all the spindles on a working speed frame.

(c) The condition of cans received.

8.6.2.2 Machine related

(a) Condition of the running parts of the machines.

(b) Proper working of all stop motions.

(c) Balancing of flyers.

(d) Alignment of the flyers.

(e) Alignment of the cots to the bottom rollers.

(f) Loading of the top arms.

(g) Condition and positioning of separators.

(h) Setting of the suction tubes.

(i) Setting of clearer clothes.

8.6.2.3 Setting related

(a) The settings and alignments of rollers in drafting zone as per the length of fibres.

(b) The settings done and that specified for both bottom rollers and top rollers.

(c) Whether the wheels put are as per requirement?

(d) Whether the top arm pressures are as required and uniform on all spindles?

(e) Use of spacers, condensers, sliver guides, false twisters, etc., as per plan.

(f) Suiting of the coils per inch and the gap between coils to the hank of rove.

8.6.2.4 Performance related

(a) The quality of rove, i.e. without unevenness, slubs, undrafted portions and high twisted portions.

(b) The breakages and their reasons.

(c) The hank of rove produced and planned.

(d) Variations in the hank of rove and the norms.

(e) Uniformity of the rove and U%.

(f) The production obtained and the targets.

(g) Whether the stretch is in control in all the spindles?

(h) Whether the breakages are within control?

(i) The machines running speeds and the production against the requirement.

8.6.2.5 Documentation related

(a) Machine wise mixing and hank worked.

(b) Colour codes used for speed frame bobbins for different mixings and hanks.

(c) Hank fed, hank delivered and process parameters adapted for each machine.

8.6.2.6 Work practice related

(a) Timely removal of suction wastes from the suction box.

(b) Putting the sliver wastes taken out in the bins properly.

(c) Waste collection and sending to waste section with proper documentation.

(d) Tenters carrying out the work as specified.

(e) The workers following the work practices as specified.

(f) Whether the machines and the materials are labelled properly for identification?

(g) Cleanliness of the drafting zone.

(h) Following of the colour codification and channelization as per plan.

(i) Proper cleaning of bobbins before putting on the machine.

8.6.2.7 Log book related

(a) Mixing and hank changes planned and completed.

(b) Changes to be done in next shift.

(c) Colour codification used for speed frame bobbins.

(d) Machine wise stoppages and their reasons.

(e) Problems faced and actions taken.

8.6.2.8 M.I.S. related

(a) Machines worked.

(b) Mixing worked on each machine.

(c) Hank of rove in each machine and mixing.

(d) Hanks produced in each machine.

(e) Men employed.

8.6.2.9 General

(a) The speed frames allocated to different mixings and hanks and the plan.
(b) Matching of drafting system and flyers with the requirement of hank and mixing.
(c) Maintaining the temperature and humidity as per requirement.
(d) Adequate training of the workmen.
(e) Carrying of the maintenance as per plan.
(f) The transportation of bobbins to ring frames as per plans.
(g) The housekeeping.
(h) Availability of sufficient empty bobbins.

8.7 Normal problems in speed frames

8.7.1 Higher U% of rove

Some of the reasons for higher U% in rove are inadequate top arm pressures, improper settings, worn out gears and/or bearings, grooved top rollers, tilted top rollers, wrong selection of condensers, poor cleaning of draft zone, higher stretch may be at feed or at delivery, uneven feed material, sliver splitting in creel, jerks in creel movement, vibrations in the machines, worn out aprons, variation in bare bobbin diameter, improper choice of ratchet wheel and lifter wheel, load variation between top arms, choking of flyers, number of wraps on the presser finger not same on all spindles and improper build-up of bobbins. Meticulous checking of each spindle on regular basis and correcting the defectives is very essential to get uniform rove. Following are some hints:

(a) Refer the spectrogram and check the spindle and the feed material before taking any action.
(b) Maintain the machine in good condition without any worn out parts.
(c) Keep the work area clean.
(d) Maintain required humidity and temperature.
(e) Keep the speeds such that the breaks are almost zero.
(f) Control air currents.

8.7.2 Higher breakages

Main reasons for high breakages in speed frames are uneven material, worn out parts, groove cut or improperly buffed top rollers, vibrations, insufficient twist, improper draft distribution, fluctuations in temperature and humidity, improper build of bobbins, draw frame sliver with singles, thick places, bad piecing, entanglements, etc., uncontrolled air current, rough surface in the flyer tube, choking in the flyer tube, high tension draft in creel and creel rollers not rotating freely, higher stretch and lower twist in rove, bottom rollers with burrs or greasy materials, clearers fully covered with wastes, mix up of bobbins of different diameters, spacer too narrow and less break draft.

8.7.3 Soft bobbins

Soft bobbins are normally due to finer hank, may be due to singles or a finer drawing hank, less number of turns on presser, the shift on cone drum (building mechanism) faster than required, lower twist, lower relative humidity, keeping bobbins in stock for a long time and keeping bobbins one above the other while stacking.

8.7.4 Lashing in

Whenever an end gets broken and joins to an adjacent end, we get lashing in. Fixing of separators and setting the suction tubes near to the front roller nip shall solve this problem. Moreover, we should work towards zero breaks.

8.7.5 Hard bobbins

Hard bobbins are due to a coarser hank; may be due to doubles, a coarser draw frame hank and lower pressure in top arms. Hard bobbins are also due to higher twist, lesser movement of belt on cone drums, higher turns on the flyer presser, shifted cots in the back zone leading to low pressure, and a higher RH%.

8.7.6 Oozed out bobbins

Normal reasons for oozed out bobbins are malfunctioning of reversing bevels in the builder motion, stopping the machine when the bobbin rails are in extreme positions, jumping bobbins due to improper fitting of empty bobbins on the bobbin driving wheel pin, broken roving end not pieced immediately resulting in reduction in bobbin diameter and loose rove, bobbin trough/rail not well balanced and not traversing up and down freely, the joint key in the carriage shaft not sufficiently tightened, adjustment of the compensating rail and setting of the initial position of the belt on the cone drum not correct, uneven wraps around the pressure of flyer and bent presser fingers.

8.7.7 Load variations between top arms

Normal reasons for variation in load between top arms are bent pressure ledge, poor condition of hose, non-uniform air pressure, non-uniform diameter of cots, poor condition of arms and elongated springs.

8.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

8.8.1 Dos

- (a) Verify and understand the mixing, hank, critical quality requirements, and the quantity to be produced in each machine before starting your work.
- (b) Verify the input materials in detail and confirm it as of correct quality.
- (c) Verify the calculations and assumptions before making a change in mixing or hanks.
- (d) Stick to colour codes and other identification system agreed between sections.
- (e) Maintain uniform process parameters on all machines for a given mixing and hank.
- (f) Work for getting maximum utilization and efficiency for which men are engaged.
- (g) Keep the separators always in working order immediately after attending a break.
- (h) See that number of turns of presser is always same.
- (i) Align the flyers such that flyer legs of all flyers are in the same direction.
- (j) Monitor and control the wastes generated mixing wise and machine wise.
- (k) Check personally the problems in working rather than depending on a third person.
- (l) Check for proper removal of wastes from time to time.
- (m) Check the working of safety systems and stop motions before starting the machines.
- (n) Keep the doffed speed frame bobbins preferably in a pegged trolley.

(o) Transport doffed bobbins in pegged trolleys or by overhead bobbin transporting.

(p) Cover the materials in stock if it is not likely to be used immediately.

(q) Clean the remnants by hand before putting the bobbins in speed frames.

(r) Take periodic rounds in ring frames and observe the working of the bobbins.

8.8.2 Don’ts

(a) Do not run a spindle where the breaks are frequent. Check and start after doff.

(b) Do not cut the slivers from a full can and distribute on other spindles to avoid idle spindles. Suggest draw frame section to reduce the sliver content in the cans.

(c) Do not remove the floating condenser if setting is done with floating condenser.

(d) Do not keep the doffed bobbins on the drafting section; put them directly on a pegged trolley.

(e) Do not transport the speed frame bobbins in box trolleys if floor is not smooth.

(f) Do not allow a spindle with broken rove to work for a long time; stop the machine first in case you are busy on another machine.

(g) Do not decide on colour code by yourself.

(h) Do not put soft wastes like bonda wastes, roving end wastes and sliver wastes on floor; collect them in waist bag and then dispose in the cans allotted for that.

(i) Do not press the front top roller to make the slack roving tight; instead stop that spindle and restart after doff.

(j) Do not draw more material or produce more than the ordered quantity.

(k) Do not stop the roving machine when the bobbin rail is in its top most or bottom most position and changing its direction of movement.

(l) Do not engage people in the shift unless you have confirmed orders.

(m) Do not allow tilting of slivers in cans, pressing slivers.

(n) Do not allow the use of knife for cleaning bobbins.

(o) Do not allow the use of knives for cleaning lapping on rubber rollers.

(p) Do not use chalk for marking bobbins.

8.9 Responsibilities of supervisor in speed frame

(a) Completing the assigned jobs and achieving the production with quality as required for ring frames besides maintaining the discipline, housekeeping and team working.

(b) Ensuring that all the programmed machines are kept working, however, not allowing for excess stock in case the production rate is lesser in ring frames.

(c) Getting the machines started in time after each doff, cleaning or repairs, changeovers, etc., and achieving efficiency.

(d) Ensuring clean working area and good housekeeping all the time.

(e) Ensuring that all materials and records are kept in their respective place.

(f) Verifying the mixing and hank of sliver of draw frame before taking for speed frames.

(g) Checking and adhering to the colour codes as decided and displayed.

(h) Taking corrective actions while limiting him to the authorities given to him.

(i) Getting the wastes collected from each machine and putting in designated places and disposing/reusing after documenting.

(j) Providing the speed frame bobbins of required mixing and hanks in time to ring frame section as per the requirement of the spinning machines.

(k) Ensuring safe handling of the materials and preventing wastes and poor quality due to poor handling practices.

(l) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(m) Reporting to HRD in case of any accidents and filling the accident reports in time.

(n) Helping spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

8.10 Authorities of supervisor in speed frame

(a) Advising draw frames to change length set, or to stop the machines as per stock.

(b) Questioning the jobber and workers for low production and unsatisfactory work.

(c) Advising HRD in case of serious lapse in discipline by any employee under him.

(d) Allotting or changing jobs to workers considering their skills and the requirements.

(e) Recommending leave and/or permission to the subordinates in the section.

(f) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(g) Rejecting draw frame can if found with entanglements and slipped coils.

(h) Rejecting bad quality materials like draw frame sliver, speed frame bobbin, etc., and sending to mixing with proper recording.

(i) Discarding damaged bobbins, cots, aprons, etc., and maintaining proper documenting and accounting.

8.11 Some hints for better performance

(a) Always keep a watch on humidity and temperature as it affects the working.

(b) Always keep the drafting zone clean by using a fluff gun or a broom stick.

(c) Periodically remove the clearer wastes and do not allow it to roll back.

(d) Clean the inside of flyer leg while mending a broken rove.

(e) Keep watch on tension of running roves and adjust the builder motion.

(f) Keep a watch on stop motions so that machine is stopped immediately in case of a sliver break of break in rove.

(g) Verify the condensers and sliver guides at each spindle and ensure that they are as per the requirement of the hank, and are in good condition.

8.12 Applicable formulae

$$\text{Front roller delivery in inches per minute} = \frac{\text{Spindle speed in RPM}}{\text{Twist per inch}}$$

$$\begin{array}{c}\text{Production per spindle}\\ \text{per shift in kgs}\end{array} = \frac{\begin{array}{c}(\text{Spindle speed in RPM} \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency \%})\end{array}}{\begin{array}{c}(\text{Twist per inch} \times \text{Hank of rove}\\ \times 840 \times 36 \times 100 \times 2.2)\end{array}}$$

$$\text{Mechanical draft} = \frac{\text{Surface speed of delivery roller}}{\text{Surface speed of feed roller}}$$

$$\text{Actual draft} = \frac{\text{Hank delivered}}{\text{Hank fed}}$$

9
Ring spinning

9.1 Purpose of ring frame

- To draft the rove to produce spun yarn of required count and impart twist to get the required strength and stability considering the functional requirements and wind the yarn on suitable packages.
- To produce yarns uniformly with reasonably low hairiness and imperfections.

9.2 What ring frames should do?

(a) Draft the rove to get the required count of yarn.

(b) Twist the drafted strand to get the required strength and stability for the yarn.

(c) Wind the yarns on bobbins enabling them to feed to next process.

(d) Collect the soft wastes and loose fluff by making use of a suction box.

9.3 What ring frames should not do?

Ring frames should not create unevenness like thick and thin places, slubs, hairiness and other yarn faults. It should not cause drop in strength due to excess twist or thin places, cause excessive end breakages and roller lapping. It should not spoil the build of the packages and generate excessive dust and fly in the department resulting in fluff.

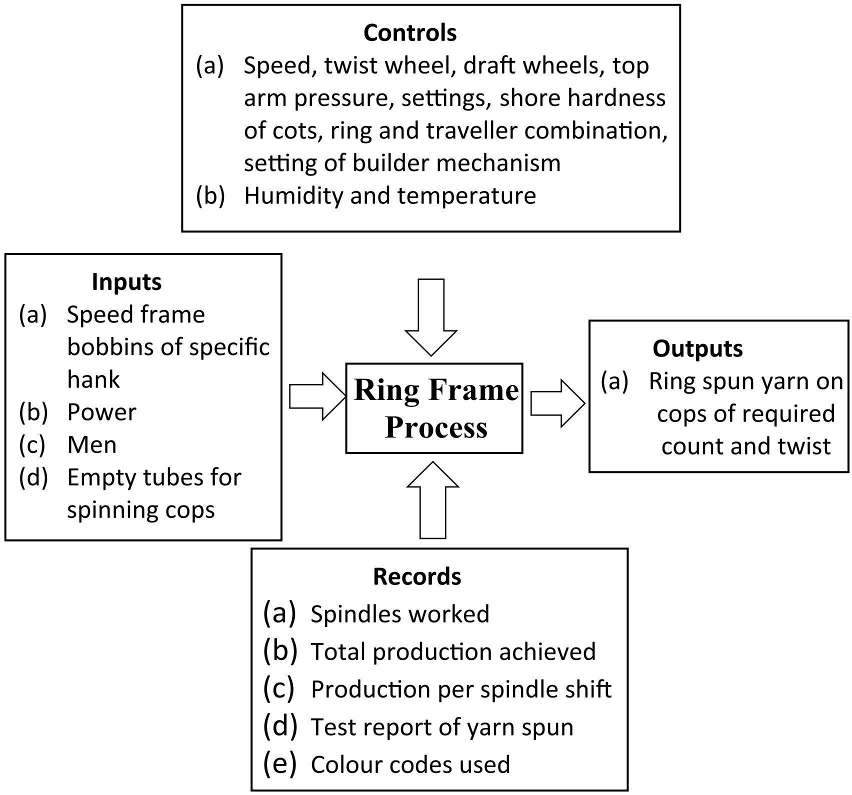


Figure 9.1 Process of ring frames.

9.4 General activities of ring frame

(a) Understanding production requirements from cone winding.

(b) Getting required speed frame bobbins for spinning.

(c) Creeling the speed frame bobbins on ring frames.

(d) Setting the drafting, twisting and cop building parameters as per the count, yarn quality requirement and materials in use.

(e) Selecting and installing suitable traveller as per count and material.

(f) Running the machines and attending to breaks if any.

(g) Removing the full cops and sending to winding.

(h) Keeping the machines, especially the drafting zone in a clean condition all the time to avoid imperfections.

(i) Sending back the empty bobbins to speed frame section.

9.5 Knowledge required for running ring frames

(a) Importance and functions of various mechanisms in ring frames and infrastructure needed for running.

(b) Spinning parameters and the method of setting them on ring frames to get the required quality.

(c) The suitability of lift and ring diameter, the types of rings and travellers, lappet hooks, rubber cots and aprons for different materials and counts.

(d) The selection of draft in front zone and break draft zone considering the speed frame material and the count being spun.

(e) Production balancing; importance and methodology for different product combinations.

(f) Role of humidity and temperature in maintaining quality and productivity for different product combinations.

(g) Workloads, work allocation and standard working conditions appropriate.

(h) Calculation of production and efficiency, the industry norms and the factors affecting productivity.

(i) Colour codification and its importance.

(j) Precautions to be taken while working ring frames.

(k) Importance of cleanliness and personal safety.

9.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the supervisors refer and follow.

9.6.1 Control points in ring frames

(a) Deciding and adopting process parameters, viz. actual count, twist, speeds, settings, draft, draft combinations, rings, travellers, spacers, chase, winding and binding ratio.

(b) Engaging required and trained workmen.

(c) Deciding and providing required air changes, humidity and temperature.

(d) Deciding colour codification and implementing.

(e) Deciding the work allocation for employees.

(f) Evolving the maintenance schedules and activities and implementing them.

9.6.2 Check points in ring frames

9.6.2.1 Material related

(a) The bobbins received and the plan.

(b) Quality of bobbins received from speed frames.

(c) Availability of bobbins from speed frames to run the spinning fully.

9.6.2.2 Machine related

(a) The condition of the machine parts.

(b) Condition of the cots and the hardness as required.

(c) The condition of inside path in rings.

(d) Level of ring rail on both the sides and throughout the length of machine.

(e) Cot's alignment to the bottom roller axis.

(f) The top arm loading.

(g) Centring of the lappet hook and spindle.

(h) Check and ensure that the bobbin holders are free.

(i) The spindles idle due to mechanical reasons.

9.6.2.3 Setting related

(a) The spindle speed, front roller speed and the plan.

(b) The machine settings against the parameters planned.

(c) Suitability of the cots, rings and traveller for the materials worked.

(d) Suitability of the lappet hooks for the count and the materials worked.
(e) Cop build; whether it is proper and appropriate to the ring diameter.
(f) Check the working of traverse and ensure that it is proper.
(g) Working of overhead cleaners; ensure that it is not disturbing the ends.

9.6.2.4 *Performance related*

(a) Working of the ring frames as per the count pattern decided.
(b) The count of yarn as per requirement and the variation within limit.
(c) The twist per metre (TPM) of yarn as per requirement and its variations.
(d) The production and efficiency obtained against the plan.
(e) The yarn uniformity, appearance, hairiness, etc., as per requirement.
(f) Whether the breakages are in control?
(g) Whether the wastes generated are within limits?

9.6.2.5 *Documentation related*

(a) The machine wise counts worked.
(b) The colour codes used of empty bobbins.
(c) The wheels, ring travellers, spacers and cots used where counts changed.
(d) Recording of traveller renewal.
(e) The doff labels put on spinning doffs.

9.6.2.6 *Work practice related*

(a) Whether the maintenance is done as per plans?
(b) Cleaning properly of the bobbins used before using.
(c) Removing of pneumafil wastes in time as per schedule.
(d) Following up of the colour codification and channelization.
(e) Disposing of wastes with proper accounting and labelling.
(f) Keeping the drafting zone and yarn path clean.
(g) Maintaining the temperature and humidity as per need.
(h) Cleaning of the crates before putting newly doffed cops.
(i) The quality of piecing of siders.

(j) Check and ensure that there are no cross creeling of bobbins.

9.6.2.7 Log book related

(a) The machine numbers and number of machines working in different counts.

(b) The count changes done in the shift.

(c) The changes to be done in next shift with clear indication of production to be taken out in the running count.

(d) Stock of speed frame bobbins at the start and end of the shift in each mixing.

(e) Stoppage and reason for stoppages.

(f) Special instructions written in the log book and to be written by you.

9.6.2.8 M.I.S. related

(a) Date and shift.

(b) Mixing and count.

(c) Ring frame number.

(d) Number of spindles in the machine.

(e) The hanks produced.

(f) Production in kilograms.

(g) Men employed in the section.

(h) Mixing wise pneumafil and bonda wastes.

(i) Stoppages if any with reason.

9.6.2.9 General

(a) The men allocation and the norms.

(b) Adequate training of the workmen.

(c) The housekeeping in the section.

9.7 Normal problems in ring frames

9.7.1 Ring cut cops

Ring cuts are due to the cop diameter becoming more than the limits prescribed by the ring diameter. The possible reasons are the count being coarse, the build not adjusted properly, a bigger ratchet wheel, less number of teeth on ratchet wheel being pushed each time, loose ratchet wheel, vibrating spindles, nonalignment of rings in the centre of spindle axis, use of a lighter ring traveller, jammed poker bars, insufficient pressure on top rollers resulting in coarser count, etc.

9.7.2 Hard twisted yarn

Hard twisted yarns are normally due to count becoming very coarse because of inter doubles or lashing in, front roller delivery becoming less due to a loose roller, worn out threads in fluted roller joints, failure of delay drafting mechanism where delay drafting is provided, loose timer belt driving the front roller in case of timer belt drive, and traverse going out of drafting area, and so on.

9.7.3 Uneven yarn

Uneven yarns are due to number of reasons like uneven feed material, uneven roving stretch at creel, improper settings in drafting zone, misalignment of top rollers with respect to bottom rollers, worn out cots, excessive cot hardness, worn out aprons, jerky bottom apron movement, improper selection of spacer, low pressure in top arms, non-uniform top arm loading, eccentric fluted rollers and cots, jammed arbours, faulty bottom roll drive, vibrating spindles, jammed bobbin holders, improper distribution of drafts between break draft zone and main zone, improper cleaning of drafting zone, lapping in adjacent spindles, faulty traverse motion, traverse going out of drafting area, damaged cradles, top roller contaminated with grease, fluff accumulation in drafting zone, etc.

9.7.4 Soft twisted yarn

Soft twisted yarns are due to loose tapes, worn out tapes, jammed spindle bolsters, loose bobbin on spindle, jammed jockey pullies, spindle button missing, and so on.

9.7.5 Higher hairiness

Higher hairiness is due to number of reasons like worn out rings, worn out travellers, improper profile of traveller, excessive yarn tension and very low yarn tension, worn out lappet hooks, worn out separators, higher spindle speed, improper selection of traveller, variations in fibre lengths, lower humidity in the working area, too big a balloon, anti-balloon rings and yarn guides badly centred or with roughened surface, vibrating spindles, cop diameter too large, fibres protruding from cop get caught by traveller, dry atmosphere leading to high static charges, missing condensers in front one of drafting, etc.

9.7.6 Lean built cop

Lean built cops are due to count becoming very fine than planned, excessive breakages on a particular spindle, high chase length, smaller ratchet wheel, i.e. less number of teeth on ratchet wheel, selection of actuating pins and the number of teeth in ratchet lower/higher for the yarn count and improper balancing of ring rail and lappet, etc. Normally the eccentric spindles and non-centring of lappet hooks are the one which contribute for high breaks and then to lean built cops.

9.7.7 Sloughing off at winding

The normal reasons for sloughing off at winding are loose built soft bobbins, very low chase length, improper combination of winding and binding coils, ring rail getting stuck in spinning due to any reason and too light traveller.

9.7.8 Undrafted end

The normal reasons for undrafted ends in spinning are high twist in rove, lower break draft, low top arm pressure, higher humidity, smaller spacer, channelled aprons and cots.

9.7.9 Higher thin places

The normal reasons for higher thin places are excessive draft, wider roller settings, worn out gear wheels in drafting zone, jerks in working, eccentric movement of cots and fluted rollers, partial lapping on drafting rollers, higher stretch between bobbin holder and drafting zone, and broken roving guides.

9.7.10 De-shaped cops

The main reasons for de-shaped cops are not attending to breakages in time, not attending to creel runs out in time and excessive breakages.

9.7.11 Idle spindles

The idle spindles add cost to the manufacturing without producing. Some mechanical defect prevents the spindle from working in a normal way. The main reasons are non-creeling of bobbins in time, tape breakages, apron breakages, oil flowing to rollers from gears and broken or missing parts.

9.7.12 Slub

Slub can happen due to improper mixing of fibres, too much variations in fibre lengths, improper opening, low pressure in drafting roller, inadequate drafts applied, lower setting of drafting rollers for the fibre length in use, damages in card wire points resulting in bunches of fibres, lashing in or lapping in spinning, damages in the draft gear wheels and slippage of rollers while drafting.

9.7.13 Crackers

We get this problem when a ring frame running on a coarse count for a long time is taken for fine counts. The cots would have developed channels which are not visible by bare eyes. In fine count, the rove will not get the required pressure when the rove goes inside the channel developed. This results in inadequate drafting at such places. If the yarn is pulled, the cracker effect goes off and we get a regular yarn. It is suggested to buff the cots whenever a ring frame is taken on fine counts from coarse count.

9.7.14 Shade variations

Shade variations in ring spun yarns are normally due to mix up of sliver of different mixing at any place in spinning preparatory, a major change in mixing components (cotton lots, e.g. new cotton crop) in the same mixing but not taken separately. Sometime shade variations are observed due to smoke contaminations by a wearing V belt or fire accident in adjacent area. We get part of the cops with different shade in all the machines in such cases.

9.7.15 Higher end breaks

There are number of reasons for an end to break. Following are some prominent reasons.

(a) Creel breaks due to lower twist in rove, jammed bobbin holders, bobbins touching adjacent bobbins, overhead blower blowing on the rove resulting in break, and cross creeling.

(b) Breaking of rove at the condenser due to broken condenser, small sized condenser, and thick place in rove, and bobbin running out.

(c) Breakage due to problems in drafting zone like improper setting, worn out cots and aprons, oily aprons, oily surface of bottom roller, improper pressure on top rollers, fluff accumulation, worn out wheels driving the drafting system, worn out threads at fluted roller joints, and so on.

(d) Breakages after front roller nip are due to improper alignment of lappet hook and spindle, improper centring of spindle and ring, worn out ring, worn out traveller, improper traveller, improper combination of ring and traveller, worn out lappet hook, low twist in yarn, uneven yarn, traveller clearer setting not proper, ring rail not in level, loose tapes, fallen down button in spindles, vibrating spindles, very high speed of spindles, too early change over from slow to fast speed, bad condition of separators, vibrations due to worn out bearings in tin roller shaft, worn out gears giving jerks, inadequate suction leading to lashing in of broken ends, bobbins not fitting properly on spindles and so on.

9.7.16 High yarn faults

The reasons for short length thick faults are presence of large amount of trash or high proportion of seed fragments, insufficient removal of neps in combing, poor opening and cleaning in blow room and card, use of higher total draft at ring frames, use of too wide or too narrow setting of spacers at ring frames and bad piecing at ring frame.

The normal reasons for long length faults are poor condition of drafting at ring frames, poor housekeeping in spinning, hard piecing at roving and poor mechanical conditions at combers.

Table 9.1 Other reasons for yarn faults

Reasons	Type of Fault
Fly accumulation at traveller	A3 and A4
Foreign matter	A3 and A4
Wrong spacer	A4, B2 and C2
Smaller cage length and tight cage setting	B4, C4.D3 and D4
Fused fibres in synthetic materials	B3, C3 and C2
Poor piecing at ring frame	C3 and C4
Defects in drafting elements at speed frames	C3, C4, D2, D3 and D4
Cracked aprons in ring frames	B2 and C2
Roving stretch	H1
Apron felting	F

9.7.17 High count variation

The reasons for high count variations can be generally explained as follows.

(i) High U% at finisher draw frame, stretch at roving, stop motions not acting effectively at draw frames and high stretch at speed frames are main reasons for within bobbin count variations.

(ii) Hank sliver difference between draw frame cans, non-optimum setting system for changing the draft change pinion, high number of changes and unnecessary changes of change pinion, excessive hank difference within roving bobbins and between roving bobbins, top arm pressure variations are main reasons for between bobbin count variations.

9.7.18 Twist variations

Normal reasons for twist variations are poor condition of spindle tape, jockey pulley condition not good, poor condition of spindle bolster, one or more spindles driven by a tape remaining idle, partial brake applied on running spindle, cotton sticking to spindle tape causing slippage, buttons fallen down on spindles and not holding the bobbin firmly, too many breaks and workers holding yarn for more time while piecing.

9.7.19 Top apron damage

Normal reasons for top apron damage are defective traverse motion and high twist in roving causing channeling groves, excessive top arm pressure, fluff accumulation in drafting zone, stickiness caused by materials used for colour coding, wrong and/or defective cradle, defective spacer; spacer touching the apron and top roller lapping.

9.7.20 Bottom apron damage

Normal reasons for bottom roller damage are tension pulley jammed, top apron cradle not sitting properly, inadequate or too high arm pressure, defective traverse motion, bottom roller lapping and oil migrating from bearings to the aprons near to the roller stands.

9.7.21 Spindle tape breakage

Normal reasons for spindle tape breakages are bobbin sitting very tight on spindle, spindle tape elongation, condition of spindle lock is poor and touching the tape, hard waste entangled on spindle, spindle tape joint is not proper and jockey pulley alignment is not proper.

9.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

9.8.1 Dos

(a) Verify and understand the mixing, count, critical quality requirements of yarn and the quantity to be produced in each machine before starting your work.

(b) Verify the input materials for quality, stock, colour codification used and compare with the plan given to you.

(c) Verify the calculations and assumptions before implementing.

(d) Stick to colour codes and other identification systems agreed.

(e) Maintain uniform process parameters on all machines for a given yarn/count.

(f) Work for getting maximum utilization and efficiency for machines working.

(g) Monitor the production on periodic basis by checking the hanks produced.

(h) Monitor and control the wastes generated mixing wise and machine wise.

(i) Attend to breakages without delay as it can spoil yarn in adjacent spindles.

(j) Clean the clearer rollers frequently.

(k) Clean the suction tubes by using a broom stick.

(l) Remove the fluff from drafting zone using a broom stick or a fluff gun.

(m) Check personally the problems in working rather than depending on others.

(n) Check for proper removal of wastes from time to time.

(o) Check the safety systems and stop motions before starting the machines.

(p) Cover the materials in stock if it is not likely to be used immediately.

(q) Clean the speed frame bobbins removed and give back to speed frames.

(r) Always transport speed frame bobbins in pegged trolleys.

(s) Take periodic rounds in winding and understand the working of yarns.

(t) Keep doff separately in case of a machine stopping due to any breakdown. Get the materials checked for quality like twist variations, count variations and imperfections before giving it for winding along with regular material.

(u) Maintain lowest break draft possible without getting undrafted ends.

(v) Identify the spindles giving repeated breaks and attend to it on priority.

(w) Ensure that all empty bobbins are pressed properly on spindles after doff.

9.8.2 Don'ts

(a) Do not use knife or any sharp object for removing the lapping; take the cot out and clean by hand. Use hooked knife like ATIRA knife in case of synthetic fibres getting lapped.

(b) Do not allow the speed frame bobbin to run out fully where traditional speed frames with flyers fitting on spindles are used. Remove it when there are 30 to 40 coils as the initial coils in a bobbin shall be very uneven and shall be of low twist.

(c) Do not overlap a rove while changing a bobbin. Cut the old rove and insert new one without allowing for spinner doubles.

(d) Do not decide on colour code by yourself; discuss with winding and take decision.

(e) Do not draw more materials from speed frame and keep in stock at spinning.

(f) Do not alter the wheels within the middle of production; change the wheels after doffing and inform winding.

(g) Do not produce more yarn than the ordered quantity.

(h) Do not engage people in the shift unless you have confirmed orders.

(i) Do not allow stacking of bobbins on the ring frame tops or in the roving passage in drafting area.

(j) Do not allow the use of knife for cleaning bobbins (bottoms and remnant speed frame bobbins).

(k) Do not make double piecing, i.e. gaiting a broken end. Always piece the end by taking the yarn from the bobbin out.

(l) Do not make piecing by taking the ends on the back side of top roller.

(m) Do not allow any parts or other materials to be kept on ring frames.

(n) Do not use chalk for marking bobbins.

(o) Do not use bags for keeping spun yarn doffs.

(p) Do not allow the use of broken/damaged empty bobbins.

(q) Do not use broken or damaged crates for keeping spinning doffs.

(r) Do not throw wastes on floor; keep them in the waist bag.

(s) Do not waft (fan) the loose fluff, but collect it by wiping.

(t) Do not stop the machine when the ring rail is in the top most position.

(u) Do not ratchet to delay taking doff; it is better to stop the machine instead.

9.9 Responsibilities of supervisor in ring frames

(a) Completing the assigned jobs and achieving the ring frame production with quality while maintaining discipline, housekeeping and team working.

(b) Ensuring that all the programmed machines are kept working.

(c) Getting the machines started in time after each doff, cleaning, repairs, count changes, etc., and achieving maximum utilization.

(d) Ensuring clean working area and good housekeeping all the time.

(e) Ensuring that all materials and records are kept in their respective place.

(f) Verifying the speed frame bobbin details like mixing, hank, colour codes, machine number, etc., before taking them for spinning.

(g) Checking and adhering to the colour codes as decided and displaying them.

(h) Taking corrective actions like getting the settings corrected while limiting to the authorities given to him.

(i) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(j) Providing the speed frame bobbins of required mixing and hanks in time to ring frame section as per the requirement of the spinning machines.

(k) Ensuring safe handling of the spun materials and roving bobbins and preventing wastes and poor quality due to poor handling practices.

(l) Supplying materials in time to winding department.

(m) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(n) To report HRD in case of any accidents and filling the accident reports in time.

(o) To help spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

9.10 Authorities of supervisor in ring frames

(a) Questioning the jobber and workers when the production is low, work place is not clean, housekeeping is bad and work done is not satisfactory.

(b) Sending memo to HRD in case of lapse in discipline by any of the employee working under him.

(c) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(f) Rejecting the speed frame bobbins if found with too much defects like soft, hard, sloughing off, slubs, uneven, etc.

(g) Discarding damaged empty bobbins, crates.

9.11 Some hints for better performance

(a) Always keep the drafting area clean.

(b) Plan the activities of doffing and ensure that all doffer boys are ready before stopping a ring frame for doffing.

(c) Keep the idle spindles at lowest possible level.

9.12 Applicable formulae

$$\text{Front roller delivery in inches per minute} = \frac{\text{Spindle speed in RPM}}{\text{Twist per inch}}$$

$$\begin{array}{c}\text{Production per spindle}\\ \text{per shift in kgs}\end{array} = \frac{\begin{array}{c}(\text{Spindle speed in RPM} \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency \%})\end{array}}{\begin{array}{c}(\text{Twist per inch} \times \text{Count Ne}\\ \times 840 \times 36 \times 100 \times 2.2)\end{array}}$$

$$\text{Production per machine per shift in kgs} = \frac{\text{Hank} \times \text{Number of spindles}}{\text{Count of yarn Ne} \times 2.2}$$

$$\text{Mechanical draft} = \frac{\text{Surface speed of delivery roller}}{\text{Surface speed of feed roller}}$$

$$\text{Actual draft} = \frac{\text{Hank delivered}}{\text{Hank fed}}$$

10
Rotor spinning

10.1 Purpose of rotor spinning

- To spin yarns of required count from short staple fibres using a rotor for twisting, opening roller for opening fibres and winding directly on large cheeses, thus ensuring long joint-less yarns and uninterrupted running of the machine without a need for stopping for doffing.
- To consume the soft wastes generated while spinning and converting them into useful yarn.

10.2 What rotor spinning should do?

(a) Opening the fibres from the draw frame sliver using opening roller and feeding it to the rotor one by one through a narrow funnel.

(b) Accumulating required number of fibres inside the rotor before twisting them and converting to yarn.

(c) Twisting the yarn by taking out collected fibres from the centre of the rotor.

(d) Winding the converted yarn onto a large package, either cheese or cone.

(e) Doffing full cheeses while working without stopping the entire machine.

10.3 What rotor spinning should not do?

(a) Should not produce uneven and faulty yarn.

(b) Should not create slubs, hairiness and other yarn faults.

(c) Should not result in very low strength of yarn.

10.4 General activities in rotor spinning

(a) Getting draw frame sliver in suitable cans from draw frames.

(b) Setting the machine parameters for the counts spun considering the hank of sliver and the fibre length.

(c) Feeding the sliver from can to the feeding funnel.

(d) Loading empty cheese on cheese holder and wrapping a small length of yarn on it.

(e) Inserting the tail end of yarn into rotor and pulling it out along with accumulated fibres in the rotor and winding the yarn on the cheese.

(f) Producing yarns on cheeses and sending to next process.

(g) Sending the empty cans back to draw frames.

10.5 Knowledge required for running rotor spinning

(a) Importance and functions of various mechanisms in rotor spinning and infrastructure required in the section.

(b) Various types and configuration of rotors for different types of yarns.

(c) Production balancing: Importance and methodology for different product combinations.

(d) Role of humidity and temperature in maintaining quality and productivity.

(e) Workloads, work allocation and standard working conditions appropriate.

(f) Calculation of production and efficiency, the industry norms and factors affecting productivity.

(g) Colour codification and its importance.

(h) Precautions to be taken while working rotor spinning machines.

(i) Importance of cleanliness and personal safety.

(j) Firefighting and first aid.

(k) Safety gadgets used in the factory and the workplace.

10.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. Each mill should prepare its own “Control Points and Check Points” and display them in the work area, so that the supervisors shall refer and follow. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets.

10.6.1 Control points in rotor spinning

(a) Deciding and adopting process parameters, viz. actual count, twist, speeds, rotor diameter and angle, hank to be fed, final package dimensions, etc.

(b) Deciding and providing required air changes, humidity and temperature.

(c) Deciding colour codification and implementing.

(d) Deciding the work allocation for employees.

(e) Engaging sufficient and trained workmen.

(f) Evolving the maintenance schedules and activities and implementing them.

10.6.2 Check points in rotor spinning

10.6.2.1 Material related

(a) The cans fed and the plan.

(b) Quality of the sliver fed.

(c) Trash contents in sliver; ensure it is within limit.

10.6.2.2 Machine related

(a) The condition of the opener roller pins.
(b) The condition of the groove inside the rotors.
(c) Condition of the rubber coating on take-up roller.
(d) Condition of the winding drums.

10.6.2.3 Setting related

(a) The machine speeds and the plan.
(b) The machine settings as per the parameters planned.

10.6.2.4 Performance related

(a) The count of yarn and the variation. Check whether it is within limit.
(b) The TPM of yarn, the requirement and the variation.
(c) The production and efficiency obtained and the plan.
(d) The uniformity and appearance (diameter in case of very coarse yarns) as per requirement.
(e) Whether the breakages are in control?

10.6.2.5 Documentation related

(a) Machine wise mixing and count worked.
(b) Details of count labels put on the cheeses.

10.6.2.6 Work practice related

(a) Whether the maintenance is done as per plans?
(b) Cleaning of the cans used before putting in draw frames.
(c) Removing the wastes in time as per schedule.
(d) Following of the colour codification and channelization as per plan.
(e) Whether the wastes generated are within limits?
(f) Disposing the wastes with proper accounting and labelling.
(g) Cleaning the rotors by tenters every time they attended a break.

10.6.2.7 Log book related

(a) Machines worked on different counts.

(b) Production achieved in each machine.
(c) Number of men employed.
(d) Number of full cans in stock at the beginning and end of the shift.

10.6.2.8 M.I.S. related

(a) Date and shift.
(b) Machine number.
(c) Mixing and count.
(d) Number of drums.
(e) Production achieved in kilograms.

10.6.2.9 General

(a) Working of the rotor spinning machines as per the count pattern decided.
(b) Whether the workmen are adequately trained?
(c) Whether the temperature and humidity are maintained as per need?
(d) Whether the housekeeping is good?

10.7 Normal problems in rotor spinning

10.7.1 Neppy/uneven yarn

Dust accumulation within rotors, mark in rotor grove, damages in rotor covers, lapping on opener roller, damaged wires on opener roller are the main reasons for neppy and uneven yarn in rotor spinning.

10.7.2 Stitches

Stitches on cheeses are mainly due to lapping on the cradle sides, choke up in the traverse path, lapping on drum, damaged cradle bearing, damaged bobbin holder and snap in traverse bar belt.

10.7.3 Irregular yarn

Variations in dynamic tension while spinning is one of the reasons apart from the condition of rotor inner grove and the condition of naval.

10.7.4 High snarling tendency

Improper selection of groove; i.e. V groove instead of U groove used in rotor.

10.7.5 Higher hairiness

Higher opener roller speed and damaged pins in opener rollers are the normal reasons for rupture of the fibres that lead for higher hairiness. Rough surfaces in the yarn path also contribute of higher hairiness.

10.7.6 High trash content in yarn

Uncleaned rotors, high trash content in the drawing sliver, lower opener roller speed are the normal causes of high trash in the yarn.

10.8 Dos and don'ts for supervisor

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

10.8.1 Dos

(a) Verify and understand the mixing, count, critical quality requirements, package weight and dimensions and the quantity to be produced in each machine.

(b) Verify the input materials like mixing and hank and compare with the plan.

(c) Verify the calculations and assumptions before implementing.

(d) Stick to colour codes and other identification system agreed between sections.

(e) Check and verify the rotor parameters and its suitability for the count worked.

(f) Maintain uniform process parameters on all machines for a given mixing and count.

(g) Work for getting maximum utilization and efficiency.

(h) Monitor and control generation of wastes mixing wise and machine wise.

(i) Check personally the problems in working rather than depending on a third person.

(j) Check for proper removal of wastes from time to time.

(k) Check the working of safety systems and stop motions.

(l) Cover the materials in stock if it is not likely to be used immediately.

(m) Ensure that the cans returned to draw frames are cleaned.

(n) Always transport cans on trolleys.

10.8.2 Don'ts

(a) Do not decide on colour codes and markings by yourself.

(b) Do not decide on the package size and weight by yourself, but consult the user.

(c) Do not draw more cans or produce more quantity than the ordered quantity.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not use chalk for marking cheeses or cones.

10.9 Responsibilities of supervisor in rotor spinning

(a) Completing the assigned jobs and achieving the yarn production with quality besides maintaining the discipline, housekeeping and team working.

(b) Ensuring that all the programmed machines are kept working and idle rotors are attended without delay.

(c) Getting the works started in time and achieving maximum utilization and efficiency.

(d) Ensuring clean working area and good housekeeping all the time.

(e) Ensuring that all materials and records are kept in their respective place.

(f) Verifying the draw frame can details like mixing, hank, colour codes, machine number, etc., before taking them for spinning.

(g) Checking and adhering to the colour codes as decided.

(h) Taking corrective actions like getting the speeds and settings corrected, replacing worn-out parts, etc., while limiting him to the authorities given.

(i) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(j) Providing the draw frame cans of required mixing and hanks in time to rotor spinning section as per the requirement of the spinning machines.

(k) Ensuring safe handling of the materials and preventing wastes and poor quality due to poor handling practices.

(l) Supplying materials in time to packing or next process.

(m) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(n) To report HRD in case of any accidents and filling the accident reports in time.

(o) To help rotor spinning in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

10.10 Authorities of rotor spinning supervisor

(a) Questioning the jobber and workers when the production is low, housekeeping is poor, and the work done is not satisfactory.

(b) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(c) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(f) Rejecting the draw frame cans if found with too much defects like wrong coiling, entanglements, too many breaks, thick and thin places in sliver, etc.

(g) Rejecting empty tubes for winding in case of poor quality, wrong printing of labels and wrong colour codification.

(h) Discarding damaged empty tubes.

10.11 Some tips for better performance

(a) Always clean the inner surface of rotor while mending yarn breaks.

(b) Check and ensure that the quality of pins in opener roller is always good.

(c) Keep the idle drums at lowest possible level.

10.12 Applicable formulae

$$\text{Delivery in metres per minute} = \frac{\text{Rotor speed in RPM}}{\text{Twist per inch} \times 39.4}$$

$$\begin{array}{c}\text{Production per drum}\\ \text{per shift in kgs}\end{array} = \frac{\begin{array}{c}(\text{Rotor speed in RPM} \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency \%})\end{array}}{\begin{array}{c}(\text{Twist per inch} \times \text{Count Ne}\\ \times 840 \times 36 \times 100 \times 2.2)\end{array}}$$

$$\text{Production per machine per shift in kgs} = \frac{\text{Hank reading} \times \text{Number of drums}}{\text{Count of yarn Ne} \times 2.2}$$

$$\text{Actual draft} = \frac{\text{Hank delivered}}{\text{Hank fed}}$$

11
Cone winding

11.1 Purpose of cone winding

To clear the yarn from objectionable faults and winding them with uniform tension on large packages like cones or cheeses to facilitate the activities of warping, weaving, knitting, etc., and for easy handling while transporting and marketing.

11.2 What cone winding should do?

(a) To clear the yarns from objectionable faults which can hinder the process of warping, weaving or knitting.

(b) To wind yarns with uniform tension so that the yarns unwind uniformly in knitting, warping, weaving and other processes.

(c) To wind yarns of required length on cones or cheeses so as to have minimum remnants while working on warping or knitting.

(d) To wind yarns on large packages without any slippage or entanglements.

(e) To provide clear identification on cones/cheeses to identify the material, type of yarn, lot, count, the winding machine and drum used.

11.3 What cone winding should not do?

(a) Should not cut unobjectionable faults and create problems of knots or bad splices.

(b) Should not increase hairiness.

(c) Should not develop winding faults like bunches, snarls, ribbon, stitches, sunken nose, etc., which can create problem in further processes.

(d) Should not mix up different counts or different lots of yarns.

11.4 General activities in cone winding

(a) Getting programme from user departments for the yarns required by them.

(b) Informing spinning section regarding the yarn requirement and getting the ring frame yarns for winding.

(c) Allocating different machines and drums for winding as per requirement.

(d) Setting the yarn clearers considering the quality requirements and the actual level of faults in the yarn received.

(e) Winding the yarn on large cones with predetermined length and tension.

(f) Mending the breaks and cops run-outs with suitable splicing or knotting.

(g) Doffing full cones and sending to the next process or packing as the case may be.

(h) Cleaning the remnant cops and sending the empty cops to ring frames.

(i) Rewinding cones with defective winding like ribbons, stitches, sunken nose, etc.

11.5 Knowledge required for cone winding

(a) Functions and use of machines, mechanisms and infrastructure in the section.

(b) Setting yarn clearers, splicers, tensioners, length monitors and cone holders as per the yarn quality requirements and the fibres in use.

(c) Knowledge about cone angles, cone dimensions, cone quality requirements and selection of cone holders and drums to suit the requirements.

(d) Production balancing.

(e) Role of humidity and temperature in maintaining quality and productivity.

(f) Workloads, work allocation and working conditions appropriate to the section.

(g) Calculation of production and efficiency, the industry norms and factors affecting productivity.

(h) Colour codification and its importance.

(i) Precautions to be taken while working.

(j) Importance of cleanliness and personal safety.

(k) Safety gadgets used in the factory and the workplace.

11.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the people can follow.

11.6.1 Control points in cone winding

(a) Selection of suitable process parameter considering the material and customer requirements. The parameters to be controlled are speeds, yarn clearer settings, tension, cone dimensions, length of yarn in cone, wax quality and settings at contamination channel.

(b) Cone identifications, viz. cone tip, cone label, winder no., machine no., lot no., contract no.

(c) Engagement of trained workmen.

(d) Evolving maintenance schedules and activities, and implementing them.

(e) Deciding the work allocation and production targets.

11.6.2 Check points at cone winding

11.6.2.1 Material related

(a) Materials brought for winding and the critical requirements.

(b) Spinning doff stocks and winder allocation.

(c) Cones required in each lot to complete packing.

(d) Doff labels on the cops/crates, date and shift of spinning and the ring frame number.

(e) Whether the identification given for cops is as decided and agreed?

11.6.2.2 Winding machine related

(a) Condition of machine parts, viz. drums, cone holders, tension units, porcelain guides, suction units, air valves, air pipes, conveyor belts, splicing/knotting units, doffing units, empty cone reserve, creel magazine, etc.

(b) Working of all stop motions.

(c) Whether the tension applied as per yarn quality?

(d) Working of waxing units.

(e) Whether the wax discs are proper?

(f) Condition and cleanliness of the yarn path and the machine.

(g) Alignment of the creel pegs and the yarn guides.

(h) Whether the cone holders are set properly?

(i) Working of magazines; revolving properly and exact placing of the cops.

(j) Whether the conveyors are moving freely?

11.6.2.3 Setting related

(a) Whether the settings are done as per the yarn quality requirement?

(b) Check settings for Slubs, long thick, long thin, count mix, length taken out for splicing.

(c) Whether the speed is as per standards?

(d) Whether the tension applied as per yarn quality?

(e) Suitability of the prisms used in splicer for the count and materials.

(f) Whether the settings of splicer are as per the yarn quality?

(g) Whether the length set is as per requirement and uniform on all drums?

11.6.2.4 Performance related

(a) Clearing efficiency of yarn clearers.
(b) Production efficiency.
(c) Winding drum-wise performance.
(d) Winder-wise production and wastes generated.
(e) Cone quality.
(f) Weight variations between cones.
(g) Hard wastes generated and the reasons.
(h) Splicing quality.
(i) Friction value for waxed yarns.
(j) Cone hardness.
(k) Increase in hairiness and imperfections after winding.

11.6.2.5 Documentation related

(a) Whether the cone labels are entered with all relevant information?
(b) Whether the cone weights are uniform and as per calculation and length set.
(c) Whether the data of each winding machine was entered in the records?
(d) Memo and documentation prior to sending cones to next process or packing.
(e) Whether the remnant cops are counted/weighed, recorded and returned to spinning with proper memo?

11.6.2.6 Work practice related

(a) Following of the material handling systems as per requirements.
(b) Whether the winders are putting the correct type of knot while mending breaks in case of manual winders?
(c) Removing the unused materials in time from time to time.
(d) Keeping the machines and surroundings clean all the time.
(e) Using the spinning doffs with the machine traceability in view.
(f) Removing hard wastes from time to time from suction box.

(g) Whether the workers are wearing waist bags and collecting the defective cops, cleaning them and putting back for winding?

(h) Whether the cleaned cops are put back randomly or fed to the nearest drum?

11.6.2.7 Log book related

(a) The machines allotted for different counts and lots, the number of drums allotted, the colour codification and cone identification used, the lot completion details, the winders engaged and the production of each winder, the doff stock at the end of the shift.

(b) Stoppages with reasons for stoppages.

(c) The problems faced like short of materials, materials not received in time, breakages, and quality related issues

11.6.2.8 M.I.S related

(a) Lot number and contract number.

(b) Count and type of material.

(c) Winding machine number.

(d) No of drums.

(e) Winder number.

(f) Productions – Winder wise and machine wise.

(g) Average weight of cones and total cones.

(h) Date and time of production.

(i) Date and time of issue to next process/packing.

(j) Remnants returned to spinning.

(k) Colour codification used.

11.6.2.9 General

(a) The temperature and humidity maintained and the requirement.

(b) The quantity of hard wastes generated.

(c) Whether the hard wastes generated are within the norms?

(d) Whether the machine cleaning was done properly by the maintenance people?

(e) Whether the paper/plastic cones used are of required quality?

(f) Bringing required paper/plastic cones for the next shift and handing over.

(g) Whether you received the shift in a good condition?

(h) The condition of the section when handed over the shift.

11.7 Normal problems in winding

11.7.1 Improper splicing

Normally spinning mills run different counts on the same winding machine, but shall not be able to match the prism size, the air pressures, timing, etc., required for the yarn. The problem is more in coarse counts. Improper selection of prism, low air pressure, improper mingling chamber and improper setting for opening and splicing are the main reasons for improper splicing.

11.7.2 Electronic yarn clearer (EYC) failures

Normal reasons for EYC failures are fluff accumulation in the measuring slot, low input voltage, blunt cutters, jammed cutters and loose fitting of PCB.

11.7.3 Double end

When an end is still running in winding, the cop is removed and new cop is put and another end is taken up and joined, resulting in double end. Failure of EKP (Electronic Knotter Programmer) in cutting the end after a splice or knot, and failure of bobbin conveyor belt are the main reasons for double ends found on cones.

11.7.4 Stitches

Variation in cone holder settings, vibrations in cone holder/drum, inadequate tension, variation in tension, improper rotation of the cradle bearing centre, loose cradle, ribbon formation, yarn sloughing, yarns coming out of clearer slots, low contact pressure of cone at high yarn tension and damaged drums especially near the drum nose are the normal reasons for stitches. The static electricity generated during winding, especially creates stitches in man-made fibre yarn winding, which are prone for static charges.

11.7.5 Soft/bulged cones

Normal reasons for soft or bulged cones are very low tension, yarn going out of the tension disc, fluff accumulation between tension discs, improper rotation of tension discs, winding angle too large and contact pressure too high.

11.7.6 Sunken nose/base

The main reasons for the sunken nose or base are improper fitting of paper cones on cone holder, improper size of paper cones and improper setting of cone holder.

11.7.7 Weight variation between cones

The normal reasons for weight variation between cones are variations in tensions between drums, improper setting of either conometer or diameter on cones, malfunctioning of drum sensor and too much variation in yarn count.

11.7.8 Shade variation within cones

The normal reasons for shade variations within cone are mix up of yarn from different mixing, variation in day-to-day mixing preparation and addition of soft wastes, ring cut or abrasion of yarn polishing a part of yarn, very slack tape resulting in a very low twist per inch (TPI) in spinning, contamination of oil or grease while spinning and exposing the ring cops to smoke or fumes.

11.7.9 Wrong cone tip or cone label

It is normal practice that empty cones and cone labels are brought in advance and labels are pasted to the empty cones before winding yarn on it and kept it in cone magazine. Sometimes, there shall be a change in programme and different count is started on the same drums. In such cases, if the winder does not remove all the spare empty cones from the machine, some cones might be with wrong cone tip and cone identification label. The empty cone and the label to be used on a machine are indicated to all by hanging a specimen cone. Sometimes, when a count is changed, the specimen cone and label are not updated on winding machine, and hence wrong cone tips and labels may be used.

11.7.10 Lapping on winding drum

Normal reasons for lapping on winding drum are cuts on drum, drum got cut by excessive yarn tension, uneven contact of the drum brush with the drum, winding at a low humidity, any flaws on the drum and poor quality of wax.

11.7.11 Increase of imperfections during winding

Winding normally increases imperfections like neps and thick places by 20% to 30%, whereas thin places are not affected. The normal reasons are improper tension setting, tension disc not rotating smoothly, scratches in yarn path, fluff and accumulation of wax and trash, pre-cleaner setting not between 5 and 7 times the yarn diameters, very high winding speed for the yarn, unwinding accelerator not placed at proper height and excessive contact pressure between cone and drum.

11.7.12 Excessive yarn breakage

Normal reasons for excessive yarn breaks are yarn with too many faults, too high tension set, tension disc not rotating smoothly, flaws in yarn path, pre-cleaner setting smaller than 5–7 times the yarn diameter, waste yarn sticking on drum brush due to flaw on drum nose, unwinding accelerator not aligned properly with bobbin, unwinding accelerator not positioned at correct height, faulty yarn clearer, too soft spinning bobbin, broken yarn or double piecing in bottom of the cop and defective built of cop.

11.7.13 Frequent pick failure on bobbin side

Normal reasons for pick failures on bobbin side are as follows.

(a) Re-tie pipe: Yarn is being caught by the re-tie pipe, insufficient stroke adjustment, insufficient stroke due to twisting of re-tie pipe due to excessive wear of re-tie opener cam, and improper clamping.

(b) Magazine suction: No suction, weak suction, yarn tail too low in magazine vacuum nozzle, insufficient residual back wind removed from the cop.

(c) Tension cutters are blunt.

11.7.14 Pick failure on package side

The normal reasons for pick failure on package side are as follows.

(a) Worn out brake shoe of the drum.

(b) Suction mouth package set far away from the package.

(c) Comb catching the yarn.

(d) Low suction pressure.

(e) Reverse rotation of drum; oil remains on the surface of reverse roll, reverse roll worn out or drum belt worn out.

(f) Reverse rotation of the package; rotation of cone holder is sluggish or package brake is not working properly.

11.7.15 Missed splicing

Reasons for frequent missed splicing are low opening and splicing pressure, wide/loose settings of the yarn holding lever or feeder arm and poor untwisting.

11.7.16 Low splice strength

Reasons for low splice strength are splicing pressure too low, too short air blasting time, too long splice length and insufficient untwisting of yarn end.

11.7.17 Yarn not accepted by splicing nozzle

The normal reasons for yarn not getting accepted by splicing nozzle are abnormally high yarn tension and yarn getting caught by suction mouth.

11.7.18 Splice thick at one side

The normal reasons for splice being thick at one side are dull yarn cutter, insufficient clamping of upper and lower ends and inadequate setting of untwisting nozzle.

11.7.19 End missing for splicing

At the end of winding from the spinning bobbin or when a yarn breaks, the yarn gets wound on either the end of the take-up tube or on to the package layer. Thus, the pickup motion cannot locate the end for piecing. Other reasons are improper gap between the drum cover and package, excessive sloughing, excessive surface cut of spinning bobbin, winding speed too high and high static charges.

11.7.20 Ribbon winding

The normal reasons for ribbon forming are as follows.

(a) Ratio of the drum diameter to package diameter becomes an integer at certain point of winding and forms ribbon. Ribbon breakers are provided to break the ribbon. Improper setting of ribbon breaker is one of the main reasons for ribbons.

(b) Excessive contact pressure, improper rotation of cradle, excessive moisture in spinning bobbin and spinning bobbin too soft are other reasons.

11.7.21 Wrinkles

Wrinkles occur due to short traverse at the start. Other reasons are inadequate tension, inadequate contact pressure, deflection of take up tube centre, and poor alignment of contact surface to take up tube and drum.

11.7.22 Scramble

Scramble is loosely wound yarn on the middle surface of cone. They are normally due to drum not stopping at yarn breakage, joining motion repeating several times, suction mouth coming in contact with package, too low contact pressure, ribbon coming off and weak starting force of drum.

11.7.23 Stepped winding

Stepped winding on cones are due to flaw on drum and drum cover, low yarn tension and disengaging yarn from the yarn path after machine maintenance or cleaning.

11.7.24 Saddle back package

The normal reasons for saddle back package are excess tension, low contact pressure and low increase.

11.7.25 Swelled package

Reasons for swelled package are no tension applied due to improper guiding of yarn on tensor, foreign substance staying on tensor disc and improper movement of tension disc, ribbon winding and improper movement of wax.

11.8 Dos and don'ts for cone winding

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

11.8.1 Dos

(a) Verify and understand the cone quality requirements before starting your work.

(b) Verify the calculations and assumptions before implementing.

(c) Stick to colour codes and other identification system agreed between sections.

(d) Work for getting maximum utilization and efficiency for which men are engaged.

(e) Have control on generation of hard wastes.

(f) Check personally rather than depending on a third person.

(g) Check the grey yarn lot running.

(h) Check the visual quality of cones produced.

(i) Check the settings at electronic yarn clearers.

(j) Check the cleanliness of the machine.

(k) Check the tension and uniformity in tension.

(l) Check the working of waxing in case of wax being used.

(m) Decide on the length to be set after considering allowances for wastes and slippage.

(n) Check the length set and compare with the standard.

(o) Check the speed set.

(p) Check the production to be taken out in the lot.

(q) Confirm that the yarn is approved by QA before it is brought to winding.

(r) Check the available quantity of yarn in winding and the yarn required for completing the lot before bringing fresh yarn.

(s) Check the details written in display boards.

(t) Take the stock of yarn at the end of each shift and hand it over to next shift.

(u) Discuss with the packing/warping in-charge before taking any yarn for winding.

(v) Make trail on five drums before finalizing parameters on all drums.

(w) Keep only those materials that are required for working in the shift.

(x) Always insist on wearing waist bag and collecting all hard wastes in the bag.

(y) Handover the machines and the winding section to next shift in a clean condition.

11.8.2 Don'ts

(a) Do not decide on colour code by yourself; discuss with the users and suppliers.

(b) Do not draw more yarn or produce more cones than the ordered quantity.

(c) Do not increase speeds or the weight of packages to get more productions.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not start the machine if the yarn received is not as per the plan given.

(f) Do not use broken plastic cones for winding yarn.

(g) Do not run the drum which is not giving the required cone quality.

(h) Do not start winding if the lot numbers are not matching to order.

(i) Do not accept the yarn if colour code used are not as per requirement.

(j) Do not run coarse counts by the side of fine counts.

(k) Do not allow cleaning of machine with compressed air while working.

(l) Do not allow anyone to use compressed air for cleaning self.

(m) Do not allow using of loose hard wastes for cleaning the machines.

(n) Do not allow wearing of loose cloths while working on the machines.

11.9 Responsibilities of supervisor in winding

1. Completing the assigned jobs and achieving the winding production with cone quality besides maintaining the discipline, housekeeping and team working.
2. Ensuring that all the programmed winding machines are kept working.
3. Ensuring clean working area and good housekeeping all the time.
4. Ensuring all materials and records are kept in their respective place.
5. Verifying the yarn lot number before taking yarns for winding.
6. Checking and adhering to the colour codes as decided.
7. Taking corrective actions like getting the settings corrected, getting the cones rewound, while limiting him to his authorities.
8. Putting the hard wastes collected in designated places and disposing after documenting.
9. Ensuring safe handling of the cones and preventing wastes due to handling.
10. Supplying cones in time to user department/packing.
11. Maintaining discipline in the section and informing the higher authorities in case of any serious breach.

12. Reporting to HRD in case of any accidents and filling the accident reports in time.
13. Helping winding in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

11.10 Authorities of supervisor in winding

(a) Rejecting the ring frame cops which are having problems like lean built, ring cuts, double gaiting, slough off and without count label.

(b) Questioning the jobber and workers when the work done is not satisfactory.

(c) Sending memo to HRD in case of serious lapse in discipline.

(d) Allotting or changing jobs to winders and other workers considering their skills.

(e) Arranging rewinding of the cones in case of winding defects and informing higher authorities regarding the quantity and the reasons for rewinding.

(f) Recommending leave and/or permission to the subordinates in the section.

(g) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

11.11 Some hints for better performance

(a) Always keep the winding area clean.

(b) Do not bring more yarn from spinning and keep in stock at winding section.

(c) Observe for repeated breaks in drums and attend the electronic yarn clearer.

(d) Keep the idle drums at lowest possible level.

11.12 Applicable formulae

$$\text{Yarn clearing efficiency \%} = \frac{(\text{Faults present in yarn fed} - \text{Faults in cleared yarn}) \times 100}{\text{Faults present in yarn fed}}$$

$$\text{Production per drum in kgs} = \frac{(\text{Winding speed in YPM} \times \text{No. of minutes in shift} ' \text{Efficiency \%})}{\text{Count Ne} \times 840 \times 2.2 \times 100}$$

12
Assembly winding for yarn doubling

12.1 Purpose of assembly winding

Winding the required number of strands side by side on a package with uniform tension making it suitable for feeding to either Ring Doubler or Two for One Twisting machine.

12.2 What assembly winding should do?

(a) To assemble number of yarns as required for doubling and wind on a single tube to facilitate twisting.

(b) To wind the component yarns with uniform tension.

(c) Ensuring uniform package dimensions and density.

12.3 What assembly winding should not do?

(a) Should not wind yarns with uneven tensions in the component yarns as it leads to snarls and corkscrew.

(b) Should not produce uneven package weights as it leads to underutilization of twisters and also more wastage of yarns.

(c) Should not prepare assembly wound cheeses in advance without confirmed orders for twisting.

12.4 Routine activities of assembly winding

(a) Taking instructions from twisting and advising winding/yarn godown to supply component yarns accordingly.

(b) Understanding the production plan and allocating the drums/ machines for different activities depending on the requirements of twisting machines.

(c) Checking the quality of materials received, viz. the cone and feeding them onto assembly winding machine.

(d) Checking the functioning of stop motions before starting winding.

(e) Checking the quality of materials produced, viz. the cone/cheese built, the weight variations, package hardness, excessive cuts, loose ends, etc., being produced by taking rounds.

(f) Supplying assembly wound packages for twisting.

(g) Maintaining records of production.

12.5 Knowledge required for working assembly winding

(a) Quality requirements of assembly wound packages for different applications like Ring Doubling and Two for One Twisting.

(b) Function and importance of various mechanisms used in assembly winding.

(c) Importance of yarn clearers, stop motions and tensioners.

(d) Package weight requirement considering the twisting machine needs.

(e) Production balancing – Importance and methodology.

(f) Role of humidity and temperature in maintaining quality and productivity.

(g) Workloads, work allocation and standard working conditions.

(h) Calculation of production and efficiency, the industry norms and factors affecting productivity.

(i) Colour codification and its importance.

(j) Precautions to be taken while working assembly winding machines.

(k) Importance of cleanliness and personal safety.

12.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area so that the people can follow.

12.6.1 Control points in assembly winding

(a) Selection of process parameters like speeds, tension, yarn clearer settings (mechanical clearers for controlling big knots and bunches), selection of knotter, splicer or knotting boards, feed package positions, delivery package weight and dimensions.

(b) Assembly winding package identifications.

(c) Allocation of trained workmen.

(d) Allocation of number of drums to winders and fixing production norms.

(e) Planning maintenance operations and implementing them.

12.6.2 Check points in assembly winding

12.6.2.1 Material related

(a) Materials brought for assembly winding and the critical requirements.

(b) Stock of assembly wound packages and material needed for completing the lot.

(c) Labels on the cones.

(d) The identification given for cones as decided and agreed.

(e) Creeling of the feed packages as per the Feed Package Position Plan.

12.6.2.2 Winding machine related

(a) Condition of machine parts, viz. drums, package holders, tension units, porcelain guides, splicing/knotting units, creel pegs, etc.

(b) Functioning of stop motions.

(c) The yarn path; it should be free from rough surfaces, serrations, and groves.

(d) The tension applied as per yarn quality.

(e) Clean condition of the yarn path and the machine.

(f) Alignment of the creel pegs and the yarn guides.

(g) Setting of the package holders.

12.6.2.3 Setting related

(a) Correctness and uniformity of the tension weights on all drums.

(b) The settings done for the yarn quality requirement.

(c) The speed as per standards.

(d) The prisms used in splicer and their suitability for the count and materials.

(e) The settings of splicer suiting the yarn quality.

(f) Whether the length set is as per requirement and uniform on all drums?

12.6.2.4 Performance related

(a) Uniformity in tension of the components of assembled package.

(b) Whether the breakages are in control?

(c) Weight variation between delivery packages.

(d) Whether the delivery packages are having required package density?

(e) Whether the machine is giving production as per plan?

(f) Production efficiency.

(g) Winder-wise production and wastes generated.

(h) Assembly wound package quality.

12.6.2.5 Documentation related

(a) Entering of yarn details with all relevant information.

(b) Entering the data of each winding machine in the records.

(c) Documenting and preparing memo before sending the packages to next process.

(d) Remnant cones handling, i.e. number and weight of remnant cones, cones returned to winding with proper memo.

12.6.2.6 Work practice related

(a) Way the winders controlling the tension of each component while attending to breakages.

(b) Cleanliness of the package storing area.

(c) Awareness among workers of the material working and the requirements.

(d) Material handling system followed and the requirements.

(e) Quality of knot put by workers in manual winding.

(f) Removing the unused materials in time.

(g) Keeping the machines and surroundings clean all the time.

(h) Whether the workers are using the cones with lot traceability in view?

(i) Removing the hard wastes from time to time.

(j) Whether the workers are wearing waste bags and collecting the wastes in them?

12.6.2.7 Log book related

(a) The machines allotted for different counts and lots, the number of drums allotted, the colour codification and package identification used, the lot completion details, the winders engaged and the production of each winder, the stock at the end of the shift.

(b) Stoppages with reasons for stoppages.

(c) The problems faced like short of materials, materials not received in time, breakages, and quality related issues

12.6.2.8 M.I.S. related

(a) Lot number and contract number.

(b) Count and type of material.

(c) Number of plies.

(d) Winding machine number.

(e) Number of drums.

(f) Winder number.

(g) Productions – Winder wise and machine wise.

(h) Average weight of packages and total packages.

(i) Date and time of production.

(j) Date and time of issue to next process.

(k) Remnants returned to winding.

(l) Colour codification used.

12.6.2.9 General

(a) Identification/codification of packages.

(b) Allocating the workers as per the work norms.

(c) Adequate training of the workers.

(d) Carrying of the maintenance activities as per plan.

(e) The temperature and humidity as per requirement.

(f) Machine cleaning done by the maintenance people.

(g) Quality of the paper/plastic cones/tubes used.

(h) Bringing the required paper/plastic cones for the next shift and handing over.

(i) Whether you received the shift in a good condition?

(j) The condition of the section when handing over the shift to next person.

12.7 Normal problems in assembly winding

12.7.1 Stitches on ply cheeses

Vibration of cradles, eccentric or damaged tubes, loose adopters on cradle, damaged drum and bent pins in stop motion are the common reasons for stitches in an assembly wound cheese.

12.7.2 Singles

Failures in stop motions like drop pin not falling, contact box pins not acting, defective micro switches, magnet coil not operating, fluff in contact box assembly, carbon depositions, etc., are the normal reasons for singles. Entanglement of yarn on drop pins does not allow the pins to fall resulting in singles.

12.7.3 Split ends and loose ends in cheeses

Operators not removing the singles from the cheeses, missing split end preventer, damaged drum are the main reasons for split ends and loose ends in a cheese.

12.7.4 Loose component ends

When a component yarn is broken or run out while multiple ends are being wound, it is very essential to see that all ends are with same tension while mending the break using staggered knot technique. The yarns need to be put properly on the knotting board. Any miss shall result in loose component end, leading to snarl after twisting.

Different tension set on the component yarns keeps one yarn tighter than the other yarn. This also leads to corkscrew effect after twisting.

12.7.5 Mix up of counts leading to corkscrew

We notice corkscrew after twisting mainly because of mix up of yarns of different counts or yarns wound with different tensions in assembly winding.

12.8 Dos and don'ts for supervisor

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

12.8.1 Dos

(a) Verify and understand the assembly wound package quality requirements before starting your work.

(b) Stick to fixed weight of assembly wound packages considering the number of assembly wound packages per one TFO package and avoid knots.

(c) Verify the calculations and assumptions before implementing.

(d) Stick to colour codes and other identification system agreed.

(e) Work for maximum utilization and efficiency for which men are engaged.

(f) Monitor and control generation of hard wastes.

(g) Check personally rather than depending on a third person.

(h) Check the count and yarn lot running.

(i) Check the visual quality of packages produced.

(j) Check the cleanliness of the machine.

(k) Check the tension and uniformity in tension.

(l) Set the length by considering allowances for wastes and slippage.

(m) Check the length set and compare with the standard.

(n) Check the speed set.

(o) Check the production to be taken out in the lot.

(p) Check the available quantity of yarn in winding and the yarn required for completing the lot before bringing fresh yarn.

(q) Check the details written in display boards.

(r) Take the stock of yarn at the end of shift and hand it over to next shift.

(s) Keep only those materials that are required for working in the shift.

(t) Always insist on wearing waist bag and collecting all hard wastes in the bag.

(u) Hand over the machines and the section to next shift in a clean condition.

12.8.2 Don'ts

(a) Do not decide on colour code by yourself.

(b) Do not draw or produce more than the ordered quantity.

(c) Do not increase speeds or the weight of packages to get more productions.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not start the machine if the yarn received is not as per the plan given.

(f) Do not run the drum if the package quality is not as per requirement.

(g) Do not use broken tubes for winding yarn.

(h) Do not start winding if the lot numbers are not matching to order.

(i) Do not accept the yarn if colour codes used are not as per requirement.

(j) Do not allow cleaning of machine with compressed air while working.

(k) Do not allow anyone to use compressed air for cleaning self.

(l) Do not allow using of loose hard wastes for cleaning the machines.

(m) Do not allow wearing of loose cloths while working on the machines.

12.9 Responsibilities of supervisor in assembly winding

(a) Completing the assigned jobs and achieving the assembly wound production with quality besides maintaining the discipline, housekeeping and team working.

(b) Ensuring that the programmed machines are kept working and assembly wound packages are fed to twisting machines as per programme.

(c) Getting the machines started in time and achieving maximum utilization.

(d) Ensuring clean working area and good housekeeping with all materials and records kept in their respective place.

(e) Verifying the yarn lot number before taking for winding.

(f) Checking and adhering to the colour codes as decided.

(g) Taking corrective actions like getting the settings, speeds and tensions corrected while limiting him to his authorities.

(h) Getting the hard wastes collected put in designated places and disposing after documenting.

(i) Ensuring safe handling of the assembly wound packages and preventing hard wastes and bad working due to handling.

(j) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(k) Report HRD in case of any accidents and filling the accident reports in time.

(l) To help winding in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

12.10 Authorities of assembly winding supervisor

(a) Questioning the jobber and workers when the work done is not satisfactory.

(b) Informing HRD in case of serious lapse in discipline by an employee under him.

(c) Allotting or changing jobs to workers considering their skills and requirements.

(d) Arranging rewinding of the cheeses in case of winding defects like singles and loose ends and advising higher authorities the quantity and the reasons for rewinding.

(e) Recommending leave and/or permission to the subordinates in the section.

(f) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

12.11 Some tips for better performance

(a) Keep the machine, especially the yarn path, clean all the time.

(b) Train workers to maintain same tension in the component yarns while knotting a broken end.

(c) Check and ensure stop motions are effective.

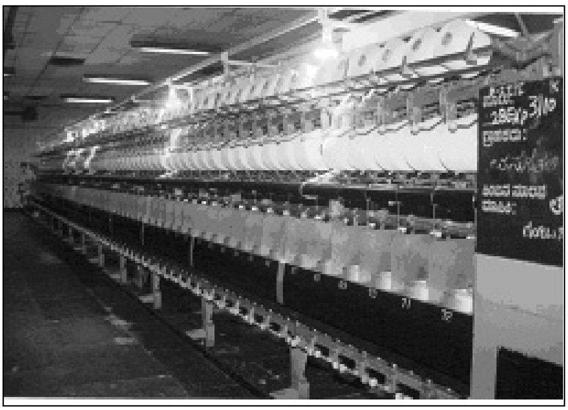
(d) Set the yarn clearers to stop big knots and bunches only, and not yarn faults like slubs and thin places.

12.12 Applicable formulae

$$\text{Production per drum in kgs} = \frac{\begin{array}{c}\text{(Winding speed in YPM}\\ \times \text{ No of minutes in shift} \times \text{Efficiency \%)}\end{array}}{\text{Resultant count Ne} \times 840 \times 2.2 \times 100}$$

$$\frac{1}{\text{Resultant count (Ne)}} = \frac{1}{\text{Component 1(Ne)}} + \frac{1}{\text{Component 2 (Ne)}}, \text{etc.}$$

13
Two for one twisting



13.1 Purpose of yarn doubling using two-for-one twisting

(a) Producing strong, round and knotless yarns by combining two or more yarns and twisting them in the opposite direction of single yarn twists by adapting Two-for-One twisting principle and winding the doubled yarns directly on large packages.

(b) Doubling is done to increase strength, smoothness, evenness, luster, uniformity and compactness of yarn and to obtain better deposition of twist.

(c) An optional additional process to get the specific effects and end uses.

(d) Producing cabled yarns by doubling the already doubled yarns. Doubled and cabled yarns are used for various purposes like sewing threads, fancy yarns, twines, tyre cords, industrial textiles, canvas, etc., apart from regular apparel materials.

13.2 What TFO twisting should do?

(a) Produce knotless twisted yarns of longer length with uniform twist.

(b) Produce final packages to be used directly in next process without rewinding.

(c) Advise the assembly winding regarding the dimensions and weight of assembly wound packages to get knotless yarn after doubling or to have minimum knots.

13.3 What TFO twisting should not do?

(a) Should not produce untwisted portions in the yarn.

(b) Do not increase knots in the yarn.

(c) Do not put big knots while mending breaks.

13.4 General activities of a TFO section

(a) Getting requirement of yarns to be doubled, and advising the assembly winding.

(b) Getting the assembly wound packages and feeding to the TFO machines.

(c) Taking the yarn through the hollow of the spindle and the cup and gaiting on to the delivery packages.

(d) Setting the twist, tension and positioning of the magnets.

(e) Running the machines and producing twisted yarns on large packages.

(f) Delivering the doffed twisted yarn packages to next process.

13.5 Knowledge required for running TFO machine

(a) Importance and functioning of mechanisms in Two-for-One Twisting machines.

(b) Factors affecting the quality of a doubled yarn in TFO.

(c) Deciding and setting the process parameters as per counts and twist requirements.

(d) Setting tension capsules, magnets, spindle tapes, etc., as per quality requirements.

(e) Production balancing – Importance and methodology.

(f) Types of Two-for-Twisters required for different counts and different materials.

(g) Workloads, work allocation and standard working conditions for running TFO.

(h) Calculation of production and efficiency, the industry norms and the factors affecting productivity.

(i) Precautions to be taken while working with a TFO machine.

13.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that people can refer and follow.

13.6.1 Control points for two-for-one twisting

(a) Selection of process parameters: twist per inch, twist direction, speeds, tension, feed package dimensions and delivery package dimensions.

(b) Delivery package identifications.

(c) Allocation of trained workmen.

(d) Allocation of number of machines to tenters and fixing production norms.

(e) Planning maintenance operations and implementing them.

13.6.2 Check points for two-for-one twisting

13.6.2.1 Material related

(a) The count, number of ply of the assembly wound packages received.

(b) The winding quality and cheese dimensions of the assembly wound packages.

(c) Number of assembly wound packages received and the further requirement as per the production programme.

13.6.2.2 Machine related

(a) Proper setting of magnets.

(b) Centring of the spindle to the yarn guides.

(c) Functioning of stop motions.

(d) Whether the yarn path is free from rough surfaces, serrations, and groves?

13.6.2.3 Setting related

(a) The tension capsules used and its suitability for the count of yarn.

(b) The twist combination put and the calculated twist per inch.

(c) The direction of rotation of spindles.

(d) The number of feed packages to delivery packages.

13.6.2.4 Performance related

(a) Twist per inch and variations in twist.

(b) Whether the breakages are in control?

(c) Production per machine and its deviation from norms/target.

(d) Quality of the delivered packages.

(e) Weight variation between delivery packages.

(f) The package density of the delivery packages against the requirement.

13.6.2.5 Documentation related

(a) The indent for doubling with details of component yarns, number of ply, the requirement of twist and its direction, and the quantity to be produced.

(b) The counts and quantity of assembly wound cheeses received.

13.6.2.6 Work practice related

(a) Identification/coding given for packages.

(b) Cleanliness and housekeeping.

(c) Cleanliness of the package storing area.

(d) The maintenance activities carried out and the plan.

(e) Knotting practice of the workmen and the knotting quality.

(f) Check and ensure that untwisted portions are controlled while attending a break.

13.6.2.7 Log book related

(a) Machine numbers and the counts worked.

(b) Men employed.

(c) Quantity of assembly wound cheeses brought count wise.

(d) Stock of assembly wound cheeses at the beginning and at the end of the shift.

(e) Production required further to complete the orders in each quality.

(f) Colour code used for doubled yarn.

(g) Stoppages and reasons for stoppages.

(h) Instructions for count change.

13.6.2.8 M.I.S. related

(a) Machine number.

(b) Count worked.

(c) Number of doffs taken.

(d) Production in kilograms (of the doff taken).

(e) Theoretical production of each machine.

(f) Up to date production completed in order.

13.6.2.9 General

(a) Stock of assembled packages and production required for completing the lot.

(b) Stock of twisted materials and the production required for completing the lot.

(c) Awareness among workers of the material and the quality requirements.

(d) Allocating the workmen as per the work norms.

(e) Adequate training of the workers.

13.7 Normal problems and nonconformities

13.7.1 Corkscrew

When one yarn is straight and other is twisted on it, results in corkscrew. Mix up of yarns of different counts, and yarns fed with different tensions either in the assembly winding or in the twisting machine are the main reasons for a corkscrew. The corkscrew effect is long and continuous when the tensions set for two yarns are different on an assembly winding, whereas short-term corkscrew effects are mainly due to improper tensions while joining a broken end in assembly winding.

13.7.2 Snarl

If one yarn is very loose for a short distance, it results in a snarl. A snarl in the doubled yarn is the weakest spot, and it is very necessary to avoid it. The operator at the assembly winder is to be trained well to ensure that tensions in both the yarns are uniform especially while mending a break.

13.7.3 Filamentation/drop in strength

Cut and rough surfaces in yarn path remove the fibres/filaments, from the yarn surface, and reduce the strength of the yarn.

13.7.4 Uneven package length in a TFO package

The variations in the feed package lengths, excessive breakages on a particular drum in a Two-for-One twister can lead to uneven package lengths. Ensuring correct weight of packages or using length monitoring units in assembly winding can help in reducing the variations between packages of TFO yarn. Proper setting of the tensioners can help in reducing the breakages.

13.7.5 Zero twisted yarns

The zero twisted yarns are produced if the magnet in the Two-for-One twister does not hold the supply package and allow it to revolve. The worker might produce a zero defect yarn while mending a break in a Two-for-One twister. In such cases, we can see a zero twist yarn followed by a knot, and the length of the zero twist being equal to the distance from the supply package to the cone being produced on the drum.

13.7.6 Multiple-fold yarn

Multiple fold yarns are produced by lashing in of a broken yarn in ply winding to adjacent yarn.

13.7.7 Big or improper knot

This problem is mainly due to improper selection of knot. Depending on the type of yarn and the number of plies the proper knotting method is to be adopted. For fine counts with just two plies, a normal dog knot or a weaver knot can suffice. If the count is coarser, fisherman knot would be more appropriate. Staggered knotting is practiced in case of multi-fold yarns or cabled yarns to avoid big knot at one place.

13.7.8 Over twisted yarn lengths

Normal reasons for over twisted yarns are wrong change gear combination, wrong primary combination, damaged gear toothed belt, take-up tube not aligned with the package drive roll, centring disc rubbing against the package drive roll, centring disc not turning freely, package drive-roll loose on the shaft, too low cradle pressure, traverse thread touches the take-up package and yarn take-up tension too high causing package to slip.

13.7.9 Slack twist

Reasons for slack twist are normally wrong change gear combination, yarn lapping around spindle, spindle brake shoe binding on whorl, spindle pot or spindle bearing defective and spindle speed too low on some spindles.

13.7.10 Loss of tensile strength in yarn

Reasons for low tensile strength in doubled yarn are yarn balloon touching the rim of spindle pot, yarn balloon bulging over the rim of balloon limiter, erratic yarn balloon, loops or kink in ply twisted yarn and damaged yarn guide element.

13.7.11 Defective package formation

Defective yarns are produced normally due to improper position of take-up tube against package drive rolls, too high or too low cradle pressure, improper pre-take-up roller pressure, improper position and slot width of traverse guide and improper functioning of ribbon breaker.

13.7.12 Variation in package density

The normal reasons for variations in package unequal density are wrap angle on spindles, unequal cradles, improper rotation of deflection rolls and lapping of pre-take-up roll.

13.7.13 Excessive ends down

The normal reasons for more ends down are incorrectly set yarn reserve at full cheese, flyer rubbing against feed package on rim of spindle pot or balloon during starting, too high take-up tension, yarn balloon touching the upper rim of spindle pot, damaged yarn guide elements, yarn waste accumulating underneath labyrinth ring on the spindle rotor, too narrow traverse yarn guide and traverse guide touching take-up package.

13.8 Dos and don’ts for two-for-one twisting

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

13.8.1 Dos

(a) Verify and understand the mixing, count, number of plies, twist, package size and critical quality requirements before deciding the machine.

(b) Get instructions regarding the quantity to be produced in each machine.

(c) Verify the input materials and compare with the production plan given to you.

(d) Verify the calculations and assumptions before implementing.

(e) Check the wheels, the direction of rotation of spindles, the tension capsules put and the uniformity in balloon tension while starting any machine on a new count/lot.

(f) Stick to colour codes and other identification system agreed between sections.

(g) Check the tension in the yarn in each spindle by a tension meter. High variation in spinning tension is a cause of strength variation.

(h) Maintain uniform process parameters on all machines for a given material.

(i) Work for getting maximum utilization and efficiency for which men are engaged.

(j) Check the working of safety systems and stop motions regularly.

(k) Cover the materials in stock if it is not likely to be used immediately.

(l) Get the removed empty tubes cleaned and given back to assembly winding.

13.8.2 Don'ts

(a) Do not decide on TPI and direction of twist by yourself; check with customer.

(b) Do not decide on colour code by yourself; discuss with user department.

(c) Do not draw more materials or twist more yarn than the ordered quantity.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not allow any parts or other materials to be kept on machines.

(f) Do not use chalk for marking packages.

(g) Do not use bags for keeping yarn produced.

(h) Do not allow the use of broken/damaged empty tubes.

13.9 Some hints for better performance

(a) Always keep the spindle driving tapes/belts in good condition and tight.

(b) Ensure uniform tension in the component yarns while doubling and twisting.

(c) Check the alignment of spindle and the yarn guides.

(d) Check the settings of magnets and ensure that supply packages are held tight and do not revolve.

(e) Keep the idle spindles at lowest possible level.

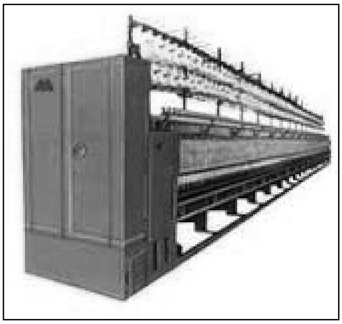
13.10 Applicable formulae

$$\text{Delivery roller speed in inches per minute} = \frac{\text{Spindle speed in RPM} \times 2}{\text{Twist per inch}}$$

$$\begin{array}{c}\text{Production per spindle}\\ \text{per shift in kgs}\end{array} = 2 \times \frac{\begin{array}{c}(\text{Spindle speed in RPM}\\ \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency }\%)\end{array}}{\begin{array}{c}(\text{Twist per inch} \times \text{Resultant count Ne}\\ \times 840 \times 36 \times 100 \times 2.2)\end{array}}$$

$$\frac{1}{\text{Resultant count }(\text{Ne})} = \frac{1}{\text{Component }1(\text{Ne})} + \frac{1}{\text{Component }2\ (\text{Ne})}; \text{etc.}$$

14
Yarn doubling – ring doubling



14.1 Purpose of yarn doubling

- Producing strong and round yarns by combining two or more yarns and twisting them in the opposite direction of single yarn twists by adapting ring and traveller principle and winding them on the bobbin fitted on the rotating spindle.
- An optional additional process to get the specific effects and end uses.
- Producing cabled yarns by doubling the already doubled yarns. Doubled and cabled yarns are used for various purposes like sewing threads, fancy yarns, twines, tyre cords, industrial textiles, canvas, etc., apart from regular apparel materials.
- Producing wet doubled yarns for specific requirements.

14.2 What ring doubling should do?

(a) Insert uniform twist on the yarn by using ring and revolving traveller.

(b) Ensuring that the twist inserted is uniform on all spindles in both twist per unit length and the direction of the twist.

(c) Winding the twisted yarn on suitable bobbins fitted on spindles.

(d) Reduce hairiness and increase elongation of yarn.

14.3 What ring doubling should not do?

(a) Should not produce uneven twist in the yarn.

(b) Should not produce unwanted knots by breaks and yarn faults.

(c) Should not damage yarn by ring cut due to yarn rubbing with ring.

14.4 General activities in ring doubling

(a) Referring the production plan and advising for preparation of cheeses.

(b) Getting the assembly wound cheeses for doubling.

(c) Creeling the machines with the required assembly wound cheeses.

(d) Changing the twist wheel, pulleys, traveller and setting the building combination as per the resultant count of the yarn.

(e) Cleaning water tray and filling with clean water for wet doubled yarns.

(f) Checking the quality of materials produced and getting them corrected.

(g) Checking and controlling the hard wastes generation and cleaning of exhausted cheeses before sending them to assembly winding.

(h) Doffing after the cops are built.

(i) Sending the doffed materials for winding after putting count label.

14.5 Knowledge required for running ring doubling

(a) Importance and functioning of various mechanisms used in Ring Doubling machines like creel, ring and travellers, stop motions, up and down motion of ring rail, cop building mechanism, drives, etc.

(b) Factors affecting the quality of ring doubled yarn and the means for control.

(c) Deciding and setting the process parameters as per the counts and twist.

(d) Different types of ring doubling system, viz. dry doubling and wet doubling.

(e) Different types of rings and travellers used for ring doubling.

(f) Calculating production and efficiency, the norms and factors affecting productivity.

(g) Precautions to be taken while working.

14.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area so that people can refer and follow.

14.6.1 Control points in ring doubling

(a) Selection of process parameters: Twist per inch, twist direction, speeds, ring and traveller, chase length, lift and cop diameter.

(b) Delivery package identifications.

(c) Allocation of trained workmen.

(d) Allocation of number of spindles to tenters and fixing production norms.

(e) Planning maintenance operations and implementing them.

14.6.2 Check points in ring doubling

14.6.2.1 Material related

(a) The count, number of ply of the assembly wound packages received.

(b) The winding quality and cheese dimensions of assembly wound material.

(c) Assembly wound packages received and further requirement.

14.6.2.2 Machine related

(a) Proper centring of each spindle.

(b) Alignment of ring rail.

(c) Centring of the creel pegs to the yarn guides.

(d) Functioning of stop motions.

(e) Condition of yarn path; free from rough surfaces, serrations, and groves.

(f) The quality of the rings, i.e. smooth inner surface.

(g) The condition of spindles; no vibration or jumping of the spindles.

(h) The condition of water and water trough in case of wet doubling.

14.6.2.3 Setting related

(a) The traveller type and number.

(b) The twist wheel put and the calculated twist per inch.

(c) The direction of rotation of spindles.

(d) The chase length set.

(e) The winding and binding ratio.

(f) Level of traveller lubricant in case of wet doubling.

14.6.2.4 Performance related

(a) Twist introduced and the variations.

(b) End breakages.

(c) Production per machine and its deviation from norms/target.

(d) Quality of the cops

14.6.2.5 Documentation related

(a) The indent given for doubling with details of component yarns, number of ply, the requirement of twist and its direction, whether wet doubling or dry doubling and the quantity to be produced.

(b) The counts and quantity of assembly wound cheeses received.

14.6.2.6 Work practice related

(a) Identification/coding given for packages.

(b) Cleanliness and housekeeping.

(c) Cleanliness of the package storing area.

(d) Carrying the maintenance activities methodically as per plan.

(e) Frequency of water changing in case of wet doubling.

(f) Cleaning of fluff accumulated in water trough.

(g) Knotting practice of the workmen and the knotting quality.

14.6.2.7 Log book related

(a) Machine numbers and the counts worked.

(b) Men employed.

(c) Quantity of assembly wound cheeses brought count wise.

(d) Stock of assembly wound cheeses at the beginning and at the end of the shift.

(e) Production required further to complete the orders in each quality.

(f) Colour code used for doubled yarn cops.

(g) Stoppages and reasons for stoppages.

(h) Instructions for count change.

14.6.2.8 M.I.S. related

(a) Machine number.

(b) Count worked.

(c) Number of doffs taken.

(d) Production in kilograms (of the doff taken).

(e) Hank meter reading of each machine.

(f) Theoretical production of each machine.

(g) Up-to-date production completed in order.

14.6.2.9 General

(a) Stock of assembled packages and production required for completing the lot.

(b) Stock of twisted materials and the production required for completing the lot.

(c) Awareness to workers of the material and the quality requirements.

(d) Allocating the workers as per the work norms.

(e) Adequate training of the workers.

14.7 Normal problems in ring doublers

14.7.1 Corkscrew

We get corkscrew when one yarn is straight and other is twisted on it. Mix up of yarns of different counts, and yarns fed with different tensions either in the assembly winding or in the twisting machine are the main reasons for a corkscrew. The corkscrew effect is long and continuous when the tensions set for two yarns are different on an assembly winding, whereas short-term corkscrew effects are mainly due to improper tensions while joining a broken end in assembly winding. The problem is more where cones are fed directly without assembly winding.

14.7.2 Snarls

If one component yarn is very loose for a short distance, it results in a snarl. A snarl in the doubled yarn is the weakest spot, and it is very necessary to avoid it. The operator at assembly winder is to be trained well to ensure that tensions in both yarns are uniform especially while mending a break.

14.7.3 Filamentation and drop in strength

Cut and rough surfaces in yarn path removes the fibres/filaments, from the yarn surface, and reduce the strength. Hence smooth surface should be ensured throughout yarn path.

14.7.4 Multiple-fold yarn

Multiple fold yarns are produced by lashing in of a broken yarn in ply winding to adjacent yarn. Multiple folds can also happen when a broken thread at ring doubling lashes and touches another running thread in the side.

14.7.5 Big or improper knot

This problem is mainly due to improper selection of knot or the knotter. Depending on the type of yarn and the number of plies the proper knotting method is to be adopted. For fine counts with just two plies, a normal dog knot or a weaver knot can suffice. If the count is coarser, fisherman knot would be more appropriate. Staggered knotting is practised in case of multi-fold yarns or cabled yarns to avoid big knot at one place. Trimming the projections with a small scissor is necessary in all cases. Ensure minimum tail length to prevent knot getting opened when pulled.

14.7.6 Uneven twisting within cop

Intermittent movement of top rollers and loose tapes are main reasons for getting uneven twisting. The intermittent movement of top roller may be due to worn-out pins on the side of top rollers or worn-out guides. Eccentric movement of either top roller or bottom roller also results in uneven twists within a yarn.

14.7.7 Twist variation between cops

Variations in tape tension because of irregular tape length, improper setting of jockey pulleys are main reasons for twist variation between spindles.

14.7.8 Increased hairiness and reduced elongation

Defective centring of spindles and lappets results in abrasion between cops and the ring and the yarn hairiness increases and the elongation reduces. Jumping and vibrating bobbins also lead to ring cuts and increasing in hairiness.

14.8 Dos and don'ts for ring doubling

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

14.8.1 Dos

(a) Verify and understand the mixing, count, number of plies, direction of twist, the delivery package dimensions critical quality requirements and the quantity to be produced in each machine.

(b) Verify the input materials and compare with the production plan.

(c) Verify the calculations and assumptions before implementing.

(d) Check for the wheels, the direction of rotation of spindles and the tension before starting any machine on a new count/lot.

(e) Stick to colour codes and other identification system agreed between sections.

(f) Maintain uniform process parameters on all machines running for a given material.

(g) Work for getting maximum utilization and efficiency for which men are engaged.

(h) Check the working of stop motions while the machine is working.

(i) Cover the materials in stock if it is not likely to be used immediately.

(j) Clean the empty tubes removed and give back to assembly winding.

14.8.2 Don'ts

(a) Do not decide on TPI and direction of twist by yourself; check with customer.

(b) Do not decide on colour code by yourself; discuss with user department.

(c) Do not draw more material or twist more yarn than the ordered quantity.

(d) Do not engage people in the shift unless you have confirmed orders.

(e) Do not allow any parts or other materials to be kept on machines.

14.9 Responsibilities of supervisor in ring doubling

(a) Completing the assigned jobs of twisting and achieving the production with quality besides maintaining the discipline, housekeeping and team working.

(b) Getting the machines started in time after doffing, cleaning, count change or repairs and achieving maximum utilization.

(c) Ensuring zero idle spindles by attending to them in time.

(d) Ensuring clean working area all the time.

(e) Ensuring all materials and records are kept in their respective place.

(f) Verifying the assembly wound package details like mixing, count, yarn lot number, colour codes, etc., before taking them for twisting.

(g) Checking and verifying the travellers, stop motions, cop built and yarn quality.

(h) Checking and adhering to the colour codes as decided.

(i) Taking corrective actions like getting the twist wheel and builder motion corrected while limiting him to his authorities.

(j) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(k) Ensuring the assembly wound packages of required mixing and counts in time as per the requirement of the twisting machines.

(l) Ensuring safe handling of the materials and preventing wastes and poor quality.

(m) Supplying materials in time to winding department.

(n) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(o) To report HRD in case of any accidents and filling the accident reports in time.

(p) To help twisting in-charge in investigating the root cause for poor quality, deviation in systems, breach of discipline and poor productivity.

14.10 Authorities of supervisor in ring doubling

(a) Questioning the jobber and workers when the work done is not satisfactory.

(b) Getting the spindles and machines repaired by calling the maintenance persons to avoid idle spindles and poor quality.

(c) Advising HRD in case of serious lapse in discipline by any one working under him.

(d) Allotting or changing jobs to workers considering the skills and the requirements.

(e) Recommending leave and/or permission to the subordinates in the section.

(f) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(g) Rejecting the assembly wound packages if found with too much defects like stitches, singles, uneven tensions, bunches, etc.

(h) Discarding damaged empty bobbins, crates.

14.11 Some hints for better performance

(a) Always keep the spindle tapes in good condition and tight.

(b) Ensure uniform tension in the component yarns while doubling and twisting.

(c) Check the alignment of assembly wound cheeses and the yarn guides.

(d) Plan the activities of doffing and ensure that all doffer boys are ready before stopping a ring frame for doffing.

(e) Keep the idle spindles at lowest possible level.

14.12 Applicable formulae

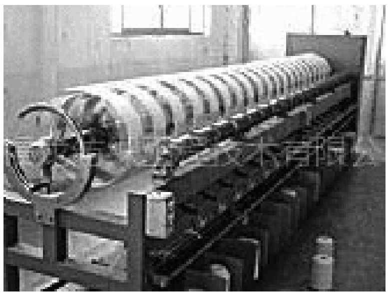
$$\text{Front roller delivery in inches per minute} = \frac{\text{Spindle speed in RPM}}{\text{Twist per inch}}$$

$$\begin{array}{c}\text{Production per spindle}\\ \text{per shift in kgs}\end{array} = \frac{\begin{array}{c}\text{(Spindle speed in RPM} \times \text{Number of minutes in a shift}\\ \times \text{Expected efficiency \%)}\end{array}}{\begin{array}{c}\text{(Twist per inch} \times \text{Resultant count Ne}\\ \times 840 \times 36 \times 100 \times 2.2)\end{array}}$$

$$\frac{1}{\text{Resultant count }(\text{Ne})} = \frac{1}{\text{Component 1}(\text{Ne})} + \frac{1}{\text{Component 2 }(\text{Ne})}; \text{etc.}$$

$$\text{Production per machine per shift in kgs} = \frac{\text{Hank reading} \times \text{Number of spindles}}{\text{Resultant count of yarn Ne} \times 2.2}$$

15
Reeling



15.1 Purpose of yarn reeling

To wind the yarn from hard packages into loose hanks of predetermined length in order to facilitate wet processing of yarns in loose form.

15.2 What reeling should do?

(a) Should produce all hanks with uniform girth as agreed upon.
(b) Should produce all hanks of uniform length.
(c) Should produce cross reeled hanks or plain reeled hanks as needed.

15.3 What reeling should not do?

(a) Should not produce entangled hanks or knots.
(b) Should not produce hanks with uneven tensions.
(c) Should not produce hanks with uneven lengths.
(d) Should not produce hanks with uneven girth.
(e) Should not produce hanks with snarls.

(f) Should not produce hanks with skewness.

15.4 General activities in a reeling section

(a) Getting the required yarns from yarn godown, spinning or winding for reeling.

(b) Conditioning the cops either in water or in steam before taking for reeling to set the twist and avoid snarls, skewness and uneven shrinking after reeling.

(c) In case cones or cheeses are received for reeling, ensuring that the packages are autoclaved with steam.

(d) Verifying the conditioning of the cops and their dryness before reeling.

(e) Setting the girth on the reeling machine or selecting the reeling machine with specified girth where changing the girth is not possible on the machine.

(f) Setting the reels to get either plain hank or cross hank depending on the requirement of the customer.

(g) Verifying the stock of hanks in bundling section and checking their compatibility for packing (heavy and light hanks).

(h) Informing the spinning to produce fine or coarse yarn depending on the stock of heavy and light hanks.

(i) Segregating heavy and light hanks and keeping separately.

(j) Verifying the tie-yarn in stock and arranging for them as needed.

(k) Putting the tie-yarn on hanks for identification of count and mixing of yarns.

(l) Getting the water tank cleaned from time to time in the yarn conditioning area.

(m) Dressing the hanks and preparing knots.

(n) Sending the knots for bundling.

15.5 Knowledge required for reeling

(a) Types of reeling, i.e. plain reeling and cross reeling.

(b) Different systems of hank, viz. Metric hank and British hank.

(c) Different girth available for Metric hanks and British hanks.

(d) The normal girth practiced for different types of yarns.

(e) Setting of reeling machine to get the required girth and length.

(f) Taking out the reeled hanks from reel without entanglements.

(g) Dressing of hanks and preparing knot.

(h) Relation between count and number of knots in a bundle.

(i) Tie yarn and its importance.

(j) The quality requirements of a tie yarn.

15.6 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that people can refer and follow.

15.6.1 Control points – reeling

(a) Type of hank required by the customer.
   (i) British or Metric hank.
   (ii) Plain reel or cross reel.
   (b) The tie-yarn specified or decided.
   (c) The length of yarn in each hank.

(d) The girth (Note: 54 inches is normal girth for cotton yarns; whereas for very coarse counts in OE yarns 60 inches girth is taken. The girth of a Metric Hank is 1 m)

(e) Production required in each count and their programme.

(f) Type of machine to be allotted for the production in hand.

15.6.2 Check points – reeling

15.6.2.1 Material related

(a) The count of yarn received and the orders.

(b) Proper conditioning and drying of the yarns supplied.

(c) Dryness of the yarns before taking for reeling.

15.6.2.2 Machine related

(a) Firmness of the reel frame.
(b) Level of reel frame.
(c) Working of traverse motion in case of cross reel.
(d) Proper shifting after each lea in case of plain reel.
(e) Surface smoothness of the reel.

15.6.2.3 Setting related

(a) The girth set and the requirement as per count and order.
(b) The length set on reel; no variation in length between hanks in the same reel and between reels.
(c) The shifting set properly after each lea for plain reel.

15.6.2.4 Performance related

(a) The production per reel achieved in shift.
(b) The breakages observed.

15.6.2.5 Documentation related

(a) The yarn type and the quantity received for reeling.
(b) The tie-yarns used for different counts and combinations.
(c) The name of the reeler and production of each reeler.
(d) The markings on the bundles.

15.6.2.6 Work practice related

(a) The tie-yarns provided and agreement with the customer.
(b) Dressing of the hanks produced.
(c) Whether the workers are searching the broken end properly and knotting properly?
(d) Collecting of hand wastes and putting in waste bags.

15.6.2.7 Log book related

(a) The number of reels worked on different count and combinations.

(b) Production achieved in each count and combination.
(c) Instructions for reeling further as per the order status.
(d) Stock of light and heavy knots in bundling.

15.6.2.8 M.I.S. related

(a) Counts and combinations worked.
(b) Number of reels engaged.
(c) Production achieved in each reel.
(d) Number of knots produced.
(e) Number of bundles produced.

15.6.2.9 General

(a) Whether the machines allotted for reeling (plain reel or cross reel, hand reel or powered reel) are as per the customer requirement.

15.7 Normal problems in reeling

15.7.1 Uneven girth

Uneven girth can happen because of improper setting of reel from one end to another. It can also happen because of improper tightening of the reel and the reel getting collapsed while working.

15.7.2 Curly hanks

Improper conditioning of the yarn before reeling is the main reason for curly hank. Higher twist in the spun yarn than specified also results in curly hanks.

15.7.3 Entangled hanks

While removing the hanks from reels, if they are not slid properly can result in entanglements. Improper dressing of hanks also results in entanglements.

15.8 Dos and don'ts for reeling

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

15.8.1 Dos

(a) Check the yarns received for the mixing, count, quantity and type of reeling required.

(b) Check and ensure that the reels are made firm before starting.

(c) Verify the tie-yarn and confirm it as specified for the count.

(d) Insert the tie-yarn in the exact way as required.

(e) Ensure proper dressing of the hanks before making knots.

(f) Check the markings on the bundle.

(g) Inform spinning regarding the count to be maintained as per bundling requirement.

15.8.2 Don'ts

(a) Do not use a yarn that is not conditioned properly.

(b) Do not decide the reeling parameters by yourselves; take instructions from the user or customer.

(c) Do not collapse the reel in between its working.

15.9 Responsibilities of supervisor in reeling

(a) Completing the assigned jobs of reeling and achieving the production with quality besides maintaining the discipline, housekeeping and team working.

(b) Getting the reels started in time and achieving maximum utilization.

(c) Ensuring zero idle spindles by attending to them in time.

(d) Ensuring clean working area all the time.

(e) Ensuring that the records are kept in their respective place.

(f) Verifying the yarn received in details like mixing, count, yarn lot number, colour codes, etc., before taking them for reeling.

(g) Checking and adhering to the tie-yarns as decided.

(h) Getting the wastes collected from each machine and putting in designated places and disposing after documenting.

(i) Supplying materials in time to user department.

(j) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(k) To report HRD in case of any accidents and filling the accident reports in time.

15.10 Authorities of supervisor in reeling

(a) Questioning the jobber and workers when the production is low and the work done is not satisfactory.

(b) Referring to HRD in case of serious lapse in discipline by any working under him.

(c) Allotting or changing jobs to workers considering their skills and the requirements.

(d) Recommending leave and/or permission to the subordinates in the section.

(e) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

(f) Sending the cops back for conditioning if snarls or skewness is found.

15.11 Some hints for better performance

(a) Always keep the reel firmly secured before starting.

(b) Keep the driving belts tight.

(c) Ensure uniform tension in all the spindles.

(d) Check the alignment of material fed (cops or cones) and the yarn guides.

(e) Keep the idle spindles at lowest possible level.

15.12 Applicable formulae

(a) British hank = 840 yards = 7 leas

(b) One lea = 120 yards

(c) 80 rounds are required to make 120 yards in case of standard 54 girth reel.

(d) One metric hank is 1000 m

(e) One metric lea is 100 m.

(f) 100 revolutions are required for one metric lea.

16
Cone packing

16.1 Purpose

- Packing the required number of cones in suitable form to reach the customer safe without damage and is convenient for handling at customer's end.
- The cone packing needs to address the legal requirements and trade requirements by making suitable markings on the packages to indicate the manufacturer and the country, the materials inside the package, the numbers and the weight and the period of manufacture apart from the package identification number.

16.2 What cone packing should do?

(a) Each cone should be labelled to indicate the material, count and the manufacturer, to help customer while using them.

(b) Checking and ensuring the colour codifications on the top and bottom of the cones as per the agreed norms.

(c) Ensuring identical dimensions and weight of cones in a package.

(d) Each individual cone need to be checked for quality, cleaned and put in a suitable LDPE bag to protect them from water or moisture while in storage or in transit.

(e) Where specified, the cones need to be inserted with cone discs to prevent collapsing during transit.

(f) Packing cones in such a way that they are tight inside the package and shall not move from its place because of handling of packages.

(g) Package should have suitable code by which the packer, packing date and shift can be traced.

(h) The package should have proper marking in line with the legal and regulatory requirements including the font size, the colour of ink, the information printed and the package ID.

16.3 What cone packing should not do?

(a) Defective cones should not be packed.

(b) Uncleaned cones should not be packed.

(c) Cones with varying dimensions should not be packed.

(d) Cones without a label should not be packed.

(e) Cones with difference in shades should not be packed.

(f) Cones of different counts shall not be packed together.

(g) Cones with different colour codification should not be packed together.

(h) Cones of different lots and merges shall not be packed together.

(i) Cones should not be loosely packed.

(j) The carry strap should not be loosely tied.

(k) Extra material shall not be packed against a contract without the permission of the customer.

(l) Ink, which is likely to bleed, spread or fade shall not be used for marking the packages.

(m) The font size shall not be smaller than specified by law.

16.4 Different methods of packing cones

Figure 16.1 Cones waiting for packing.

The cone packings are done in various forms. The type of package to be packed and the package dimensions are agreed between the customer and the supplier depending on the facilities available and the convenience. The normal types are Bag packing, Bale packing, Carton packing, Pallet packing (Shrink packing) and Wooden case packing.

16.4.1 Bag packing

The bag packing is normally followed when the distance travelled is less and also the yarns are not of delicate quality.

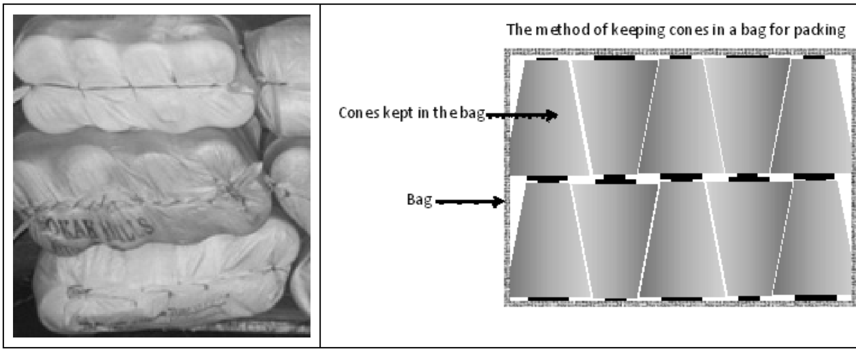


Figure 16.2 Bag packing.

Bag packing is the simplest type of packing and normally followed in the lower end market. The bags were used to be of hessian cloth, but now they are replaced by woven HDPE clothes.

Normally 50 kg to 60 kg are packed in bags. Two layers of cones are put in bag with alternate cones inverted to save the space and also to make the packing compact. Each cone would have been packed in a polythene bag. The cones shall then be covered with HDPE cloth. The bag is then stitched manually tight ensuring that the cones are not displaced.

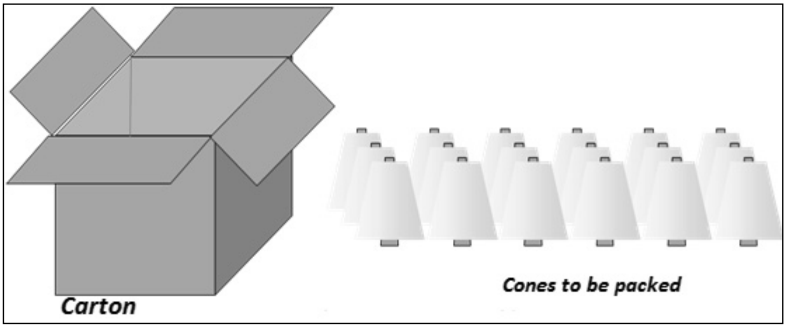
16.4.2 Bale packing

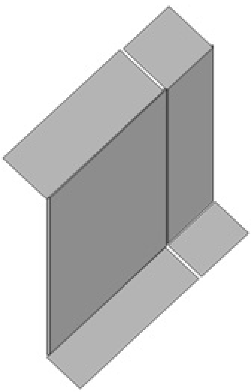
Bale packing is similar to bag packing, but cones are put in one layer only, which makes the bales much compact, as can be seen in Figure 16.3.

Figure 16.3 Bale packing of cones.

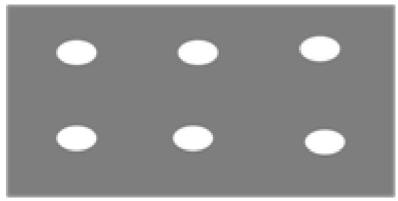
16.4.3 Carton packing

Carton packing is widely practised for yarns for high end use, the processed yarns and for exports.

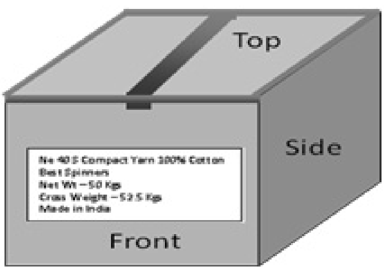




Carton box before opening



Cone separators used in the carton



Packed carton

Storing of packed cartons

Cartons kept on pallets for despatch

Traditionally 7 ply cartons were being used for export and 5 ply cartons for local orders. After the introduction of container systems, where the cartons are loaded in the container directly at the spinning mill and unloaded at customer's end without any internal transshipments, need of 7 ply was not felt, and now 5 ply and 4 ply cartons are being used.

The carton packings are normally of 50 kg to 60 kg, excepting in some cases where 24 kg is practised, specifically to help female workers to handle.

16.4.4 Pallet packing

The bags, bales and cartons require manual handling. As the labour costs are increasing and the availability of labour for physical works of handling cartons and bags is very difficult, the shrink packaging of cones on pallets are introduced. In this case any weight starting from 200 kg to 1000 kg can be packed in one package. The handling shall be by forklifts, ensuring no damages while handling the packages.

Figure 16.4 Shrunk packed cones on pallets.

Stretch wrapping machines are normally fully automatic. The pallets are wrapped using stretch cling film. It ensures stable and moisture-proof wrapping of pallets at minimum cost. Optimum wrapping of pallets using wide range of film material is made possible by the Powered Pre-Stretch Unit which can stretch the film up to 300% (1 m long becomes 4 m long). Powered Pre-Stretch unit has a separate motor to stretch the film. This simple and sturdy machine can operate continuously under severe industrial environment. The machine can be easily operated by unskilled workers in the packing line as the cycle of operation is completely automated. Now fully automated machines are available for transportation of cones and for packing. Some systems are shown in Figure 16.5.

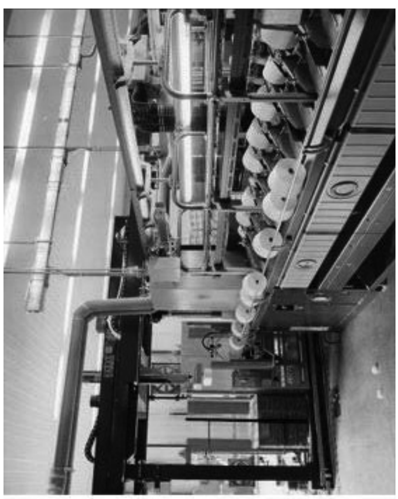
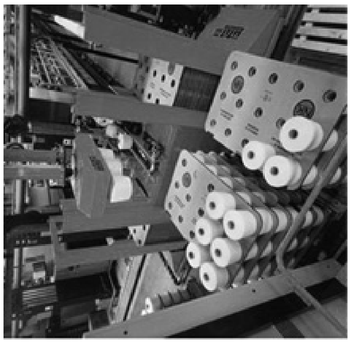


Figure 16.5 (a) ERGO G2 automatic cone packing system.



(b)

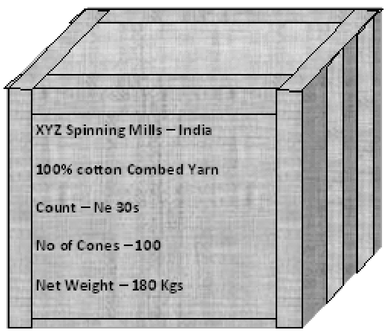
(c) ROCPACK/HP automatic cone packing.

ROCPACK/HP Machine automatically wraps-up either conical or cylindrical yarn packages having variable diameter (from 160 to 300 mm) with a high-density polyethylene film. One of the major features of the ROCPACK/HP Machine is that it does not carry out welding operations on the polyethylene film used for packing process.

The wrapping is performed by actuating a piston, which pushes the edges of film (already wrapped around the cone/cheese) inside the spool, thus obtaining a better yarn package presentation and an easy-to-remove packing material at the time of usage. The ROCPACK/HP Cone Packing Machine can pack up to 900 yarn packages/h approximately (depending on the type of cone/cheese used).

The advantages of ROCPACK/HP Machine are: higher productivity, manpower reduction, accuracy and flexibility, relief from heavy lifting, complete control of material flow, prevention of yarn damages.

16.4.5 Wooden case packing



Packing of cones in wooden cases was being practiced for a long time for exports. The wooden cases were very heavy and were difficult to handle. However, after introduction of carton packing, which is not only light and easy to handle but also cheap, the packing in wooden cases has been stopped almost all over.

Figure 16.6 Wooden case packing.

16.5 Critical requirements of cone packing

(a) All cones packed should be identical, that is of same count, mixing and lot. Materials of other lot should not be packed together.

(b) All cones should be of same dimensions and equal weight.

(c) When specific number of cones is put either in cartons or in bags, it should tightly fit; but should not bulge out.

(d) All cones should have identification label pasted inside.

(e) Colour codification should be followed to identify mixing, count, type of yarn (carded/combed, warp/hosiery/compact, etc.).

(f) The content of yarn on each cone should be identical. This is normally assessed by weighing the cones. During the process of manufacturing of paper cones, variations in the weight of paper cones are introduced which give rise to the variations in the gross weight of wound cones of yarn.

(g) All cartons used should be of same dimensions and have same weight, so that the gross weight will not vary.

(h) Cones should be cleaned and inspected before putting in LDPE bags. Cones which are having stitches, sunken nose, shade variation, ribbon or any other visible defect should not be packed.

16.6 Control points and check point

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own "Control Points and Check Points" and display them in the work area, so that the people refer and follow.

16.6.1 Control points

(a) The contract against which the cones are to be packed.

(b) The type of packing to be done.

(c) Number of cones per package.

(d) The gross weight and net weights expected and their tolerance.

(e) Packing configuration, i.e. dimensions, packing materials and mode of keeping cones.

(f) Number of packages to be packed.

(g) Markings to be put on packages.

(h) Special instructions – Whether to use cone discs or not, number of carry straps to be put, neutral packing or normal packing, etc.

16.6.2 Check points

(a) Cleaning, inspection and brushing of the cones.

(b) Labels put and the requirement.

(c) Cone's tip and base as specified.

(d) Cone dimensions and uniformity.

(e) Quality of the LDPE bags; i.e. clean, transparent and of a specified gauge.

(f) HDPE cloth for its specified thickness and dimensions.

(g) Dimension of cartons and uniformity in dimensions.

(h) Whether cone discs were inserted as per requirement.

(i) Putting of tail ends where specified.

(j) The bursting strength and number of plies of cartons.

(k) Cleaning, treating and fumigating of the pallets used.

(l) The number of cones put in each package and the requirement.

(m) The number of packages packed and the requirement.

(n) Markings put on packages and the requirement.

(o) Whether the packages are weighed and weights recorded.

(p) Updating the packing record as and when the packing was done.

(q) Net weight of each package and the accepted limits.

(r) The name of the packer recorded against the packages he packed.

16.7 Normal problems in packing

Normal problems faced in packing are

(a) The cones of varying weight, and not getting the required net weight of packing.

(b) Cone dimensions varying and hence the cones fit loose or very tight.

(c) Cones are defective and needs rewinding to complete the packing.

(d) Shade variations found in the cones forcing packing to stop.

(e) Packing materials not received in time.

(f) Cartons received with higher moisture and hence they are weak.

(g) Wrong label found while inspection.

(h) Damaged stencil resulting in marking defects.

(i) No space for keeping the packed material.

16.8 Dos and don'ts

Understand clearly what you are supposed to do without fail and what you should not do at any cost. Some examples are given below.

16.8.1 Dos

(a) Check for the contract in detail for the type of packing required.

(b) Verify the quality of packing materials like HDPE cloth, LDPE bags, cartons and shrinking filament before starting the work of packing.

(c) Check all the cones for labels and visible defects before putting in LDPE bags.

(d) Check the quality of stencils before using for marking.

(e) Check the computer printout in case of computerized labeling system.

(f) Check for the tightness of packing.

(g) Update the packing register as and when the packings are done.

(h) Enter the name of packer against each package.

(i) Engage only permanent workers for packing. Do not give it on contract.

16.8.2 Don'ts

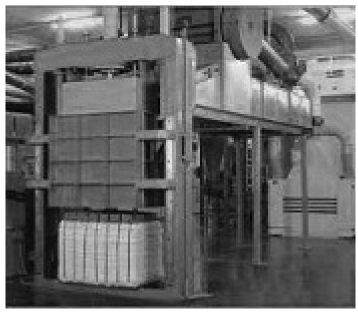
(a) Do not pack defective cones.

(b) Do not use defective packing materials.

(c) Do not overwrite and correct a mistake while marking. Discard that and use new packing materials and mark it properly.

(d) Do not use old packing materials with different markings to save cost.

17
Bale packing of yarn



17.1 Purpose of bale packing

Packing fixed number of bundles of yarn hanks into a bale of predetermined standard weight, enabling easy storing and transportation without damaging the yarns.

17.2 What bale packing should do?

(a) Pack predetermined number of yarn bundles having predetermined number of neatly dressed yarn hanks of predetermined length as a bale.

(b) Maintain the bale weight as per norms specified, i.e. English bale or Metric bale.

(c) Maintain standard bale dimensions.

(d) Cover all bundles together with a waterproof sheet of paper or plastic.

(e) Pack the bale tightly with standard dimensions.

(f) Mark the bales as per the norms laid out by regulatory bodies.

17.3 What bale packing should not do?

(a) Undressed or entangled hanks should not be bundled.

(b) Number of hanks in a bundle should not vary.

(c) Should not pack bundles of non-standard weights.

(d) Should not mix hanks of different yarns or different mixing.

17.4 Stages in bale packing

(a) The reels are set for specified length, may be in yards or in metres, as per the requirement of the customer.

(b) Hanks are taken out after predetermined length is reeled.

(c) The hanks are dressed to remove entanglements and make the yarn easy for unwinding in next process.

(d) The dressed hanks are twisted by hand and made into a knot.

(e) The knots are weighed and segregated as standard weight, heavy or light knots.

(f) Predetermined number of knots is taken by combining dressed and segregated knots to make the required weight of bundle. A bundling machine is used for this. The standard weights are 10 lb (4.53 kg) in English system and 5 kg in Metric system.

(g) The knots are bundled and tied.

(h) 40 bundles are packed as a bale using a baling machine.

(i) The standard weight of a bale is 400 lb (181.2 kg) in English system and 200 kg in Metric system.

(j) Bales are marked as per the existing norms specified by regulating authorities. In India, The Textile Commissioner is specifying the norms for marking, including the contents, the size of the fonts and the colour of ink to be used.

17.5 Control points and check points

It is essential to have clarity on the points to be controlled to achieve the targets and those to be checked to ensure the process in control. These points need to be reviewed from time to time and modified to suit the requirements of individual companies and their targets. Each mill should prepare its own “Control Points and Check Points” and display them in the work area, so that people can refer and follow.

17.5.1 Control points

17.5.1.1 Bundling

(a) Number of hanks per bundle depending on count.

(b) The bundle weight and acceptable limits for weight variation in knots.

(c) The bundle markings.

(d) Production required in each count or in order.

17.5.1.2 Baling

(a) Type of bales to be packed, i.e. English or Metric.

(b) Markings to be put on pressed bales.

(c) Bale dimensions.

17.5.2 Check points

17.5.2.1 Material related

(a) The count of yarn received against the packing plan.

(b) The identification tags on hanks.

(c) Packing materials received – Brown paper, twines, straps, bamboo strips, hessian cloth, HDPE cloth, stencil, ink, etc.

17.5.2.2 Machine related

(a) Condition of the bundling machine and baling press.

(b) Condition of weighing balance.

(c) Calibration of weighing scales.

17.5.2.3 Work practice related

(a) Dressing of knots.

(b) Weighing of knots.

(c) Segregation of knots as per their weight.

(d) Keeping the work area clean and tidy.

(e) Aligning the knots while bundling.

(f) Keeping the printed paper properly while bundling.

(g) Following safety precautions while arranging for bales.

(h) Weighing the bales.

(i) Marking the bales.

(j) Entering the bale numbers and weight in packing register.

17.5.2.4 Documentation related

(a) Bale numbers packed and packing details like count, contract number, material, bale weight (gross as well as net).

(b) Serial numbers of bales sent to warehouse.

(c) Names of the packers against each bale packed.

17.5.2.5 Log book related

(a) Packing done and the packing to be done as per the orders in hand.

(b) Stock of materials waiting for packing.

(c) Packed bales waiting to be sent to warehouse.

(d) Special instructions if any for the next shift.

17.5.2.6 M.I.S. related

(a) Number of bales packed in each count.

(b) Quantity packed in each count.

(c) Packing materials consumed.

(d) Packing materials in stock.

17.5.2.7 General

(a) Housekeeping.

(b) Stacking of the materials packed.

17.6 Normal problems in bale packing

17.6.1 Not able to pack the bundles as the specified weight is not obtained

This problem is mainly due to the mean count being heavy or light than the specified. This leads to accumulation of knots either on heavy side or on lighter side. The incharge of bundling should inform the spinning incharge and get some yarn specially spun by keeping the wrapping either heavy or light as needed. One should ensure that by changing the draft pinion at Ring frame, the variation within the population should not go beyond the limits specified. The machines should be corrected after getting required quantity spun for completing the packing.

17.6.2 Not receiving the packing materials in time

As the packing materials occupy more space, it is normal practice to indent only for required quantity and making a schedule for their delivery. Sometimes due to unforeseen conditions like heavy rains, power failures at manufacturer's end, breakdowns of vehicles, strikes or traffic jams, etc., there may be delay in getting the materials. In number of cases, the delay is due to rejection of packing materials by quality assurance checkers either due to variation in density of packing fabric, poor quality bamboo sticks, improper cutting of stencils, and so on. It is essential to understand the criticality of meeting the delivery schedules, and accordingly planning should be made.

17.6.3 Knots not dressed properly

Dressing of knots is a skilled job, done by experienced workers. If a less trained worker does the dressing, it may not be proper and there may be entanglements. Redressing shall have to be done in such cases, which consumes time and packing shall be delayed.

17.6.4 Surplus stock of knots after completing the order

It is a normal problem as spinning cannot be done exactly matching to the order requirement. The problem shall be more in case of rejections due to heavy or light knots. To help packing, surplus yarn will have to be spun. In such cases, one has to work out the exact requirement of yarn to complete packing and to make full bales with the surplus yarn.

17.6.5 Shade variation between knots

Shade variations may be due to various reasons like mix up of sliver of a different mixing, improper conditioning of cops before reeling, not drying the conditioned cops properly before reeling, reeling of old stock yarns of different lots to salvage them, cops getting spoiled due to falling on dirty wet floor or getting exposed to smoke from a burnt out rubber belt or fire accident.

17.6.6 Curly hanks

Curly hanks are mainly due to very high twist in the yarn or the cop missing the conditioning. The problem is more with rotor spun yarns due to dust accumulation inside the rotors.

17.7 Responsibilities of a supervisor in bundling and baling

(a) Completing the packing of bales as per the delivery schedule committed.

(b) Getting the required materials from reeling by giving regular feedback on the heavy and light knots in stock and the quantity required for completing the order.

(c) Ensuring clean working area and good housekeeping all the time.

(d) Ensuring that the records are kept in their respective place.

(e) Verifying the yarn received for mixing, count, yarn lot number, colour codes, etc., before taking for bundling.

(f) Checking and verifying the tie yarns as per count and mixing.

(g) Checking the quality of packing materials and stencils used for marking.

(h) Verifying the marking instructions before allowing for marking on bales.

(i) Verifying the serial number of bales packed and correctness of recording them. The number once allotted to a bale cannot be changed as it involves legal formalities.

(j) Getting the light and heavy knots segregated and stacking them separately.

(k) Ensuring the safety of people working as the accidents in a bale press may be fatal.

(l) Maintaining discipline in the section and informing the higher authorities in case of any serious breach in discipline.

(m) To report HRD in case of any accidents and filling the accident reports in time.

17.8 Authorities of supervisor in bundling and baling

(a) Allocating the bale numbers in serial referring to the packing and excise registers.

(b) Filling details of packing as required by regulating authorities.

(c) Questioning the workers when the work done is not satisfactory.

(d) Sending memo to HRD in case of serious lapse in discipline by any of the employee working under him.

(e) Allotting or changing jobs to workers considering their skills and the requirements of the department.

(f) Recommending leave and/or permission to the subordinates in the section.

(g) Stopping the production in case of any deviations found in the quality and informing the superiors for necessary corrective actions.

18
Humidification management

18.1 Introduction

Correct ambient conditions are essential to prevent degradation of textile materials while they are undergoing various operations that strain them during manufacture of yarns. Fibres should have requisite properties so that the final product retains its basic shape, size and strength. Above certain moisture limit, i.e. above the upper limit of relative humidity for the fibre and the process, fibres tend to stick and lead to formation of laps on the rolls which disrupt the production process. Fibres become brittle and store electric charges generated because of friction between the fibres during their individualization process when atmospheric humidity is very low.

Modern spinning and winding equipments are designed to operate at high speed, however the increase in ambient temperature curtails the speed limits of operation. The sophisticated electronic controls in modern textile machinery also require controlled temperature which should not exceed 33°C or so. It is also necessary to limit the range of temperature to which the textile machinery is exposed, since the structure of the machinery containing metal parts which expand or contract at different rates with temperature (due to difference in co-efficient of thermal expansion) will be subjected to mechanical stress. Hence, along with maintenance of stable relative humidity conditions recommended for different textile processes, it is also desirable to maintain a constant temperature level within a range.

Mechanical properties of fibres and yarns also depend on the surrounding temperature conditions to which these are exposed during the textile process. Apart from the dust levels, the stickiness in some of the cottons also demands controlled weather. When cotton is sticky, higher humidity creates sticking of fibres to rollers and other parts of the machine. The general reasons for controlling temperature and humidity in a textile mill are as follows:

- Dry air causes lower regain contributing to poor quality and lower productivity.
- Yarns with low moisture content are weaker, thinner, more brittle and less elastic, create more friction and are more prone to static electrification.

- Materials at optimum regain are less prone to breakage, heating and friction effects; have better handle and feel, fewer imperfections and more uniform.
- Higher humidity reduces static problems. Reduced static makes materials more manageable and increases machine speeds.
- Textile weights are standardized at 65% RH and 20°C. Low humidity causes lower material weight and lowered profits.
- Humidification reduces fly and micro-dust, giving a healthier and more comfortable working environment.

Table 18.1 Generally recommended humidity levels in a spinning mill

Department	Cotton % RH	Man-made Fibres % RH
Opening and Picking	45–60	50–55
Carding	50–55	50–60
Silver Lapping	55–60	55–65
Ribbon Lapping	55–60	55–65
Combing	55–65	55–65
Drawing	50–60	50–60
Roving	50–60	50–60
Spinning	45–60	50–65
Winding and Spooling	60–65	60–65
Twisting	60–65	50–65

Similar to the requirement of humidity, the temperature also plays an important role in the textile processes.

Table 18.2 The normal temperature levels followed in spinning mills

Department	Min Temperature		Max Temperature	
	°C	°F	°C	°F
Cotton Mixing	27	80	33	92
Blow Room	27	80	35	95
Cards and Draw Frames	27	80	35	95
Comber	27	80	33	92
Ring Frame	30	85	35	95
Winding	27	80	33	92

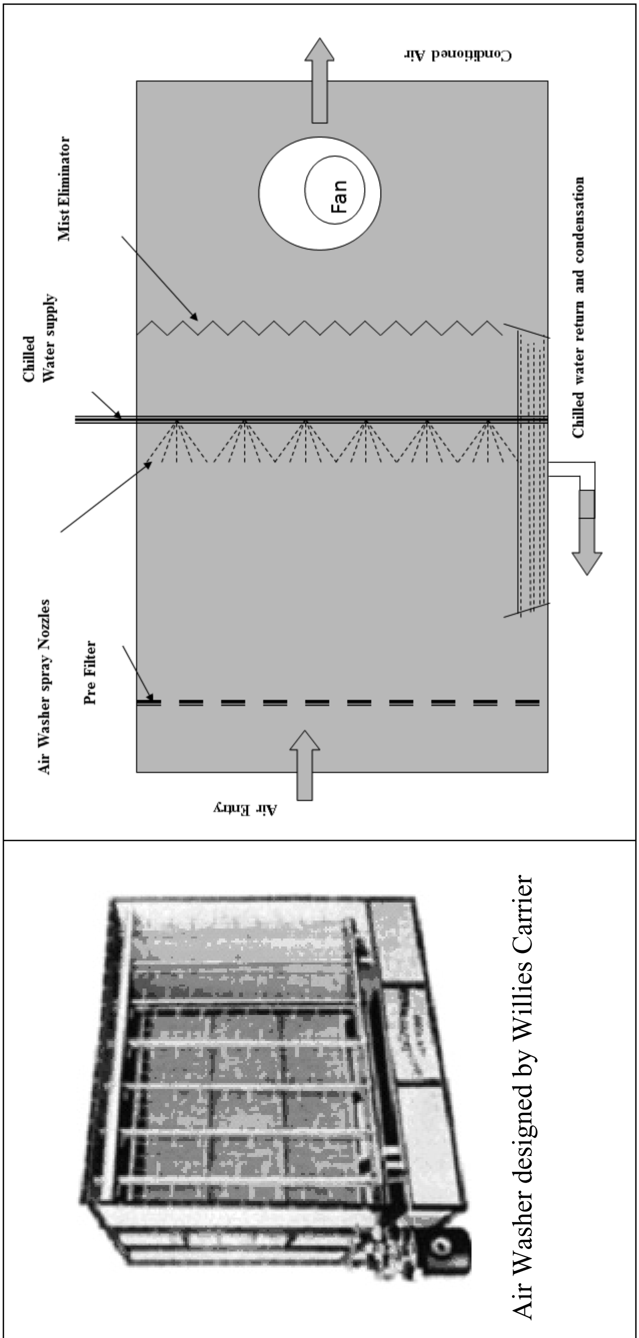


Figure 18.1 Air washer plant.

It is essential for a shop-floor textile engineer to have knowledge of the humidification system, and should be able to maintain it to get the best benefit.

18.2 Air washer plant

Willies Carrier designed spray type air conditioner (air washer) for his textile mill that became the basis for the modern Air Handling Units used in textile industry. Carrier used air washers extensively for cooling and dehumidification in many industrial applications. Over a time, this air conditioning approach became less popular in offices and commercial places, but is still very popular in Textile Industry as in addition to conditioning supply air stream, air washers are capable of cleaning it with low pressure drop and minimum maintenance.

Air Washer Plants are big centralized units which use water spray from a bank of nozzles on air moving with a force. The water spray not only adds humidity, but also cleans the air from dust by making them wet and heavy, which fall down. A set of eliminators prevent the movement of water droplets and the dust particles along with the humidified air. Hence the production area gets humidified clean air.

18.3 Air cooling plant

In contrast to the air washer, in a traditional central station air-handling (cooling) unit using a plate-finned chilled water cooling coil, the water is supplied to a multi-row cooling coil and does not come into direct contact with the supply air stream. The chilled water cools the coil surface which, in turn, cools and dehumidifies the supply air stream. Moisture from the supply air condenses onto the coil surface and drains by gravity to a pan located beneath the coil. This system is used to dehumidify when temperature and humidity are both high.

18.4 Air handling

Processes used in conditioning air from one state to another state vary widely depending on factors like the volume and qualities of the air to be conditioned, the temperature and humidity to which the air must be conditioned and whether a portion of the conditioned air will be re-circulated or 100% outside air will be used. Additionally, the qualities desired in the conditioned air vary. In some instances only the temperature of the air is important whereas in other instances the humidity of the air is more important.

The various components of Air Handling Units in textile industry include centrifugal fans or axial flow fans, high pressure blowers, heavy duty exhaust fans, air volume dampers, input air filters, mist eliminators, water sump, spray nozzle bank, condensers, chillers, heat exchangers, steam heaters, cooling coils, ducting, air distribution baffles or louvers, supply air diffusers and grilles, return air grilles, split grilles, etc.

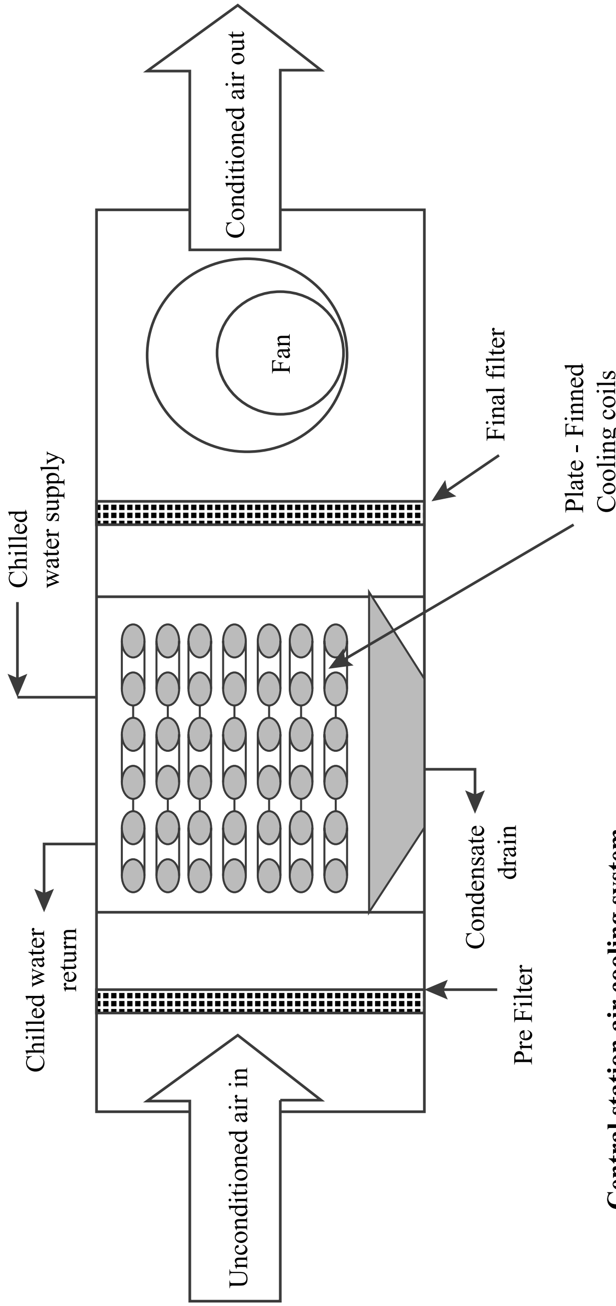


Figure 18.2

Central station air cooling system

Spray air washers using spray water as the medium for adiabatic cooling of air (by direct evaporation of water into the air stream thereby reducing the air's dry-bulb temperature and raising its humidity) are extensively used in humidification systems for textile mills, due to the following advantages:

- Significant saving in initial capital cost and energy cost with evaporative cooling systems, compared to air-conditioning systems.
- Reduced power demand with reduction in electrical maximum demand charges.
- Improved air quality due to air cleaning properties of spray water.
- Flexibility to use chilled water in air washer instead of normal temperature water, when outside air is exceptionally hot and humid.
- Humidification system deploying water as cooling medium is environment friendly.

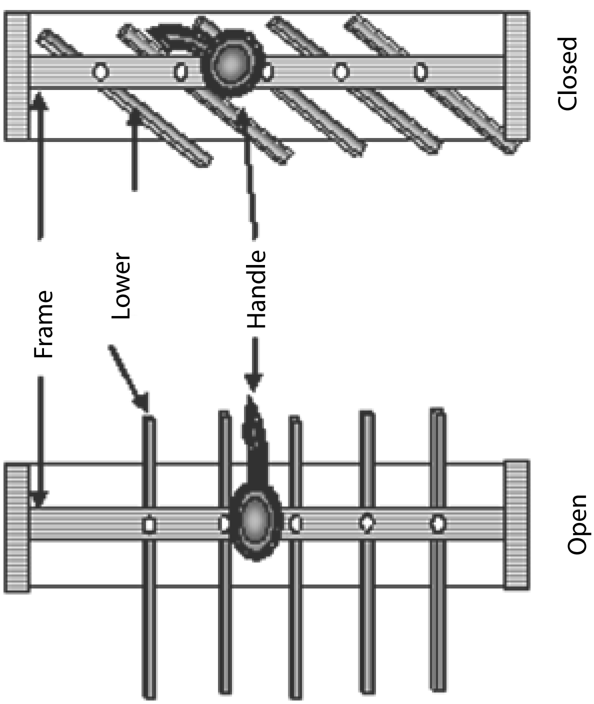
18.4.1 Supply air

The supply air dampers or louvers regulate the amount of air fed to the air washer plant. The dampers are made with light sheet metal which is rust proof. They can be opened or closed as shown in Figure. It can be either operated manually or connected to a control unit, which monitors its opening. Separate set of dampers are installed so as to facilitate either taking only outside, or recirculating the inside air. Sometimes a combination of outside air and inside air shall be made.

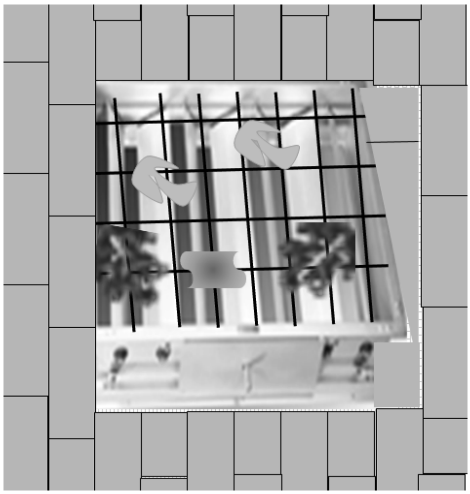
Filters or strainers are installed in the supply airline to prevent unwanted materials like leaf bits, fibres and dust particles coming along with air, which might spoil the equipment and chock the air path. Normally nylon or polypropylene mesh is used in case of recirculation of air, and wire mesh is used for outside air inlets. The size of mesh shall depend on the place of their installation. The mesh used for fresh air is made with sturdy metal wires, and the openings are also bigger with areas of over 1 square inch. The purpose of this mesh is to restrict the direct entry of large sized floating particles in outside air like leaves, papers bits and polythene pieces. It also protects the plant from birds.

18.4.2 Return air

The air from the production area is taken from specially designed underground trenches. Specially designed grills are provided to prevent heavy materials like bobbins, cones, lumps of cotton, paper pieces, etc., from going in the trench.



Supply air dampers



Supply air filter – Mesh fitted to the window

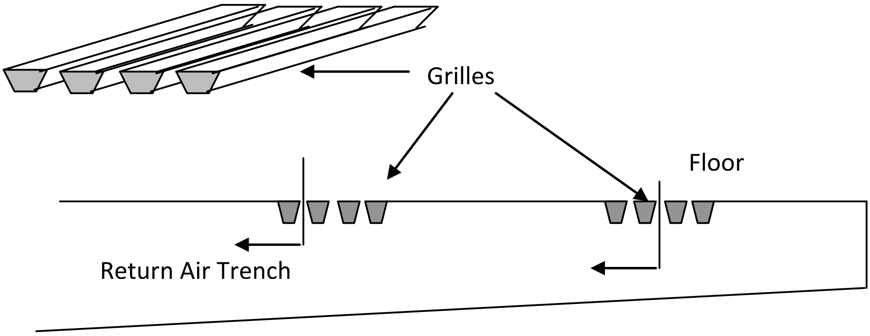
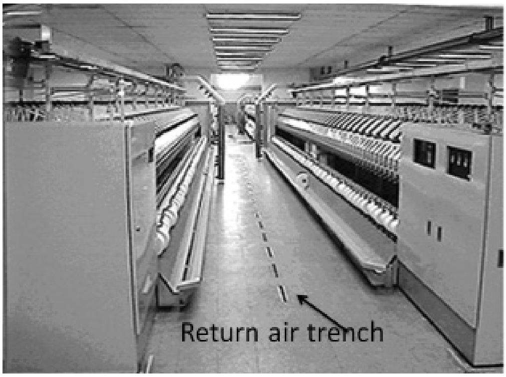


Figure 18.3 Floor Grilles.

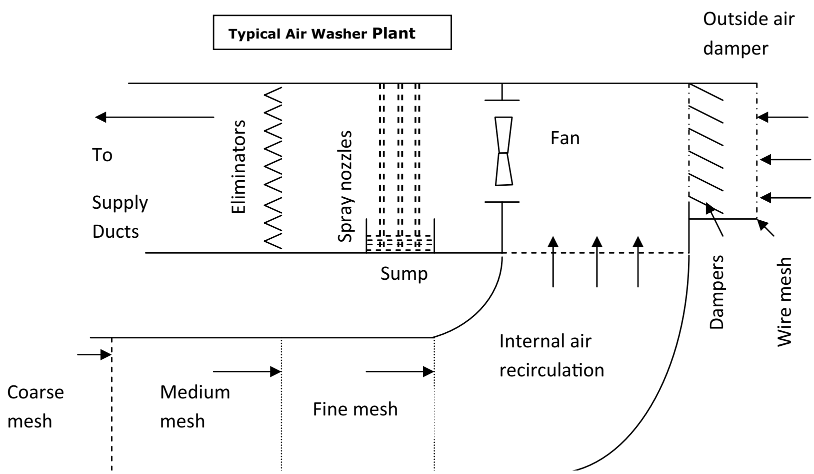
In the return air ducts meshes of different sizes are used in tandem. The first set of mesh shall be coarser preventing heavy particles and lumps of fibrous dust entering the plant, whereas the subsequent meshes restrict the flow of small dust particles and micro dusts.



Floor Grilles are the exhaust grilles fitted at different locations over the trench. The spent air along with floating fibre passes through this grille into the trench. The grilles should be painted with enamel paint. It is essential to specify aluminium with a baked enamel factory finish for grilles, registers and diffusers and not allow field painting or flat paint finishes.

Figure 18.4 Return air trench.

In the return air system, contaminated air is returned to the AC that is located outside the room, through openings under the machines. Solids are removed by filtration and/or water sprayed into the air stream. An important part to be noted is majority of the solids in the room are carried upward by the heat generated by the machines, only about 30–40% of the total fall out is captured by this system. However by placing the supply air diffusers in the top and return air suctions in the bottom and maintaining the quantity of air extraction balancing with the air inflow can reduce the problem of the solids going up.



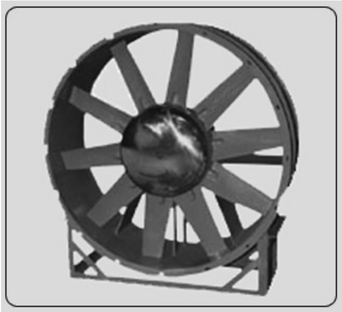
18.4.3 Filters

The initial filters used in the return air duct were just a flat wire mesh, which got replaced by nylon and polypropylene. As the volume of air required to be circulated was more and the air was dustier in cotton textile mills, there was a problem of frequent chocking up of the filters. The zigzag meshes were developed to provide more surface area for the air being filtered. Although, this reduced the frequency of cleaning, still the problems of improper cleaning, and progressive reduction of filtering were there. The developments of rotary air filters, which are now very common in all modern plants ensure continuous cleaning of mesh, and always expose clean mesh for the air entering. This has improved the efficiency of air washer plants significantly.

High density negative ionizer takes over where normal perforated filters cannot filter all micro particles. They operate by electronically generating a powerful stream of negative ions by around 70 trillion per second in intermittent pulses which “wash” the air at a rate of nearly 100 ft/min.

18.4.4 Fans

A fan is typically a mechanical device that causes a movement of air, vapour and other gases in a given system. The fans are fixed on wall in between the air inlet and the spray nozzles. The air is blown on the water spray, which then hits the eliminators and passes into the distribution ducts. Diffusers are used to spread the humidified air uniformly in the work area.



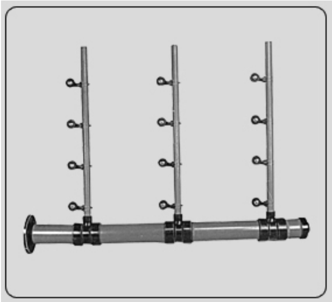
Axial Flow fan draws the air and blows forward, which moves in the axis of the fan. There would be no centrifugal effect on the airflow generated. Guides or stator vanes serve to smoothen/straighten the airflow and improve efficiency. They are used to supply fresh air, to suck air from return air trenches, to suck air from rotary filters, to exhaust air out, etc. Depending on the purpose and the quantity of air handled the size and materials of the fan are decided.

Figure 18.5 Axil flow fan.

Normally high efficiency axial flow fans, with aluminium impellers, adjustable pitch aluminium blades with direct drive having totally enclosed motors are selected to deliver the designed supply air quantity against the required static pressure, after considering pressure-drop in fresh air damper, air washer internals, washer-dampers, supply air ducting, and supply air diffusers with volume control dampers.

18.4.5 Spray nozzle sets

The nozzles are the units which atomize the water particles and help them mix with flowing air. The efficiency of humidification unit greatly depends on the fineness of the water particles in the spray. Normally two sets of nozzles installed one opposite to other shall be used in air washer plants for textile mills. The nozzles spray water against each other so that the incoming air must pass through a wall of water two or three feet thick. This does three things to the air, viz. washes and cleans the air, saturates it with moisture and controls the temperature of the air.



Spray set is an assembly (bank) of two horizontal header pipes on which number of vertical branch pipes/riser pipes are fitted. The spray nozzles are fitted on to the riser pipes. The spray header is connected to the delivery of the pump. The pipes are evenly distributed in turn to distribute nozzles to create a uniform mist.

Figure 18.6 Spray nozzle set.

18.4.6 Atomizer for humidification plants

Atomizer is a revolutionary product aimed at saving the precious energy hitherto wasted in the humidification plants. The concept of large number of small nozzles used in the air washer plants is sought to be changed drastically by introducing the revolutionary concept of atomizer. These atomizers change all the equations of humidification plants with respect to number of nozzles used; horsepower of the water pump and redefine them so as to conserve the precious energy. The problem of energy being lost as frictional losses in the small nozzles has been effectively addressed. This is how the atomizers compare with the existing (conventional) nozzles.

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- Number of atomizer required per plant is limited to 6–20 numbers depending upon the size and condition of the plant.
- No replacement is required for atomizers which is otherwise the case with existing (conventional) small nozzles. Replacement is required due to choking as well as breakage during each cleaning time.
- No periodic maintenance required. It means savings in manpower and spare nozzles.
- Reduced frictional losses save energy (15–40% saving can be achieved depending upon the actual plant conditions).

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18.4.7 Filtering water

The textile mill environment is with fibrous material and loose fibres can be seen floating in the air, which settles on walls, open water in tanks, roof, etc. The water fed to the air washer plant if contaminated with fibres choke up the nozzles, and the force of spray reduces. The water shall not atomize, but big drops shall just fall down. The air will not get the required atoms of water. Therefore, the water fed to the humidification plant should be free from fibres and floating materials. Hence filtering water using either stationary strainers or rotary filters is practised.

18.4.8 Eliminators

After the air passes through the spray section of the washer unit, it passes through mist eliminator blades that function to remove condensed moisture. These eliminator blades are constructed of stainless steel in newer units, and galvanized metal in older ones.

Air supplied to the production area should have moisture in the form of atomized vapour, so that, it could be absorbed easily by the fibres. The air should not come with water droplets, as they are heavy, and cannot be absorbed easily by the fibres. These droplets, if comes, deposit on the material and make it wet and stick them on the machine parts, walls, stresses, etc. The water droplets lead to rusting of machine parts.

Figure 18.7 Eliminators.

Eliminators arrest the droplets of water from moving along with the air carrying atomized water vapours. The eliminators normally get chocked with moist lint as the moist air hits the eliminator. It is very essential to clean the eliminators frequently. The eliminators should be designed in such a way that it is easy to open and clean.

18.4.9 Supply air distribution

Textile plants are generally served by uniform air distribution through sheet-metal ducts run above the false ceiling in respective departments and taking care in the design to direct supply air through suitably positioned outlets to motor-alleys and other points of concentrated heat loads. Plant duct work is either galvanized metal or aluminium. Some plants have the air conditioning duct work cast into the concrete structure of the building under the floor.

The distribution of air uniformly or as required in the work area can be done by designing the duct dimensions suitably, and joining them with suitable duct tapes. The diffusers are fitted on the ducting which distributes the air uniformly, without directly blowing on the materials or creating turbulence.

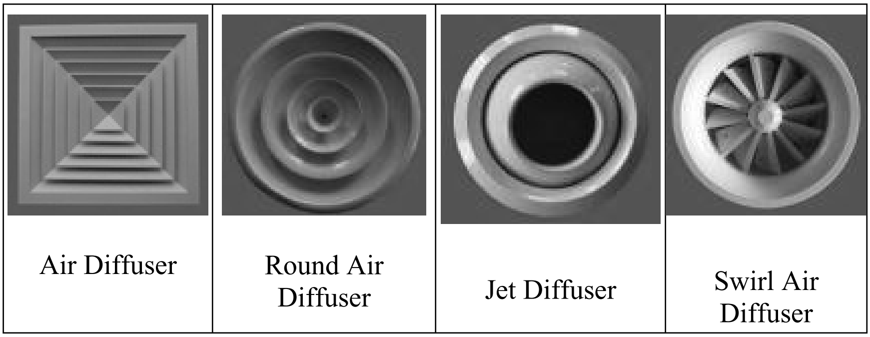


Figure 8.8 Diffusers.

18.4.10 Temperature and humidity monitoring

The air after passing through the air washer and eliminator is sensed for the temperature. Depending on the requirement of the department the air can be either cooled or heated. Normally for cooling, chilled water is added to the air washer, whereas for heating, the radiators or infrared heaters are provided after the eliminators. The temperatures of outside and inside air are considered for making a decision for mixing the proportion of return air with the outside air. The return air is first filtered and then fed to air washer or thrown out to the atmosphere.

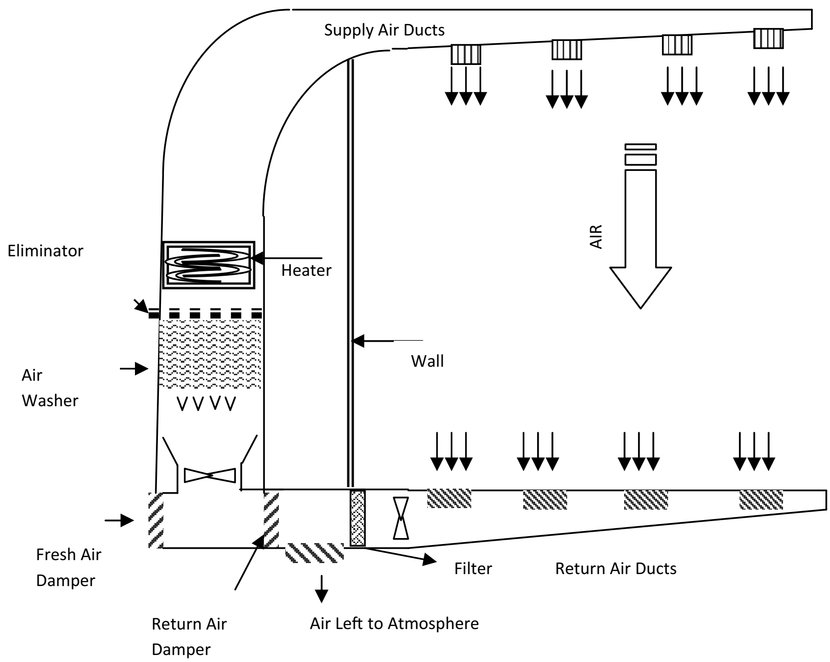


Figure 8.9 Mixing fresh air and return air.

The humidity is monitored by increasing or decreasing the water pressure in the air washer and by judicially combining return air with outside air depending on the humidity conditions. Now various sensors are available, which monitor the opening and closing of the dampers and the water pressures to maintain the required humidity and temperature.

18.5 Localized humidification control

18.5.1 Need for localized humidification control

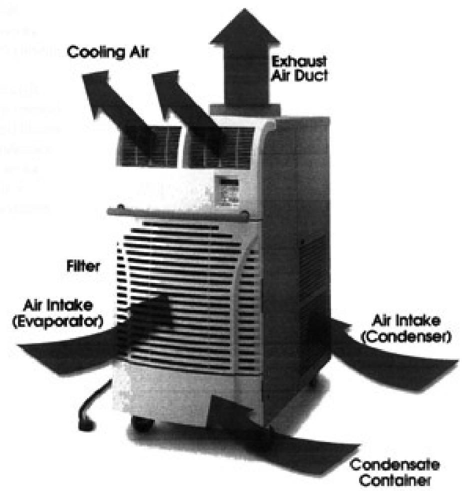
The conditioned air supplied by a humidification or air conditioning plant is normally by diffusers, which is intended to spread the air uniformly in the working area. The return air trenches suck the air and hence the air shall be moving from the diffusers to return air trenches. But our purpose of humidifying the department is to help the running material to absorb the humidity from the air supplied. It is more important for the working materials to get exposed to the humidity rather than the complete department. The human beings working in the production area require a humidity range of 45–60% for comfortable working whereas the working material depending on the process requires different humidity and temperatures. Sometimes we need to dehumidify to get correct results. Hence it is suggested having systems providing humidity or dehumidify at the spot of material working. Spot humidifiers are one such development.

18.5.2 Spot coolers

Spot cooling is a method of cooling overheated areas within a larger area, as opposed to providing general cooling by means of a centrally controlled air conditioning system. In operation, spot cooling is an extremely efficient means of cooling people, processes, and equipment because it directs a localized stream of cool air exactly where it is needed. By localized controls, the overall costs of power can be reduced.

18.5.3 Heating lamps

In a number of cases, we need to keep a small area in the production department either dry or hot depending on the nature of the material being processed. This cannot be done by central plants. Heating lamps are a solution for that. The classical examples are the use of heating lamps above the creel of draw frames, combers and speed frames during rainy season, use of heating lamp on the two-for-one twister while twisting cotton PVA doubled yarns for super soft terry towel making, conditioning chambers, etc.



Spot cooler

While installing heating lamps, it is necessary to understand the purpose, and adjust the distance between the lamp and the machine to get the best results. If the lamps are very near, the metal parts of the machine also become hot; this is not desired. The heat from the lamp should not get wasted by radiation. Hence use of reflectors in the back is suggested to get maximum benefit. As the bulbs shall be very hot, it can break if comes in contact with water droplets. The reflector also protects the bulb from water droplets falling from the top.

18.5.4 Subsystem humidification

Subsystem humidification of air conditioning instead of a block system helps improvement of efficiency, the comfort and the hygienic conditions within the production room and reduction of the energy needed for the conditioning of the air in the room. These goals are obtained in a weaving shed by precisely controlling the moisture content of the yarn being fed into each loom by removing solids and heat generated by the weaving process at their source, and by improving the handling of the air in the weaving room. The weaving process would run best with a very high room humidity level, in the 85–95% range, but operator comfort imposes a limit, usually 60–65%. Therefore, the concept of localized humidification is beneficial. Trials done by SITRA (Patent No. 174964 dated 2 July 1990) at Coimbatore indicated that inducing humidified air at the creel of ring frame instead of humidifying the entire room is economical and gives equally good results.

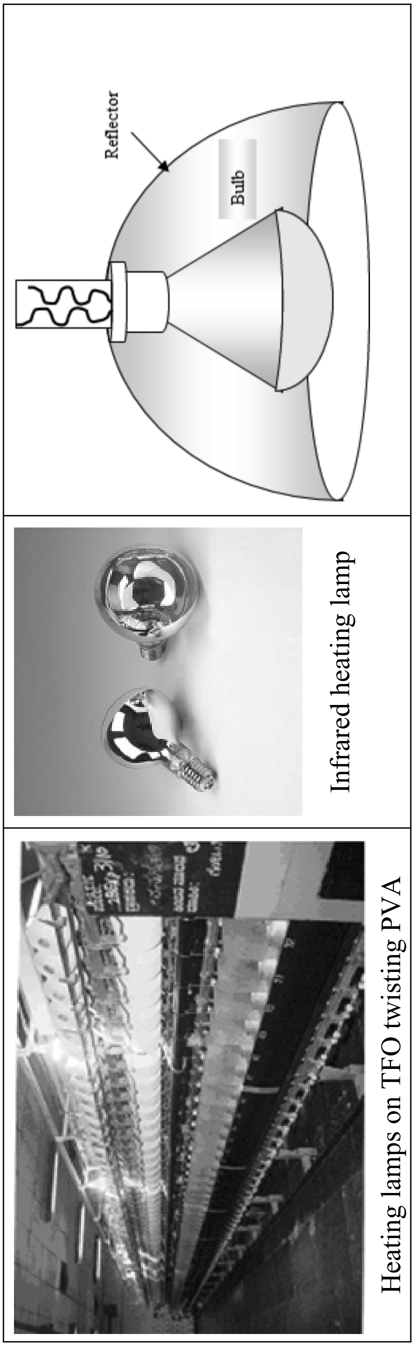


Figure 18.10 Heating lamps.

18.5.5 Exhausting air

Providing of ducts and exhaust fans to collect the dry or humidified air from selected parts of the machine also helps in providing the clean work area to the material in process and preventing disturbance to adjacent processes. The air suction units like pneumafil provided in ring frames, speed frames, draw frames, carding, etc., not only concentrates on preventing the dust flying out, but also guides the air movement. The conditioned air fed to the production department through the diffusers at the top spreads all over, whereas our intention is that it should interact with the material being processed. As the return air system is sucking air from the department, the conditioned air is also sucked out wasting all our efforts for conditioning. The system of extracting air from the machines directs the wind flow towards the machines and the material in process.

Flow Master by Luwa

Collection of dusty air from machines

The Flow Master displacement air outlet developed by Luwa is an example for local conditioning in manufacturing halls with an irregular local heat load distribution. Flow Master is a displacement air outlet which distributes the supply air at a low speed near the floor, with little induction and turbulence. The air which has been heated up by machines and humans rises and is removed via the extraction openings from the room or directly as machine extraction air.

Some mills have exhaust fans on the walls. These are provided to throw out hot air from the working area. Where humidification is required and provided by various means, the exhaust fans tend to throw the humidified air out. Therefore, it does more harm than good. It is always advisable to provide suitable ducting and collect the hot air from the point of generation and guide them out by installing exhaust fans at suitable location.

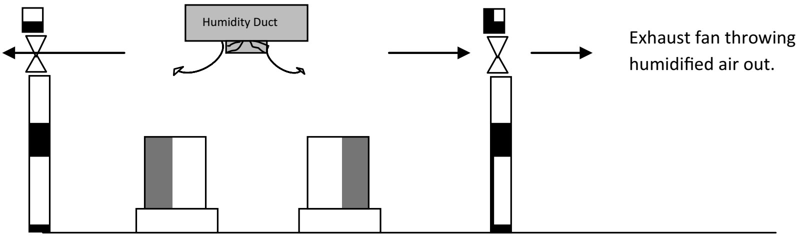


Figure 18.11 Wrong positioning of exhaust fans.

18.5.6 Machine air-conditioning

In machines with high speeds like ring frames the generation of heat is high. Further the ballooning throws out the moisture from the fibres in process. Therefore, a specialized treatment of air and humidity is required at spindle point, whereas in the creel, as the materials are almost stationary, tend to absorb more moisture. The treatment needed for creel is therefore to be different compared to actual spinning area.

The extremely high energy requirements in twisting on one hand, and the homogeneous temperature and humidity needs in the creel area on the other, create a need for targeted machine air-conditioning. The air is guided directly to the bobbins via low-induction slide vane outlets. A simultaneously controlled extraction of the heat produced by the process guarantees optimal running of the machine.

18.5.7 Yarn conditioning plants

Humidification needs are not only for getting a good working during production, but also to ensure that the material is made suitable for further working. During spinning and winding, the yarn package runs at a high speed, because of which the moisture in the yarn is thrown out. The normal moisture in ring spun cops and cone winding shall be around 4.5–5.0%. To have a good working in warping or knitting, the yarn should have moisture of above 7%. The commercial moisture regain considered for overseas market is 8.5%, whereas in the mills, it is very difficult to get that moisture content. To get the advantage of moisture content, people started keeping high humidity in winding section by installing mist humidifiers. This resulted in the rusting of machine parts, but the moisture in the cone did not increase. The cones were remaining dry as the cones were put in polythene bags immediately after doffing to avoid handling stains. Then the system of keeping cones in a humidified room for 24 h was started, which only added the space problem, but the cones did not absorb moisture as they were tightly built to have higher yarn content on cones and to have higher container capacity to reduce transportation costs. The yarns made for hosiery is normally waxed, which also is a hindrance for the yarn to absorb moisture. By keeping cones in a humidified room for a long time gave higher moisture content in the outer surface of cones, but not uniformly inside the cone. Some even tried subjecting cones to direct steam at different pressures. The imbedded air in between the fibres and yarns had no place to come out, which was also a hindrance to moisture absorption. There used to be condensation of water droplets at the surface of cones and in the polythene bags, but the moisture was not entering the core of the yarn. It increased the problems rather than reducing. The yarn conditioning plants and auto claves were designed to give moisture to the yarn by force.

The cones are kept in an enclosed chamber, which shall first be made vacuum by a vacuum pump. By this, the trapped air between fibres and yarns are taken out. Afterwards live steam would be allowed to enter the chamber. As the air has been removed, the water molecules can enter the cavity in the fibres, and the absorption of moisture becomes more effective

Figure 18.12 Yarn conditioning machine.

18.5.8 Static elimination

Static charges develop because of the friction between either fibres or between fibres and the machine parts. The humidification makes the air conductive and reduces the static charges. However, the generation of static charges shall not be uniform throughout the production area. Therefore, it shall be advantageous to attack the places of static generation and eliminate the charges rather than increasing humidity throughout the working area. Various devices are available for arresting static charges; out of them air ionizers have a direct link to air handling.

Figure 18.13 Air ionizer.

18.6 Problems encountered in air washer operations

18.6.1 Microbiological growth

Air washers provide an ideal environment for the growth of microorganisms because of the process contaminants and soluble oils that feed them. Most deposits from air washer units contain dirt and debris from the process involved, corrosion products, and some crystalline particulate matter. The most important part of the deposit is the microbial growth or slime masses, which are the most difficult to measure. They result in the very sticky slime that combines with the dirt and debris, corrosion products, and crystalline matter to form hard encrusted deposits above the water level and thick slimy masses below the water on metal surfaces inside the washer. When microbial growths combine with process contamination, the resulting deposit in some cases is like a separate organic chemical that is almost impossible to remove. Controlling the growth of microorganisms in a chilled water or air washer system is the key to an effective treatment programme. Microorganism growth can cause odours, carryover by blocking air passages, encrustation, and corrosion under deposits. In addition, they can cause air washer sump screens to plug, which results in overflow of solids into the sump recirculating pump and the subsequent plugging of spray nozzles and into the fan. Deposits occur inside the fan shroud, disturbing air flow. The resulting solids get carried through the fan deposit in the duct work. In extreme cases, deposits develop on the fan blade itself, unbalancing the fan so that it must be shut down and cleaned.

18.6.2 Oil

Lubricating oils that are atomized into the air stream due to heat generated from high speed machinery operations can foul the system. The build-up of lint in the system will also cause system fouling. Oil and other materials picked up from the plant air can be tremendous nutrients to feed microorganism growth. Even though pre removal of oil may be accomplished with the filters, some oil will be present in the washer and will cause sticky surfaces and increased microbiological growth, and will generally increase the fouling tendency of the unit. Additionally, if certain amines are used in the microbicide programme, oil can be coagulated in the washers and chilled water sump to form an extremely sticky slime that will quickly collect fibres and other suspended solids. These problems can be controlled by using an oil emulsifier to pull the oil into the water and then allow it to be removed with the bleed or overflow, and by low level foaming of the sump water. This foaming will float the lint and allow it to be removed with the bleed or the overflow. If left untreated, the oil in a system can film out and build up to a point that the system is forced to shut down. It can form jelly-like build ups on the eliminator sections of the air washer which will stop air and moisture flow.

18.6.3 Foam

This problem is generally caused by the chemicals being added for treatment, but may be the result of impurities being cleaned from plant air or of high solids in the washer water. Severe foam can overflow the sump pan of the washer onto the floor, spreading slime and dirt, and producing hazardous walking conditions. It can also be sucked out of the eliminator section of the washer

18.6.4 Carryover of solids

Carryover of solids is caused by microorganism growth on eliminator blades which disrupts air flow and allows solids to pass into plant duct work, and by foaming which also sends solids from the washer sump into the plant. Extremely high levels of dissolved solids in the washer sump water can also result in carryover. These solids can cause a variety of problems in the plant, from spotting of product to disrupting the temperature and humidity controls. Their worst damage is done in the plant duct work. Most textile plant duct work contains a mat of lint and fibre on its inside surfaces. This mat builds up over a period of time and is removed on a regular basis. When this mat becomes wet with solids from the washer, it becomes encrusted with the dirt and salts that are present in the washer water. Severe corrosion results, particularly with the ducts made of aluminium and phosphate used as one of the treatment chemicals in the water.

18.6.5 Corrosion

Corrosion potential is most severe in textile air washer and chilled water systems during summer operation as the water in the systems de-concentrates. Chiller tube sheets and heads are the most vulnerable areas for corrosion. Idle chilled water lines in winter are also vulnerable if they are left full of water. Lint, dirt, fibre, oil, and microbiological deposits from the air washers cause most of the corrosion problems on the chiller tube sheets. They combine in some cases to totally slime areas of the tube sheet. Severe pitting occurs underneath deposits of this nature. Corrosion in any metallic system is controlled by the passivation of the metallic surfaces that come into contact with the water. Carbon dioxide, sulphur dioxide and other corrosive gasses scrubbed from the air stream can cause serious problems when dissolved in the water. They form dilute mild acids which will readily attack the unprotected metallic surfaces of the system. Nozzle loss is very characteristic of this condition. To correct this condition, corrosion inhibitors are used which lay down a thin monomolecular coating on the metal surface, while increasing the pH of the system to a level close to 9.0. This neutralizes the dilute acids, puts a protective coating on the metal surface, and retards the rapid growth of bacteria in the system. Corrosion is characteristic of conditions during the period when the air washer acts as a dehumidifier. At this point, the water that is washed from the air will dilute the natural buffers that are found in the water, and allow the pH of the system to slowly drop. The result is corrosion and the perfect conditions for bacteria growth. It is normally recommended to clean both the tube sheet and the heads thoroughly and to coat them with several coats of suitable epoxy paint. There is little corrosion potential inside the air washer units themselves, except for the mild steel or galvanized piping and any other mild steel structures present. Except for the insides of piping, the best preventive measure for corrosion remains to be a good coating of paint.

18.6.7 Encrustation

This is the name given to a deposit when it occurs above the water level in a dry area of an air passage in an air washer unit. This is a very difficult deposit to remove. Neither strong acids nor caustic seems to be effective as cleaning agents. In some cases, a chisel is the only way to remove these deposits. These deposits are composed of lint, dirt and debris, fibre and process contamination. They are held together by the organic slime from the microbiological growth. When a deposit of this nature dries out, it adheres to air washer surfaces like epoxy glue.

18.6.8 Odours

Most odours in textile plant air washer systems result from the chemicals used in treating the system. For example, chlorine compounds, polychlorophenates, and some organic sulphur compounds, used to kill bacteria, result in severe odour problems in plant air. Odour problems in air washer systems generally do not result from gases inside the textile plant. Most of these gases are dealt with using some form of smoke abatement.

18.6.9 Biological control

An air washer puts air out for people to breath, which must be clean and free of odours. This eliminates many of the biocides as the sulphur based carbamates for use in this type of system. To control build-up of slime use of rapid oxidizers with low odour levels as bromine and hydrogen peroxide is used in conjunction with a cationic or non-ionic biocide. Usually this includes the use of one of the polyquat biocides or glutaraldehyde. The biocides should be fed twice each week in a shock type basis, with the oxidizers being fed continuously or as a shock weekly, based on the conditions of the system and the oxidizer being used.

19
Safety management

19.1 Why safety management?

The success of a mill depends on the efficiency of people working. Efficiency results in increasing the average output per person. It is reflected in increased productivity. There is a close relationship between safety measures and the efficiency of people. Safety measures are concerned not only with the physical efficiency, and safety of the persons, but also their general wellbeing. Lack of safety exposes people to health hazards. It also involves occupational health risks. It is necessary for all in the industry to plan their activities in such a way that it is safe. They need to follow the safety regulations, provide safety gadgets, implement safe systems, periodically audit the safety systems and correct the lapses, and educate others on safety issues. One should achieve targets without mishaps, without physical loss to the people working for achieving the targets. The supervisor is responsible to monitor the safety systems while working for production and quality.

19.2 Normal causes of accidents in a spinning mill

The accidents on job in a spinning mill can be grouped into four main categories as accidents due to worker errors while working on machines, accidents due to machine malfunctioning, accidents in material handling and accidents due to poor housekeeping.

The worker errors while working on machines includes wearing loose clothes, coming drunk to the work, inadequate training, bypassing of safety switches, deactivating safety locks and not following the safety precautions, using compressed air for cleaning themselves, and so on. A loose cloth can be caught in the machine while worker is concentrating on some other point in work like creeling a bobbin on the top of the machine. A drunken worker cannot concentrate on work and may touch a running part or fall on a running machine resulting in an accident. A worker not trained well commits mistakes and get himself injured. Using compressed air for cleaning the clothes and hair after the work looks very easy and majority of the workers including senior managers opt for it. Air coming at high pressure can puncture delicate parts of skin. Sometimes we get fine metal parts, water particles, etc., along with the air. The bypassing of a safety switch for maintenance and checking purposes is not reverted back in number of cases, resulting in major accidents.

Accidents due to machine malfunctioning can be reduced by improving the maintenance. Improper maintenance and settings, poor humidity conditions leading to lapping, not calibrating the pressure gauges, not monitoring the pressure vessels and compressors are some of the causes for accidents.

Accidents in material handling include overloading the trolleys, obstacles in the alleys, narrow alleys, not maintaining the material handling equipments, not closing or locking the trolleys while in movement, slippery pathway in which trolleys have to move, insufficient light in passages, and so on. When the height of the materials loaded is high the worker shall not be able to see the passage, he may hit at some place.

Accidents due to poor housekeeping include blocking the entrances, keeping materials near to electrical control boards, keeping clothes, bags, tiffin boxes on the machines or on control panels, keeping materials in passages, and so on.

19.3 Environment, hygiene and OSHAS norms

The major safety and health issues in the spinning industry are exposure to cotton dust, exposure to chemicals, exposure to noise and ergonomic issues.

19.3.1 Exposure to cotton dust

When cotton is being processed, it emits fine dust particles into the air. These particles are breathed into the lungs by the person working with the fibre. Sometimes the person can have an allergic reaction which is similar to an asthma attack. Even if a person working with cotton does not display any allergic reactions, there is scientific evidence that people who are exposed to cotton dust may develop a permanent decrease in their breathing ability. This cotton dust related disease is known as Brown Lung or byssinosis, and affects thousands of people in the textile industry who are exposed to large quantity of dust. The symptoms of this disease include tightening of the chest, coughing, wheezing and shortness of breath. The workers are also exposed to particles of pesticides and soil.

The Occupational Safety and Health Administration, i.e. OSHA, made it compulsory for employers in the textile industry to protect their workers from over exposure to cotton dust and its evil effects. The OSHA determined certain guidelines which can be used by all. OSHA has laid down a Cotton Dust Standard with a view to reducing the exposure of the workers to cotton dust and protecting them from the risk of byssinosis. It has set up Permissible Exposure Limits (PELs) for cotton dust for different operations in the textile industry.

OSHA has given dust standards for various operations of a textile mill. Employers are required to measure the quantity of respirable cotton dust once in 6 months or whenever there is any change that might lead to a change in the level of dust. If the level of dust in the atmosphere is higher than that as per OSHA guidelines, the management should take measures to reduce the same. As per these guidelines, the employer is required to inform the employees in writing of the dust level present in the atmosphere as well as the steps that the management is planning to take for its reduction. If the dust level cannot be reduced, it is the duty of the management to provide respirators to the employees.

Using mask in the areas where there are chances of dust liberation is very essential to protect people from getting lung infections.

The mask should cover both nose and mouth.

The supervisor should insist all the workers as well as visitors to the plant to wear masks while on work, although the dust levels are well within the norms.

Figure 19.1 Wearing Mask.

19.3.2 Exposure to chemicals

The textile workers who work with dyes or finishers can develop skin allergies or rashes. Finishing agents such as formaldehyde used in permanent press materials can cause allergic reactions that affect the respiratory system. As we are discussing a spinning mill, the chemical related problems are not normally seen excepting while applying tinting or antistatic chemicals or varnishing the cots. Use of gloves is essential along with the mask. The supervisor has to ensure it.

19.3.3 Exposure to noise

Exposure to high noise levels has been known to damage the eardrum and cause hearing loss. Other problems like fatigue, absenteeism, annoyance, anxiety, reduction in efficiency, changes in pulse rate and blood pressure as well as sleep disorders have also been noted on account of continuous exposure to noise. Lack of maintenance of machinery is one of the major reasons behind the noise pollution. The supervisors should ensure proper maintenance and reduction in noise level. Where noise levels are likely to be high, the workers should be insisted to wear ear plugs.

19.3.4 Ergonomic issues

Ergonomic issues are unsafe and unhealthy working environment. Workers in these units face a number of problems such as unsuitable furniture, improper ventilation and lighting, and lack of efficient safety measures in case of emergencies. The workers in such units are at risk for developing various occupational diseases.

The following points are necessary to improve the safety and health conditions:

1. Proper lighting at the place of work to prevent strain on eyes.
2. Maintenance of machinery to reduce the level of noise.
3. Providing ear plugs to reduce exposure to noise.
4. Job rotation to avoid continuous exposure to dust/noise/heat for a long period.
5. Proper ventilation at the place of work.
6. Providing masks to reduce the exposure to dust.
7. Setting up and maintenance of dust control equipment.
8. Availability of trained medical personnel and first aid facilities as well as safety equipments such as fire extinguishers and fire alarms at the place of work.

The passing of the Occupational Health and Safety Act (OSHA) of 1970 was the means by which industries were forced to adopt standards to ensure a safe and healthy environment for workers. OSHA guarantees employees the right to a safe and healthy working environment and OSHA inspectors can walk in and inspect workplaces at any time. Workers who feel that their workplace is unsafe can file complaints with OSHA. If upon inspection, OSHA finds violations of industry standards, then the industry can be heavily fined. In addition, OSHA requires that industries keep records of work related accidents, illnesses, injuries, and exposures to harmful materials. This information must be made available to employees and government agencies and provided upon request.

19.4 Safety regulations

Accidents not only affect workers losing their livelihood but also employers in terms of compensation to be paid to the workers and loosing trained and skilled workers. Accidents are a significant cause of dispute between workers and management. The Factories Act, 1948 has laid down certain measures for the safety of workers employed in the factories. There are numbers of safety regulations developed by various countries and standard bodies. The safety or the people working on the machine have been given prime importance.

The safety regulations deal with number of issues. While discussing on machine lay out, it specifies minimum distance between two machines, minimum distance between wall and the machine, minimum number of entry and exit points for a production hall depending on its size, the minimum height of the roof, etc., so that the workers can move freely, escape in case of fire accidents and avoid hitting a machine part or to a wall.

The safety regulations also address the preventive actions in case of fire and the type of extinguishers to be used. While addressing the first aid boxes and safety gadgets, the safety regulations stress on the materials to be kept in a first aid box, maintenance of first aid box, verifying the expiry dates of medicines, providing rest room in case of accidents or illness and providing ambulance facilities. It is suggested getting the latest version of the safety regulations and following them while on work.

19.5 Safety measures

The managers and supervisors on the shop floor should ensure that the safety measures are properly implemented. Some of the common areas are discussed below.

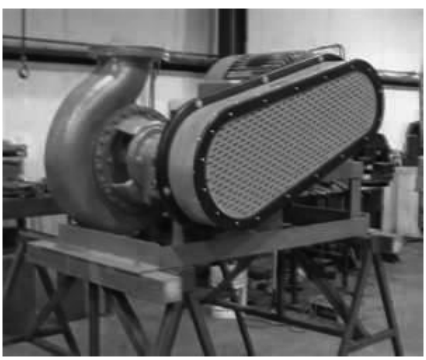
	**Machine guarding:** Ensure that power transmission parts are guarded so that no one or any material can come in contact with the moving parts.

Figure 19.2 Machine Guarding.

19.5.1 Beater guards

Any machinery equipped with a beater should be provided with metal covers to prevent contact with the beater. The covers should be provided with an interlock to prevent it from being raised while the machine is in motion and prevent the operation of the machine while the cover is open.

19.5.2 Gear housing covers

The gear housings should be properly covered. They should have interlocks so that the cover cannot be opened when the machines are working.

19.5.3 Casing

Every set screw, bolt or key on any revolving shaft, spindle, wheel or pinion shall be so sunk, encased or otherwise effectively guarded as to prevent danger in machinery driven by power and installed in the factory.

19.5.4 Work on or near machinery in motion

In any factory, when it is necessary to examine any part of machinery while the machinery is in motion, such examination should be carried out only by specially trained adult workers. Such workers should wear tight fitting clothing and their names to be recorded in the register prescribed in this connection. The machinery in motion with which such workers would otherwise be liable to come in contact during the course of its examination, should be securely fenced to prevent such contact. No woman or young person should be allowed to clean, lubricate or adjust any part of a prime mover or transmission machinery, while the machinery is in motion.

19.5.5 Means of stopping machines

Suitable devices for cutting off power in emergencies from running machinery should be provided and maintained in workroom. On operations where injury to the operator might result if motors restart after power failures, provision should be made to prevent machines from automatically restarting upon restoration of power.

19.5.6 Protection for the machine repairers

Whenever a machine is stopped for repairs and a person is working inside, provision should be made to prevent it from restarting inadvertently. Locks may be provided to control panels or the fuses may be removed and kept out.

Figure 19.3 Do not put your hand.

19.5.7 Pushbutton control

Pushbutton control should have stop and start buttons located at each end of the machines, and additional buttons located on both sides of the machine in case of long and wide machines.

19.5.8 Cleanout holes

Cleanout holes used for cleaning out the materials from a machine, mainly in blow room, within reaching distance of the fan or picker beater should have their covers securely fastened and they should not be opened while the machine is in motion. A sign board is to be put indicating it as danger and not to put hands when the machine is in operation.

19.5.9 Nip guards

The feed rolls, wherever provided should be covered with a guard designed to prevent the operator from reaching the nip while the machinery is in operation.

19.5.10 Feed rolls

The feed rolls on all opening and picking machinery should be covered with a guard designed to prevent the operator from reaching the nip while the machinery is in operation.

19.5.11 Enclosures

In a machine having wire points, strikers or combs, they need to be enclosed and provided with guards. The type of enclosure depends on the type of points and the speed in which they operate.

Safety belts: Where workers have to work at a height and support is less; they need to be provided with safety belts along with safety jacket and helmets. They need to be educated for using them.	
Safety limit switches 	**Safety limit switches:** Safety limit switches are to be provided for all the doors of any machine, which when opened while running may be prone to cause accidents. There are varieties of limit switches available, which need to be selected depending on the type of the machine. They need to be maintained and monitored.

Figure 19.4 Safety belt and safety limit switch.

19.5.12 Pressure plant

If in any factory, any part of the plant or machinery used in a manufacturing process is operated at a pressure above atmospheric pressure, effective measures should be taken to ensure that the safe working pressure of such part is not exceeded. These machines (for example, compressors, boilers) are to be inspected by a competent authority on a periodic basis, and to be certified as fit for use.

19.5.13 Hoists and lifts

The hoists and lifts should be of good mechanical construction, sound material and of adequate strength. They should be properly maintained and thoroughly examined by a competent person at least once in every 6 months. A register should be kept containing the prescribed particulars of each such examination. Every hoist way and lift way should be sufficiently protected by an enclosure fitted with gates, and the hoist or lift and such enclosure should be constructed to prevent any person or thing from being trapped between any part of the hoist or lift and any fixed structure or moving part. The maximum safe working load to be plainly marked on every hoist or lift, and no load greater than such load shall be carried thereon. The cage of every hoist or lift used for carrying persons is fitted with a gate on each side from which access is afforded to a landing. Every gate should be fitted with interlocking or other efficient device to secure that the gate cannot be opened except when the cage is at the landing and that the cage cannot be moved unless the gate is closed. Where in the hoists and lifts used for carrying persons, the cage is supported by rope or chain, there should be at least two ropes or chains separately connected with the cage and balance weight, and each rope or chain with its attachments must be capable of carrying the whole weight of the cage together with its maximum load. Efficient devices should be capable of supporting the cage together with its maximum load in the event of breakage of the rope, chain or attachments. An efficient automatic device should be provided and maintained to prevent the cage from overrunning.

19.5.14 Lifting machines, chains, ropes and lifting tackles

'Lifting machine' means any crane, crab, winch, pulley block, gin wheel and/or runway. 'Lifting tackle' means chain slings, rope slings, hooks, shackles and/or swivels. Following safety measures should be adopted in respect of lifting machine (other than a hoist and lift) and chain, rope and lifting tackle for the purpose of raising or lowering persons, goods or materials.

(a) All parts including the working gear of lifting machine and chain, rope or lifting tackle should be of good construction, sound material and adequate strength and free from defect, properly maintained and thoroughly examined by a competent person at least once in 12 months.

(b) No lifting machine, chain, rope or lifting tackle should be loaded beyond the safe working load. The safe working load should be prominently displayed on it.

(c) While any person is employed or working on or near the wheel track of a travelling crane in any place where he would be liable to be struck by the crane, effective measures should be taken to ensure that the crane does not approach within 20 ft of that place. A lifting machine or a chain, rope or lifting tackle should be thoroughly examined in order to ensure its safety.

The person working with cranes shall be provided with helmet and ensured that he uses it.

19.5.15 Floors, stairs, and means of access

In any factory all floors, steps, stairs and passages should be of sound construction and properly maintained, and where it is necessary, steps, stairs, and passages are provided with substantial hand rails. Safe means of access should be provided and maintained to every place at which any person is required to work.

19.5.16 Excessive weights

No person should be employed to lift, carry or move any load so heavy as to be likely to cause him an injury.

19.5.17 Securing ladders

The ladders, wherever used should be secured or someone should be holding it tightly. Slipping from ladder can lead to serious injuries. Foldable ladders with support in the bottom and broad bottom is recommended.

19.5.18 Protection of eyes

If the manufacturing process carried on in any factory involves risk of injury to the eyes from particles thrown off in the course of the process or risk to the eyes by reason of exposure to excessive lights, effective screens or suitable goggles should be provided for the protection of persons employed on, or in the immediate nearness of, the process.

19.5.19 Rotary filters

Waste collecting units with a provision for filtering air by rotary filters should be provided wherever the cotton dust is being liberated in a big way like blow room and carding. The earlier system of collecting wastes in a cellar and cleaning them once in a week manually is now banned.

19.5.20 Reducing valves, safety valves, and pressure gages

Reducing valves, safety valves, and pressure gages should be maintained and got periodically calibrated. They shall be got audited by competent authorities periodically as per the rules prevailing in the state.

19.5.21 Housekeeping

Aisles and working spaces should be kept in good order without any obstacles and space for free movement of men and materials. A congested alley leads to accidents like the workers cloth or body touching the running parts of the machine, stepping on slippery materials, hitting another person coming in the opposite direction, and so on.

19.5.22 Lighting and illumination

Lighting and illumination shall conform to the safety and health requirements for the people working. The passages, materials stored and machines should be clearly visible, whereas the lights should not glare and harm the eyesight. Uniform and cool lighting without shadows are the requirement.

19.5.23 Oil cups

Oil cups shall be located to permit safe and easy access. They should be of the extension type to permit oiling while machines are operating.

19.5.24 Air changes

In all workrooms in which potentially toxic substances are used, the maximum allowable concentrations and airborne contaminants shall be maintained as per the Factory Act. The number of air changes required depends on the type of machinery being installed. Table 19.1 gives the recommendations for spinning mills.

Table 19.1 Recommended air changes per hour

Department	Number of Air Changes per hour
Blow room, drawing, combing and roving	15
Carding	20
Spinning	45
Winding	30
Twisting, packing	20

19.6 Preventing and handling fire accidents

Fire accident in textile mill is a nightmare for the industry. Numbers of well reputed mills were burnt down into ashes in fire accidents. The cotton fibre when in loose form catches fire very fast, and within no time the fire spreads. It is very essential that 100% of the staff and workers are trained for firefighting and first aid in a textile mill and educated to prevent fires. The fire accidents in textile mills can be grouped into four categories, viz. due to mechanical friction, due to electrical short circuits, due to negligence of staff and workmen and due to natural reasons.

19.6.1 Fires due to mechanical friction

There are number of incidents of fire accidents in a textile mill due to mechanical friction. In blow room, the chances of fire are very high and each fire is a major fire because of loose cotton fibres.

(a) We often get stone and metal pieces along with cotton. The stone pieces when hit the beater at a high speed, produces spark resulting in fire. This problem is more in cottons procured from old ginning mills with poor floor conditions. Providing gravity traps in blow room immediately after the bale breaker can remove the stone pieces.

(b) The metal pieces are another cause of fire. Providing magnets and frequent cleaning of the magnets is very important. In almost all blow rooms, magnets are provided, but there is no system of cleaning the magnets frequently. In number of cases magnets are provided in the top and worker cannot reach the magnet. It is of no use. The magnet should be visible and approachable so that workers can remove accumulated cotton and metal parts. Openable windows need to be provided, which have transparent acrylic sheets so that worker can see the accumulated cotton and remove the metal piece.

(c) Slack belt or a snapped belt driving the fan and air leakages leads to jamming of cotton on beater which is running. This results in a fire. Periodic checking of belts is very essential.

(d) There are cases of side leather linings wearing out in the condensers leading to jamming of condensers and to fire.

(e) Fire in the central waste suction unit is very common because of the fine micro dust jamming the screens, and if not removed properly by the waste strippers, goes back and jams. As normally no worker shall be there to monitor, and it is not possible for a human to control the fire when the wastes are moving in such a high speed, it is very essential to have fire detectors, fire diverting system and CO_2 flooding in blow room.

(f) In carding, if the feeding is more and the material is not collected by doffer, there shall be loading on the cylinder. Sometimes water drops falling on cotton also lead to loading on cylinder. If loading becomes more, there shall be friction between cylinder and flats resulting in fire.

(g) Improper settings causing wire points touching some parts like front plate or lickerin resulting in fires.

(h) Lapping of cotton on flat belts where flat driving pulleys are provided results in friction and high heat generation resulting in fires.

(i) There are cases of web breaking and going back on the doffer, resulting in jam between cylinder and doffer resulting in a fire.

(j) Lapping of fibres on the fluted rollers, especially while working viscose staple fibres on high speed draw frames, is one of the main reasons for fire in draw frame section. The lapping on fluted roller is difficult to remove. If the stop motion is working well along with the brake, this type of accidents can be prevented.

(k) Jammed bearings generate excessive heat. This can happen in any machine like blow room, card or even in ring frames. Bearing jams are due to micro dust entering the bearing and drying the lubricants. It is necessary to use sealed bearings wherever the chances of dust entering the bearing are there. Periodical checking of bearing is very essential.

(l) Spindle tape entangling on tin roller pulleys and bearings in ring frames is a common reason for fires in ring frame section.

(m) Poor quality lubricants dry the bearings fast and results in a fire. Hence, one should be very strict in approving the lubricants.

19.6.2 Fires due to electrical short circuits

This is a common reason for fire. Loose wires, low capacity cables and wires, wearing out of insulations on old cables, improper control of voltage fluctuations, improper selection of motors, sudden high voltage whenever the power is resumed after a power failure are common reasons. Added to that, improper ventilation for motors results in fires.

(a) The electrical lights and their wirings should be properly designed and enclosed. The problem is more with false ceiling, as there shall be dust accumulation on the sheets and it is not easy to clean them. The fire on false ceiling spreads very fast all over the production hall.

(b) In old factories, where cables are laid underground, machines are getting modernized and speeds are increasing the load on the cable increases. There are number of cases of cable bursting resulting in major fires. All cables should be laid in such a way that they are accessible and there should be a record of the cable capacity and the load given to that cable. As the cables become old, the insulation cracks and wears out due to heat and dryness. Periodic checking of cable condition is very essential.

(c) In case of complete mill stopping due to power failure and starting the machines on power resuming there are chances of high voltage in the first machine being started. The motor may burn or it may catch fire. Therefore, after the resuming of power, phone to electric department and confirm that the power is stabilized. The fires immediately after resuming power accounts for around 40% of the fire accidents due to electrical reasons in a textile mill.

(d) During monsoon season, because of high winds, trees may fall on the power line creating a short circuit and high voltage.

19.6.3 Fires due to negligence of workers and staff

Almost all reasons for fire can come in the category of negligence of the staff and workers. If the maintenance is proper, settings are proper, safety regulations are followed strictly, and the housekeeping is maintained well almost all fires can be avoided. There are number of bad habits leading to fire. Some common examples are keeping clothes, books and tiffin boxes on the control panels, keeping materials touching the electrical control panels, not maintaining the fire extinguishers, stacking materials near control panels, stacking inflammable materials near to wastes, smoking in banned areas, lighting lamps for making pooja in the production area and so on.

19.6.4 Precautions in case of fire

(i) Every factory should be provided with such means of escape in case of fire as may be prescribed in the act like having minimum two fire exits in each shed with wide doors leading to a safe place.

(ii) The doors affording exit from any room should not be locked. They should be easily and immediately opened from the inside while any person is within the room. All such doors, unless are of sliding type, should be constructed to open outwards. It is needed to clean and maintain such doors periodically so that they are freely opened in emergency.

(iii) Every door, window or other exit affording a means to escape in case of fire should be distinctively marked in a language understood by the majority of the workers. Such marking should be in red letters of adequate size or by some other effective and clearly understood sign.

(iv) An effective and clearly audible means of giving warning, in case of fire, to every person should be provided in the factory. Workers should be educated and trained to recognize the warning signal or siren.

(v) A free passageway giving access to each means of escape in case of fire should be maintained for the use of all workers in the factory.

(vi) Effective measures should be taken to ensure that in a factory all workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such a case.

(vii) It is better to prevent the fire than to fight it after it has started. Therefore, the first steps in fire planning must include machinery maintenance to assure that the machine will not start a fire by itself. Fire can start as a result of loose parts or poorly aligned bearings and shafts. If proper maintenance is practised, most fires of a machine origin can be eliminated. This not only includes alignment of parts, but also proper lubrication and careful attention to electric motors.

(viii) It is suggested to have fire drills at least once in 6 months and all workers need to participate. A safe assembling area to be marked and head count to be done when workers assemble there. The time taken for the people to come out from the time of siren is to be noted down.

(ix) All textile opener lines need to be equipped with magnetic separators, tramp iron separators, or other means for the removal of foreign ferrous material. This is very essential to prevent fire accidents in textile mills.

(x) CO_2 flooding system needs to be provided wherever cotton is being transported by pneumatic means.

(xi) Wherever cotton is transported by pneumatic means, fire detectors and fire diversion system should be provided along with CO_2 flooding system to prevent fire from spreading.

Ban on smoking: Entire factory area of all textile mills, garment factories, cotton ginning mills, nonwoven factories should be declared as "No Smoking Zone" as a preventive measure for possible fire accidents. No smoking sign board should be displayed at all prominent places in the factory.

Figure 19.5 Sign of banning smoking.

19.6.5 Training for first aid

First aid for a slight injury in case of an accident may often prevent a serious one, or save life. First aid is not intended to take the place of a physician's services. Whenever there is a serious injury, a doctor should always be summoned. There are times when a few minutes' delay may mean the loss of a life. Therefore, it is necessary to train and educate all staff and workers for first aid.

20
Wastes in spinning

20.1 Definition and characterization

The general definition of waste refers to rubbish, trash, refuse, garbage, junk or litter, which is unwanted or cannot be used. Waste is linked to people development. Litter refers to waste disposed of improperly. In spinning industry, we normally talk of wastes related to product like hard wastes and soft wastes. Wastes are separated from the raw materials procured by us. While removing wastes, some good materials also go along with waste. It is very necessary to control good fibres going as waste and ensure that only unwanted materials are taken out as wastes, as the raw material costs are very high. Higher internal rejections, extracting higher wastes need not result in good quality product, but they definitely add to the cost. It is therefore very necessary to understand what is to be generated as waste and monitor it:

There are various definitions for waste. Some of them are as follows.

- **Use to no purpose**: If something is not serving the purpose, it is a waste. For example, a good combed yarn when a woman wanted to mop the floor using it.
- **Inadequate result**: If something is not capable of giving the required result, it is a waste. For example, an improperly prepared rove when fed to a high speed spinning machine, instead of getting 92% efficiency you may get 85% and make a loss.
- **Spending excessively**: To get good results people get good raw materials by spending more. If one takes good Shankar 6 cotton for spinning carded Ne 10s for making a car cleaning cloth, it is a waste.
- **Fail to use**: In number of cases we purchase some materials with an intention of using, but that time never comes. We may purchase ring travellers to run counts Ne 40s to Ne 60s, but we are getting orders from Ne 20s to Ne 30s.

- **Without effect**: We increased the speed to get more production but resulted in low efficiency and poor quality, and the amount realized is lesser than what we were getting earlier.

20.1.1 Anything for which customer does not pay is a waste

You may spend for decorating a product with good designs on the cartons, polybags, etc., but customer is bothered only on the quality of the product given to him. Whatever you do should benefit the customer, and he should be willing to pay for it, otherwise, what you do is a waste.

Wastes are of different types as explained below.

- **Material wasted** – May be raw materials or accessories spoiled due to poor quality or handling, more lubricants used than required or spilled out, packing materials damaged or remaining unused due to markings or damages, finished materials getting rejected or left unsold, material purchased but not utilized or materials of any type. If we take 100 kg of cotton and make a sample mixing and produce 20 kg of yarn and remaining is kept as sliver, lap or bobbins, which was never used is a waste of raw material.
- **Money wasted** – Money spent but the results were not achieved or spending more money than what would have been sufficient.
- **Time wasted** – Spending more time for a job than what was actually needed, not taking a decision in time and losing an opportunity, conducting meetings/discussions for hours together without coming to a conclusion are examples of time wasted.
- **Efforts wasted or overdone** – Putting more efforts than required, making more advertisements, putting slogans, conducting seminars and conferences without getting the anticipated results are examples of efforts wasted. In some mills, same yarn is inspected three times to ensure that quality is good; by inspecting more times, the quality cannot improve. It remains as it is. Hence additional inspection is a waste.
- **Infrastructure wasted or underutilized** – Not utilizing the facilities available like well-built testing laboratory, integrated information systems, a library with many useful books and articles, recreation facilities to keep the mind and body healthy, etc.
- **Potential unexplored** – Highly intelligent and competent people are given no responsibility and made to work at a lower level keeping a less competent person above him, not understanding the facilities available in the machine and using it only for some commodity materials. A ring frame may be having slub attachment, but we never used it.

20.2 Process wastes and product wastes

Wastes in spinning industry are normally grouped as Process Wastes and Product Wastes. Process wastes are inevitable wastes during process like the trash and short fibres removed to spin the yarns. Product wastes are defective materials produced, excessive materials produced and surplus materials fed than actual requirement to get uniform product. Following are some examples.

Process Wastes	**Product Wastes**
Blow room droppings, micro dusts extracted	Lap bits in blow room
Flat strips in carding	Sliver wastes in carding
Lickerin and cylinder droppings	Web wastes
Comber noil	Sliver wastes in combers

20.3 Avoidable and unavoidable wastes

The wastes can be further classified as avoidable and unavoidable wastes. By meticulously working out the lap length and weights fed for combers considering the noil percent and the can capacity, we can avoid wastes.

By maintaining stop motions properly one can avoid generation of the avoidable wastes. In draw frames a good stop motion not only prevents sliver being wasted, but also prevents damages to the machine. If stop motion does not work in time, there may be lapping and breakdown of machine parts, and sometimes may lead to fire accidents, especially in case of staple fibres. Setting the brake application time is very important not only to avoid breakdowns, but also to maintain good quality.

In case of spinning cotton, as the cotton has some trash, we need to remove it; along with that around 1% lint is also taken out as wastes. In case of staple fibres like viscose or polyester, there shall be no trash or short fibres. In spite of that, when we open the bales and card them, some fibres are removed as wastes, which is unavoidable.

It is not possible to avoid all the wastes, but can reduce. While attending a broken yarn, normally some yarn is taken out in winding to ensure that good yarn is knotted or spliced, but not taking more yarn than required is very important to avoid waste.

In general, the product wastes are avoidable and process wastes are unavoidable.

20.4 Non-value adding activities

We do number of activities without adding any value. We transport materials like laps, slivers, bobbins, cans, etc., from one place to another by employing men or mechanisms, which cannot add value to the material. It is essential to transport draw frame cans to speed frame, but it does not add value. If we are good in planning and arrange the programme in a way that the distance travelled is less we can avoid some non-value adding activities.

In earlier days, it was a practice to go to each machine and noting the counter readings in order to work out the machine production and efficiency. Now the machines are provided with electronic data storing system and the spinning master can verify the data at any time. Even then in number of mills, the practice of personally noting the counter reading is in practice. In addition, there are systems of taking hourly readings and reporting to boss.

In a number of cases, it is seen that people take printout from the machine, but do not analyze. The papers are filed nicely in a file, only to show to auditors that papers are being filed properly.

In traditional manual winding machines a single shaft runs carrying 60 drums, and for maintenance works full side needs to be stopped. In recent automatic machines, each drum is independent and they can be serviced without stopping the next drum. In spite of that facility, it is seen that the maintenance persons stop 5 drums or 10 drums at a time for maintenance, whereas they will be practically working on one drum at a time.

Numbers of security personnel are appointed to check the persons coming in and going out. They check the pockets of some workers but get tired in a short time. In a number of cases, they are instructed to check the dickey of the cars, but they do not check the bag kept on the seat by the side of driver. Finally, the purpose of employing them is not achieved.

20.5 Soft wastes in spinning

Soft wastes are generated before spinning. Once the fibres are twisted and converted into yarn, there shall be no soft wastes, but may be some dust liberated going as invisible wastes.

- In blow room, if there is any jamming, we get cat's tails where fibres are entangled. This can be put back in the mixing in small quantities, as this cannot be taken forward due to its high entanglements.
- While starting a scutcher, and at the time of running out, we get uneven lap bits, which are again put back in the same mixing.

- If the laps are overpressed, it may not open up properly while feeding to cards, and we get lap licking problem. The lap licking is also found when the humidity is very low. In such cases, the bad laps are taken out, broken into small pieces and fed back in the mixing.
- While feeding a lap to the card, about ¼ m of lap is taken out as it will be normally folded and of high density. This waste also can be put back in the same mixing.
- In case of breaks in carding we get wastes in the front, may be in the form of web or as sliver. If it is sliver, it should be broken into small pieces before putting back in the mixing. We need to control the percent of sliver and web wastes put back, as they shall lead to more neps in the yarn.
- The web breaks in carding are mainly due to damaged doffer, waste accumulation in the sides resulting in balls and then breaking, higher tension draft between doffer and calendar, worn out gears resulting in cuts, improper pressure on the crossrol roller, damaged trumpets leading to frequent choke ups, disturbances due to air currents, very low humidity resulting in web flying up, very high humidity resulting in web sagging, and wax depositions in coiler tubes.
- In draw frames we get sliver wastes and web wastes. These are more delicate compared to sliver wastes got from carding. The results for breakages in draw frames are improper humidity, bad surface of the rubber rollers, improper setting of clearer strip, improper pressure on the drafting rollers, worn out gears, loose belts, doubles or singles from the back, improper roller setting leading to bunches, wax deposition on drafting rollers, wax deposition in coiler tube, and bad carding material.
- In combers, we get noils, which contain mainly short fibres. Although the noils are reusable, it cannot go to same mixing. It shall be used in a lower mixing.
- The noils are extracted with a view to get certain quality of yarn, however, improper settings and improper preparation of lap can lead to higher noils and also higher breaks and sliver wastes.
- Combers are very sensitive to humidity. Variation in temperature and humidity results in sliver breaks. Other factors contributing for breakages are poorly prepared lap, improper cleaning by brush resulting in bunches coming back, rough table, over parallelization of fibres, improper tension drafts, improper trumpets and improper buffing of detaching rollers.

Roving end wastes

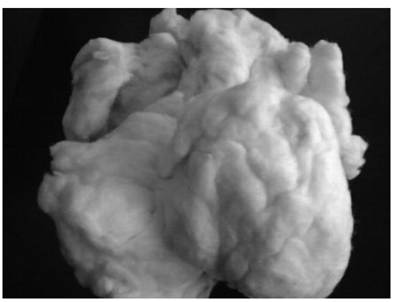
Comber noils

Sliver wastes

Figure 20.1 Different soft wastes.

- In speed frames, we get sliver wastes at the time of can running out or in the event of sliver breaks. In the front, we get roving wastes and the suction wastes. The roving ends cannot be put back in the mixing. They need to be opened in a roving end opener and used in a lower mixing. The suction wastes are also used in lower mixing.

- Roving end wastes are mainly due to improper build of bobbins which makes bobbin unusable. Improper fitting of the bobbins, improper setting of taper and traverse are the main reasons for improper build. If bobbins are kept in stock and not used for a long time, the bobbins become soft and hence not useable. In ring frames, while a count is running out, some layers of the bobbins shall be wasted as running a ring frame with very few spindles is not economical. The breaks at speed frame also contribute for waste, but the quantity is not high.
- In ring frames, we get roving end wastes and suction wastes. If there is lapping on rollers, that waste is termed as bonda. These wastes are reusable, but preferred to use in a lower mixing.
- If the speed frame bobbins are badly built, or the bobbins have become soft, the materials shall be taken out as roving wastes.
- Soft wastes can be reduced by maintaining good working, attending to breaks immediately, maintaining the springs and spring plates in the cans, having effective stop motions, and developing good work practices of material handling.
- Waste handling is also important to get more realization from the wastes. By throwing wastes on floor, they become dirty and go as sweeping wastes and price realized is very low compared to collecting the wastes and putting them in proper bins or bags. Therefore, it is necessary for all workers to wear a waist bag and put all the wastes in the bag.



Pneumafil wastes in spinning (suction box waste)

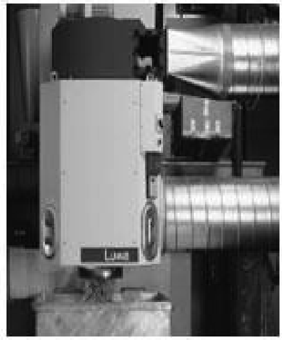
A sider putting wastes in waist bag

Figure 20.2 Putting wastes in waist bag.

Now centralized waste collection units are common for blow room, carding, combers, which collect the wastes at regular frequency and compact them into bales. This avoids wastes getting missed and also requires less manpower to handle the wastes.

 Centralized waste unit collect wastes from different machines in blow room	 Rotary filer filters the air and separates fibres
 Dust separator with screw compactor	 Bale press presses the wastes into compat bales
 All cards are connected to centralized waste collection unit	 Primary screen filter adopts a rotary filter and continuously filter the air and separated wastes from air

Fibre separator and compactor compacts the wastes and make it easy for handling



Waste separator and compactor for small quantities of wastes

Automatic panel filter for exhaust air containing dust and fibres

Fibre separator compactor

Cotton wastes paked in bales

Cotton wastes in loose form

Figure 20.3 Different systems of waste handling.

20.6 Controlling generation of process wastes

In spinning preparatory machines, there are provisions to control the generation of process wastes.

- Amount of waste extracted in blow room is mostly determined by the trash level in cotton. Cleaning efficiency of about 60% in cottons with high trash content and 50% in cottons with low trash level can be considered to be quite satisfactory in modern blow room lines, whereas in old lines cleaning efficiency of 65% is normal.
- In blow room, droppings can be controlled by changing the angle of grid bars and distance between grid bars. If the distance between grid bars is kept less, the droppings will be less. By increasing the suction speed, the materials will move fast and droppings shall be less, whereas micro-dust extracted may be more.
- While opening the fibres thoroughly by using bale pluckers, the impurities fall down easily without lint loss, whereas with hand opening and feeding system, the lint used to be adhered to the impurities and waste extracted was more.
- When bladed beaters or striker beaters are used, the opening shall not be as thorough as in pin beaters, and hence lint loss shall be more with those beaters.
- Presently, many mills are using Automatic Waste Evacuation System (AWES) in blow room, cards and combers, which removes wastes from machines either continuously or intermittently. This system not only reduces the manpower required to collect and transport wastes but also helps to control the incidence of fly and fluff generation in these departments and improves yarn quality, particularly short thick faults.
- In carding, by modifying the settings, the wastes can be controlled. By increasing flat speed or by having a closer setting between cylinder and flats, the flat strip wastes can be increased. Similarly by keeping a wider setting between front plate and the cylinder, the flat strips shall be increased.
- By adjusting the angle of mote knife or by adjusting the lickerin undercasing settings, the lickerin dropping can be changed. If fibre retriever space is increased we get more droppings. Similarly by changing the settings between cylinder undercasing and cylinder, the cylinder droppings can be varied.
- The machines having continuous waste evacuation system extract more wastes than the machines with manual waste removal, as there shall be chocking of the screens and wastes shall not be dropping.

The wastes shall drop more when the screens are clean. In case of continuous waste evacuation, as the screens are always kept clean more wastes are extracted and we get clean material.

- Waste extracted in cards is usually in the range of 4–7% depending upon the trash content in feeding material, type of card and mixings. Between same type of cards and mixing, the waste % should not vary more than ±0.5% from the average. The card waste is also governed by the cleaning efficiency achieved in blow room. Thus, while assessing the waste, combined waste extracted in blow room and cards should be taken into account. The combined cleaning efficiency will be generally in the range of 94–98%.
- In combers, the noil extraction can be controlled by setting the feed, the distance between nippers and detaching rollers and penetration of top comb. It can be varied from 12% to 24%. Generally, all cottons respond well to combing for noil extraction up to 16%. For levels beyond 16%, the law of diminishing returns operates and the improvement in yarn quality is not commensurate with the additional cost of production. Higher levels of waste should be extracted only in such cottons where combing performance is satisfactory or where the end use requires yarns of very high quality. Under good working, for every 1% increase in comber waste, yarn lea strength will increase by 1% and evenness is expected to improve by 0.15 U%. Variation in noil % between combers must be maintained within ±0.5% and between heads it must be within ±1.5%.

20.7 Hard wastes in spinning

Cotton yarn wastes (hard wastes)

Hard wastes are produced after the fibres are twisted. While piecing a broken end or when a spinning bobbin is damaged or poorly built we get hard wastes in spinning. The hard wastes generated while piecing a broken end cannot be used for spinning. These hard ends normally get contaminated with suction wastes and bonda, and hence it is needed to clean the wastes and separate hard ends.

Figure 20.4 Hard wastes.

In case of damages to spinning bobbin or when bobbin is loosely built, we get slough off wastes, which are not useful, except for cleaning machine parts. Some mills have a system of sending the hard wastes to hard waste opener and retrieve the fibres back and use in a lower mixing, especially for spinning coarse yarns using rotor spinning technology.

Yarn waste in a spinning mill should not normally exceed 0.4% with conventional cone winding. In case of automatic cone winding, the yarn waste generally varies from 0.5% in winders fitted with magazine feed to 0.8% in winders with auto bobbin feed system. However, if the yarn undergoes additional processes in post spinning such as reeling, doubler (assembly) winding and TFO twisting or ring twisting, the waste would be somewhat higher.

Sweep waste in all the departments of a spinning mill together should be within 1%. A high sweep waste arises invariably due to operatives throwing away the wastes like roller waste, lap bits, sliver bits, roving ends, etc. on the floor and generation of fly and fluff. The fly frame and ring frame tenters should be provided with hip bags (waist bags) and it should be ensured that the roller waste and roving ends are deposited in the bags after piecing the broken ends. Good waste, if any, should be picked before sweeping instead of sorting out the waste later. A high price fetched for sweep waste would give an indication of the presence of good fibres in the waste.

20.8 Invisible wastes

Normally all the wastes generated are weighed and the total weight of yarn produced and the cotton issued are tallied. We normally find that the total weight of yarn produced plus wastes collected shall be less than the weight of cotton fed. It is mainly because of some fibres and dusts mix up with exhausting air and goes off. Also the fibres loose moisture while working on the machines due to heat and air currents. Normally up to 1% invisible loss is accepted.

Invisible loss in a spinning mill occurs due to number of factors such as short fibres (fluff) escaping from the departments, improper accounting of wastes produced, weighment errors in cotton purchased and wastes sold, excess give away of yarn and inaccuracies in the estimates of stock held in process.

There are occasions that fibres from one mixing get migrated to other due to mistake. The problem is mainly in useable soft wastes. In modern systems, where centralized waste extraction units are provided, it is practically not possible to separate the wastes as per mixing. Whenever there is a doubt, people use the wastes in lower mixings to avoid quality problems. Because of this we find more invisible loss in higher mixings, which are very costly.

20.8.1 Visible wastes

- The waste materials can be seen, collected, weighed or measured and accounted.
- The visible wastes include saleable wastes like droppings, flat wastes, comber noils and hard wastes, and reusable wastes like jammed cottons, lap bits, sliver wastes, web wastes, suction box wastes, bonda and roving end wastes.

20.8.2 Invisible wastes

- The wastes escape into atmosphere, cannot be seen or collected. It happens during the micro dusts extraction at blow room, carding, air sucking out by return air ducts of humidification plants and while filtration of wastes from centralized waste collection units.
- Accounting is done by indirect way of accounting the good materials and comparing with the consumption.
- Loss of moisture while spinning is one of the major contributors for invisible wastes.
- Migration of wastes from one mixing to another contributes for invisible losses in a particular mixing.
- While cotton bales are opened some fibres cling to hessian and other packing materials, which cannot be weighed and accounted. But it is considered in the tare weight of the bales. But normally people do not weigh the hessian and bale hoops, but deduct a standard weight from each bale.
- Improper accounting of production and wastes by the supervisors and clerks is one of the main reasons not only for invisible loss but also for invisible gain. It may be improper weighing or entering data in different account.

Keeping wastes at non-designated place leads to improper accounting, leading to higher invisible losses

In Figure 20.5, we can see some hard wastes kept on packed cartons in yarn godown. This is done to avoid showing of more hard wastes as generated by a particular work area in production

Figure 20.5 Keeping wastes at non-designated place.

20.9 Yarn realization

The cotton accounts for nearly 65–70% of the yarn cost. It is therefore essential to convert cotton into yarn as fully as possible. However, due to the presence of micro dusts, trash and short fibres, all cotton cannot be converted into yarn. In the economics of a spinning mill, yarn realization plays a significant role. If we take the prevailing cotton cost and yarn selling price, even a 1% improvement in yarn realization would lead to a saving of Rs. 20 lakhs per year for a 30,000 spindle mill manufacturing 40s yarn.

The percentage of cotton realized as yarn is termed as yarn realization. If we feed 100 kg of cotton and get 87 kg of yarn, then the yarn realization is 87%. The method of working out realization is as follows.

Opening stock of raw materials in mixing –	A
Opening stock of materials in process –	B
Cotton received from godown –	C
Closing stock of material in process –	D
Closing stock of mixing in stock –	E
Total yarn produced –	F

Cotton consumed = Opening stock + Cotton received − Closing stock

$= (A + B + C - D - E)$

Realization = (Yarn produced/Cotton consumed) × 100 = (Yarn produced × 100)/(Cotton consumed)

$= F \quad 100/(A + B + C - D - E)$

Normally we get 84–88% realization in carded counts and 74–78% in combed counts. The mills having waste opening plants and rotor spinning system or DREF, recover lint from saleable wastes like flat strips, and make full use of comber noils in spinning coarse counts, and achieve realization up to 90%. In case of spinning staple fibres, a realization of 97% and above is demanded.

Yarn realization (YR) is largely governed by the level of trash in cotton, expected yarn quality and type of machinery. Achievable yarn realization can be obtained using the following formulae as given by SITRA.

A. *For mills reusing the entire usable wastes in the same mixing*

YR (%) = 97.5 − t − Wk − Wh for carded counts

And YR% = [(100 − t − Wk)(1 − Wc/100)] − Wh − 2.5 for combed counts

B. *For mills not reusing the usable wastes in the same mixing*

YR (%) = 97.5 − t − Wk − Wh − Wu for carded counts

And YR% = [(100 – t – Wk) (1 – Wc/100)] – Wh – Wu – 2.5 for combed counts

where t = trash in mixing (%); Wk = card waste (%); Wc = comber noil (%); Wh = yarn waste (%); Wu = usable waste (%).

For example, for t = 3%, Wk = 7% and Wh = 0.5%, the expected yarn realization is 87%. In the above case, if the mill produces combed yarn with a noil extraction of 18%, then the expected yarn realization will be 70.8%. In both the cases, it is assumed that the mill would reuse the usable wastes in the same mixing.

While working out realization, the useable soft wastes produced are considered as raw material in process stock.

For estimating the stock in process, normally the machines are made bare in blow room, carding, draw frames and combers and only full cans and full laps are kept for counting. In speed frames and ring frames, as making the machines bare shall be very expensive, the number of cans and bobbins working are considered as half full and the stocks are worked out. For example, if a speed frame has 120 spindles and average weight of sliver in can is 16 kg, it is considered as ½ × 16 × 120 kg. The ring frame cops and cones are actually weighed.

The exercise of working out the yarn realization is normally done once in a month by taking process stocks at the end of the last working day of the month. The supervisor in the shift ensures that as and when the machines are running out at the end of the shift, they are made bare and keeps full laps, full cans, full bobbins, etc., in an orderly manner so that they can be counted by the stock taking personnel.

The norms for wastes given by SITRA are given in Tables 20.2 and 20.3.

Table 20.2 Norms for process waste and invisible loss

Type of waste	**Norms (%)**	
Blow room droppings	Same as trash in cotton	
Gutter/filter waste	1.0	
Card waste (modern cards)	20s–40s	7.0
	Above 40s	6.0
Sweep waste (a)	1.0	
Yarn wastes (hard wastes)		
Conventional cone winding	0.1	
Doubler winding	0.1	

Ring doubling	0.1	
TFO twisting	0.1	
Auto winding	with magazine feed	0.5
	with auto feed	0.8
Invisible loss	0.5	
‘a’ includes suction fan wastes of draw frames, fly frames and humidification plant.		

Table 20.3 Norms for usable waste (%)

Type of waste	Lap feed	Chute feed
Lap bits and card web	0.7	0.2
Sliver waste in drawing and fly frames	0.5	0.5
Waste at comber preparatory and combers	1.0	1.0
Roving ends	0.3	0.3
Pneumafil wastes (ring frame)	2.5	2.5
Total	5.0	4.5

20.10 Some novel ways of getting high returns from wastes

The fibres may get dirty during transportation due to various reasons and such fibres need to be taken out. When cotton bales are opened, we find rust marks, stains, mud, etc., on the fibres which are in the surface, and they are removed by hand. As the quantity shall be very less for a spinning mill to process and reuse such fibres, the mill normally sell it out to waste merchants. After accumulating workable quantity, these cottons are opened in a waste opener, washed and bleached, carded in a slow speed card and made into sliver. It is used in making decorative items especially during festivals, preparing pooja materials like wicks for oil lamps (nanda deep), aarati, etc. The selling prices of these materials are nearly 40–50 times more compared to selling of yarns. Hence all should make efforts to collect the wastes and make them worth.

	Cotton with contaminations is salvaged from cotton mixing. They are separated from good cottons. As the cottons taken out are already opened while picking, there is no need of any opening machine. Such cottons are carded. In case of very small quantities hand carding is practised. If there is sufficient quantity, the carding machines of roller and clearer type is used and cotton is carded
 Hand carding brush with fillets	 Hand carding machine
 Roller and clearer card	 Hand carded cotton

Figure 20.6 Retrieving cottons from waste.

The cottons are also salvaged from process wastes generated during spinning like blow room dropping, card droppings and flat strips by using a waste opener. The cottons such recovered shall normally be of small length and not suitable for spinning medium or fine counts, and hence are normally used in open end spinning for very coarse counts. Alternately, these cottons are used for stuffing pillows, beds, dolls, or preparing wicks for nanda deep or aarati during performing pooja.

Cotton in doll making

Cotton wick in nanda deep

Easter eggs stuffed with cotton

Cotton wick for managalaarati

Decorating with recycled paper and cotton

Cotton ball as flower plug.

Carded sliver for decoration by using Nuno felting technique.

Figure 20.7 Novelty applications.

The yarns damaged due to various reasons are made as waste. In spinning ring cuts and double gaiting by doffer can create too many breaks in winding. Such cops are rejected by winding machine. Such yarns can be recovered by running them on a hand reel and hanks can be made. They can be hand dyed and used for making decorative fabrics using a handloom or a sample loom. Some examples are shown in Figures 20.8 and 20.9.

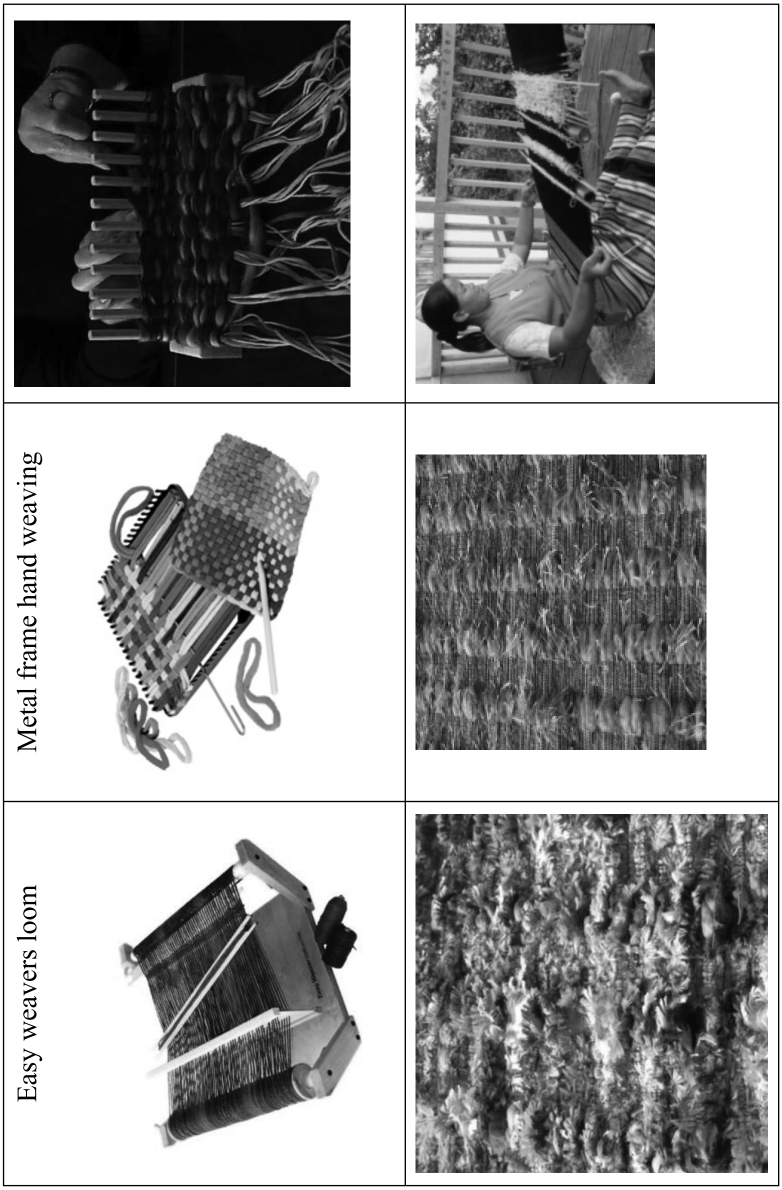
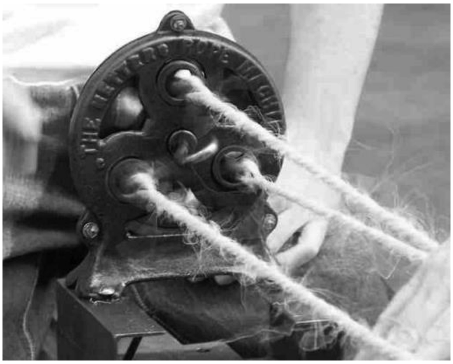
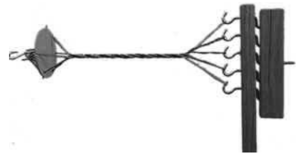


Figure 20.8 Hand weaving producing novelty from wastes.

The grey yarns and sometimes even dyed yarns salvaged from mills are used for making ropes and twines. For that purpose, number of cops or cones (bottoms only) are combined together and reeled out, and then twisted by hand machines.





Rope making

Figure 20.9 Rope making.

The technicians need to observe what is happening outside and go on thinking how best their products can be used, including the wastes so that the mills can make more profits.

21
Maintenance practices

21.1 Purpose of maintenance

(a) Maximizing the service life of all machinery and ancillary equipments.

(b) Assuring optimum availability of installed machinery.

(c) Minimizing the working costs; reducing consumption of power, spare parts and lubricants while maintaining productivity and quality.

(d) Ensuring safety of people in and around the company premises.

(e) Enabling highest production rates with consistent good quality.

(f) Ensuring minimum incidents of faults in yarns produced.

21.2 Types of maintenance

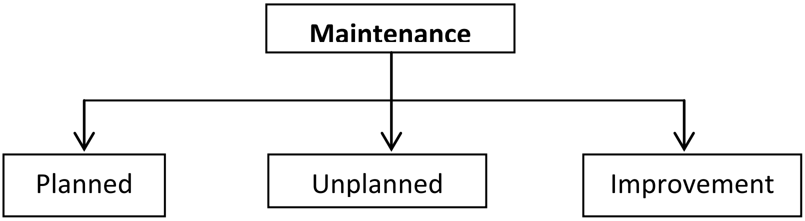


Figure 21.1 Three types of maintenance.

21.2.1 Planned maintenance

Planned maintenance aims at eliminating breakdowns and disruptions, and to achieve stability and optimum capability. It has different activities, viz. Preventive Maintenance, Condition Monitoring, Machinery Audit, Recording and Analyzing.

(a) **Preventive maintenance:** This is a planned maintenance incorporating cleaning and lubricating the machine parts, checking and detecting weak points and correcting them, and replacing the parts considering its life and condition. The frequency of cleaning, lubricating, checking and replacing various parts might have different schedules depending on the type of activity, the load being applied, the condition at which the machine works and the materials being processed. The planning may be done on different time basis like daily, weekly, fortnightly, monthly, quarterly, half yearly, yearly, and so on.

(b) **Condition monitoring**: Wherever it is possible to identify deterioration of a part by observing the machine in working or by testing the quality of output, this system can be adopted. For example by monitoring the neps in the card web, the grinding of card wires can be taken up. Condition of bearings can be checked while the machine is working by using a stethoscope or checking the temperature of the area or listening to the noise level or observing the leakage of oil or grease from the sides or observing the vibrations in creel or machine body. Following three requirements need to be fulfilled for the use of Condition Monitoring system.

(i) The rate of deterioration must be slow enough to permit detection of failure development, and then to make use of the result to plan and rectify the fault before failure occurs.

(ii) The deterioration process must exhibit sufficient and detectable change in relevant condition parameters.

(iii) Proper measuring equipment and tool along with adequate competence is essential to detect and interpret the condition.

Condition monitoring is an intelligent and efficient tool for making need based planning for corrective action before a failure. One or more suitable measurements, which are sensitive to component deterioration, are selected, and then regular readings are taken. The trends are analyzed. Any deteriorating trend observed triggers the action. This system is more useful for spinning machinery where there is progressive deterioration of parts like card wire points, the flexible bend in cards, the rubber cots, rubber aprons, rings, travellers, spindle tips, fluted rollers, and so on.

(c) **Machinery audit:** This involves thorough checking of the machine parts by a third person while the machines are taken for routine cleaning or maintenance operations or while the machine is working. It helps in early detection and prevention of mechanical fault. Machinery audit should generally cover the following aspects.

(i) A critical review or current maintenance programme such as method of operations, maintenance schedule, inspection procedure, staff employed and organization.

(ii) A detailed investigation of the machine condition in different areas like machine alignment, wear and tear of components, damages, etc.

(iii) General aspects relating to maintenance tidiness, housekeeping, tools and equipments used.

(d) **Recording:** Suitable record keeping is essential for forecasting and preventing the deterioration of machines and parts. Following records are recommended for spinning mill maintenance.

(i) Machine history – This record should indicate the machine manufacturer name, machine serial number (manufacturer's serial number as well as the serial number allotted by the mills), date of installation and the dates on which major spare parts were replaced.

(ii) Schedule register – This should indicate the planned schedules of different maintenance activities, the actual date on which the activities were carried out, the reasons for delay, the rescheduled dates with the approval of the concerned.

(iii) Corrective action register – This register is maintained for analysis of breakdown and quality deterioration. For each breakdown or quality deterioration detailed analysis is to be done and root cause should be pointed out. What actions were taken to prevent that breakdown or deterioration in quality is to be specifically recorded and instructions are to be written as to how such a situation in future is to be tackled. All people in maintenance and people involved directly in the production activities of the machines are to be educated. Check points need to be introduced and responsibility for checking those points are to be assigned appropriately.

(e) **Analyzing:** Analyzing to ensure effectivity of maintenance is very important. The purpose of analyzing is as follows.

(i) To uncover any special needs for the system for streamlining the performance of maintenance.

(ii) To identify tools and remedies necessary for improved performance.

(iii) To assist in determining the overall effectiveness of maintenance efforts.

(iv) To help for planning subsequent maintenance schedule in a better way.

Normal measures for expressing the effectivity of maintenance are as follows.

(i) Machine availability (A) percentage for production, i.e. lower time lost for maintenance and breakdowns.

(ii) Mean time to prevent maintenance (MTPM), i.e. the average time between successive preventive maintenance stoppages for a particular mechanism or function. More the time, better is the maintenance.

(iii) Mean time between breakdowns (MTBB). More the time, better is the maintenance.

(iv) Cost of maintenance. Lower the cost better is the maintenance.

(v) Reduction in consumption of power for given rate of production (U kg).

(vi) Quality of product output, for example, neps per gram in card sliver, imperfections in yarn, etc.

21.2.2 Unplanned maintenance

This is also referred as breakdown maintenance. Breakdown occurs due to various factors listed as follows.

(a) Premature failure of a component.

(b) Gradual wear and tear of parts.

(c) Unforeseen obstruction to moving parts.

(d) Drying up of lubricants leading to wearing of parts.

(e) Excessive load applied than the capacity of the machine.

(f) Water leaking on the machine parts leading to jamming of cotton.

(g) Lapping on rollers with cotton or yarn.

(h) Screws, nuts and bolts not secured tightly and becoming loose while working.

(i) Improper alignment of rollers, pulleys, bearings, shafts, etc.

Apart from breakdowns, the machines are also stopped and unplanned maintenance works done in case of count changes, mixing changes and for correcting the machines in case of poor quality or deviations in quality.

21.2.3 Improvement

There is a need for improvement at all places so as to remain competitive. This improvement should be continuous. Continuous improvement is a culture in good organizations. It can be implemented by a gradual move, where continuous monitoring and diagnosis help in devising new systems and methods for continuous improvement. A four phased approach as suggested by Neeraj Nijhawan is as follows.

Phase	Approach	Description
1	Forced deterioration	Lack of routine maintenance
2	Natural deterioration	Periodic preventive maintenance is implemented, efforts put in cleaning, inspecting, etc
3	Machine redesign/ improvement in restoring, avoid deterioration	Abnormal conditions are identified and appropriate action taken to prevent deterioration
4	Improved diagnostic technology	Machine conditions are monitored constantly so that on line maintenance is carried out

21.3 Total productive maintenance

Total Productive Maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems through the machines, equipments, processes and employees that add business value to the organization. It focuses on keeping all equipment in top working condition to avoid breakdowns and delays in the manufacturing process. The main objective is to increase the productivity of plant and equipment with a modest investment in maintenance while involving all people working on the machines, including maintenance, quality and production personnel. This helps in enhancing the volume of the production, employee morale and job satisfaction. TPM brings maintenance into focus as a necessary and vitally important part of the business. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum. The main objectives of TPM are as follows:

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.

- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non-defective.

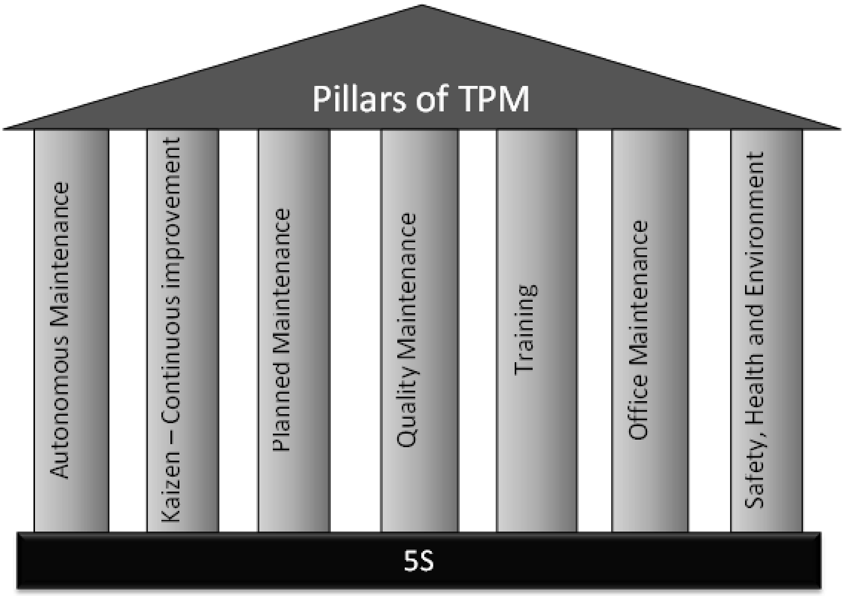


Figure 21.2 8 Pillars of TPM.

There are eight pillars for successive implementation of TPM, out of which 5S is the base.

5S concentrates on sorting and removing the unwanted materials and activities, arranging the required activities and materials in sequence, maintaining cleanliness, standardizing and following it on regular basis with self-discipline.

The second pillar, Autonomous Maintenance is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

The third pillar Kaizen is aimed at reducing losses in the workplace that affect efficiencies, by following a culture of small but continuous improvement.

The fourth pillar, Planned Maintenance is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction.

The fifth pillar, Quality Maintenance is aimed towards customer delight through highest quality through defect-free manufacturing.

The sixth pillar Training is aimed to have multi-skilled revitalized employees whose morale, is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill.

The seventh pillar concentrates on Office TPM, which is a must to improve productivity, efficiency in the administrative functions and identify and eliminate losses. Without maintaining office properly, it is not possible to demand maintenance from shop floor.

The eighth pillar focuses on creating a Safe Workplace and a surrounding area that is not damaged by the process or procedures. This pillar will play an active role in each of the other pillars on a regular basis.

The steps involved in the implementation of TPM in an organization are initial evaluation of TPM level, Introductory Education and Propaganda (IEP) for TPM, formation of TPM committee, development of master plan for TPM implementation, stage by stage training to the employees and stakeholders on all eight pillars of TPM, implementation preparation process, establishing the TPM policies and goals and development of a road map for TPM implementation.

The steering committee should consist of senior management executives like production managers, maintenance managers, and engineering managers. The committee should formulate TPM policies and strategies and give advice. Lack of top management commitment, lack of middle management support and employee resistance to change, as well for the status-conscious and hierarchy-bound middle level executives lacking initiatives are the main barriers against succeeding.

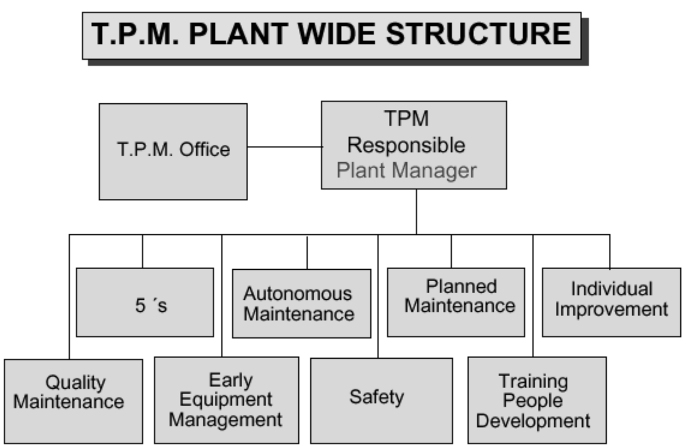


Figure 21.3 Structure of TPM.

Total Productive Maintenance concentrates on reducing the six preventable losses, viz.

1. Breakdown losses caused by the equipment
2. Set-up and adjustment losses
3. Minor stoppage losses
4. Speed losses
5. Quality defect and rework losses
6. Yield losses

The first two losses affect the availability of a piece of equipment, the third and fourth losses affect equipment efficiency, the fifth loss results in reduced quality from output and the sixth loss increases the cost and reduces profitability.

The effectiveness of Total Productive Maintenance is expressed as Overall Equipment Effectiveness.

OEE = Availability * Performance Rate * Total Yield (Quality) Rate

$$\mathrm{OEE} = A \times \mathrm{PE} \times Q$$

A – Availability of the machine. Availability is proportion of time machine is actually available out of time it should be available.

A = (MTBF – MTTR)/MTBF.

MTBF –"Mean Time Between Failures" = (Total Running Time)/Number of Failures.

MTTR –"Mean Time To Repair".

PE – Performance Efficiency; It is given by RE × SE.

21.3.1 Rate efficiency (RE)

Actual average cycle time is slower than design cycle time because of jams, etc. Output is reduced because of jams.

21.3.2 Speed efficiency (SE)

Actual cycle time is slower than design cycle time, machine output is reduced because it is running at reduced speed.

Q – It refers to quality rate, which is percentage of good parts out of total produced sometimes called "yield".

21.4 Spare part management

One of the major problems for a maintenance person is not getting the required spare in time, although the store shelves are full with number of spares. The word spare or spare part is used as a general term for indicating all kind of items needed for maintenance including spare parts of the machines, accessories used on the machines, lubricants and miscellaneous items such as emery paper, chalk powder, hard wastes, brooms, brush, and so on. As the number of items and the varieties are very high, planning and maintaining a store for spare is much complicated compared to managing a warehouse for raw materials. There are several thousand items each with different specification for different behaviour in terms of consumption rate, etc., if any technique is applied blindly without consideration of the nature of their behaviours, a mill could end up with huge stocks of non-moving items. Indenting spares to be on a safer side increases the inventory and block funds to procure essential items.

Many mills try to introduce maximum and minimum limits for each part depending on the past trend of their consumption. It is suggested to forecast replacement for costly and specific spares considering their life, the dates of their last replacement and the normal lead time to procure them and give indent for procurement indicating the required dates of delivery. The minimum and maximum limits may be fixed for consumables like lubricants, brooms, emery paper, and so on.

For ease of control, the spares are grouped as ABC items or VED items. The ABC classification is depending on the value and the quantity of consumption. Normal pattern of ABC items are as follows.

A – 10–15% of the items cost 60% of costs.

B – 15–30% of the items cost for 30% of costs.

C – 60–70% of the items cost for 10% of costs.

VED items mean Vital, Essential and Desirable. Depending on the situation a desirable item may become vital. Hence this classification cannot serve the purpose. Neeraj Nijhawan suggests classifying the spares as FISPO, i.e. Fast Moving Spares, Insurance Items or Vital Items, Standard ‘open market’ consumables, Planned Replacement Spares and Overhauling spares. The rules for stock levels and the period of review for each of the above categories are different.

21.4.1 Fast moving items

These are relatively low cost accessories or spares, and are well stocked in stores. The desirable levels of inventory to be maintained in this class of item depend upon the previous rate of consumption.

21.4.2 Insurance items or vital items

These are costly items and are stocked to insure against probability of failure. If the concerned machine is critical for ensuring continuity in production chain, then the importance of the part is still higher. Such item should be stocked depending on the lead time of procurement and its cost. Normally over 90% of such items have low probability of failure. Hence the stock needs to be reviewed and replaced every time an item is issued from stores.

21.4.3 Standard consumables

These items are reviewed according to a review calendar fixed by Store and Purchase department, and stocks are maintained as per the control limits fixed.

21.4.4 Planned replacement items

These items have a known specific service life decided in advance depending on the material worked and the production rate. Delivery schedule should ensure availability of each item well in advance prior to the date fixed for replacement. Procurement of such items is to be planned immediately after finalization of annual maintenance programme.

21.4.5 Overhauling items

These are wear and tear items needing replacement once in two or three years. The machine shall be taken for overhauling and all such parts shall be replaced at a time irrespective of their actual wear condition. Total quantity procured shall be used as per programme, and no extra part shall be kept in stock. Review of overhauling items is done 4–5 months prior to overhauling schedule and indents are raised.

21.5 Maintenance budget

Maintenance budget is a tool for planning the future activities of maintenance. It indicates the actions proposed and expected results of such actions. Expected results of the actions proposed are projected in financial terms as well as physical terms like man hours, machine hours, etc. It is normally made for a period of 1 year by referring to previous statistical data and the future requirements. The objectives of a maintenance budget are as follows.

(a) Providing a basis for examining the achievement of maintenance department.

(b) To have a check over expenditure on maintenance in different sections.

(c) Deciding the basis for planned replacement.

(d) Making a programme for systematic replacement of various components.

(e) Providing a basis for checking the efficiency of maintenance team.

(f) Providing a basis for procurement of different items in time for their use.

The maintenance head is fully responsible for making a maintenance budget and for its implementation with prior approval from the top management and finance sections.

21.6 Utilization budget

This budget aims to secure economical manufacture of products by maximizing the utilization of production facilities through a smooth operation. It means minimizing the down time for maintenance activities. It helps smoothening the operations through perfect co-ordination and good work relationship between the maintenance and production departments. Normally machine utilization budget is done for ring frame spindle utilization, which is critical for the profitability of a mill. All other stages of spinning, i.e. preparatory and post spinning should have spare capacity and the cost of their non-utilization is marginal.

The utilization loss is defined as the time for which particular machines are stopped for maintenance activities as percentage of total available machine time. Total utilization loss is obtained as the sum of all down times, i.e. both avoidable and unavoidable of the machine.

The available machine running time is the product of installed machines and the number of working hours available in a year, i.e. working days in a year 24.

21.7 Expenditure budget

The maintenance expenditure budget has following objectives.

(a) Making a planned and timely execution of maintenance activities.

(b) Ensuring availability of spares in time and preventing disruption of normal working of production.

(c) Planning for additional investments required for acquiring new equipment and tools for improving the effectiveness of maintenance.

The procedure for budgeting for next year begins in the end of current financial year, and should be a part of financial budget. The expenditures are grouped as fast moving spares, insurance spares, planned replacement spares, consumable stores and contingencies.

21.8 Budgetary control

It is imperative to ensure that maintenance activity is carried out as per budget and expenses are incurred within the budgeted limits. Budgetary control helps in identifying any deviations from the plan. This is termed as variance. The cause of deviation or variance is to be determined so that corrective actions can be taken and prevent or minimize such deviations in future. If there happens to be a genuine reason for a variance, it should be considered as valid and meaningful. This specific variance is accepted as worthwhile and future budget is planned accordingly.

A properly implemented budgetary control in maintenance expenditure helps the management in controlling the total expense on maintenance in an optimum manner. This acts as a tool for controlling expenses without affecting quality and productivity. The budget indicates where and when executive action plan is required to obtain the desired result in quality and productivity. It permits periodic comparison of the actual with the planned, and aids in measuring the performance of each maintenance team and each of production department.

22
Manpower planning and management

22.1 Introduction

Manpower planning is the process by which management determines how the organization should move from its current manpower position to its desired manpower position. Through planning, management endeavours to have right number and right kind of people at right place at right time, resulting in maximum long run benefits for both organization and the individuals employed.

Manpower planning deals with computation of the least but the most effective manpower required in any organization, considering the job description, job analysis, job evaluation, the risks and work loads of each job element.

Job description is the listing of all elements of work of each category of employees that they are supposed to do. One of the reasons for delays and errors in an activity is not having clarity on the tasks to be accomplished with clear authorities and responsibilities. In order to perform the jobs effectively the tasks are to be specified for each in the organization and without overlapping of authorities and responsibilities. The people on the spot should be clear about their role in the activity and in achieving the company objectives. The tasks, responsibilities and authorities need to be specified in job description.

Job analysis consists of observing and recording the time required to perform each detailed element of the activity. The risks involved, the possibility of working continuously at a specific speed without getting tired, the rest required between activities and for personal activities like nature calls, drinking water, taking tea and food, etc., are considered and work load is calculated. Normally a worker should not be loaded for more than 360 min in a shift of 480 min.

Job descriptions and job analysis are used to determine the number of people to be engaged, whereas Job evaluation is used to decide the remunerations to be given for the job, i.e. wages and salaries. This depends on the skills, knowledge and maturity required for the job and the risks and responsibilities involved.

In a cotton spinning mill, the requirement of number of workers also depends on the materials being processed and the count of yarn being spun. Further, the technology adapted, the level of automations, and the systems also play a part in deciding the number of people to be engaged. Hence it is not possible to suggest the number of people required for a mill without studying all the factors in detail.

22.2 Factors affecting manpower planning

Spinning industry is customer driven. The products spun and the production programme are decided as per the requirements of the customer. As the spinning caters mainly to fashion industry, the customer requirements are changing and hence the production programme and the manpower requirements also.

(a) The type of fibre used plays a major role in manpower planning and also on the training to be provided for developing a required work culture.

(b) As the raw material costs increase, more people are employed to prevent wastages and getting the materials soiled.

(c) As the count becomes coarser, the rate of production increases, and more people are needed to handle the production.

(d) When a product is of fancy in nature like slub yarns, melange, corkscrew, loop, high twist, etc., no defect in the yarn is accepted. The yarns of required quality may fetch 100–300% profits whereas a rejected yarn shall have “0” value. Hence more people are employed to inspect and avoid poor quality going to customers.

(e) Where people are less trained and their performance is low, we need more people for the same production.

(f) Frequent changes in machine layout and machine configurations take more time for workers to get adjusted. In such cases the number of workers required shall be more.

It is normal practice that supervisor shall decide on the number of people to be engaged depending on the count pattern working while taking charge from the previous shift and the number of people engaged in previous shift. Frequent count changes and uncertainty in the count pattern forces a supervisor to employ more people in order to be in safer side.

22.3 Regular and substitute workers

The workers engaged in a spinning mill can be grouped in to three categories, namely, Regular workers (permanent), Substitute (Badli) workers and Workers on daily wages. The permanent workers are normally with long experience in the same mill, and have worked on specific machines. The number of permanent workers depends on the bare minimum workers required to run the mill. The substitute workers are less trained, but have multi skills, so that they can work on any machine where a regular worker is absent. The management does not assure job guarantee for a substitute worker, but shall be liable to pay provident fund and ESI benefits (medical benefits) as per the law applicable. The names of substitute workers shall be maintained in a separate register, so that they can be made permanent as and when vacancy arises.

The workers are employed on daily wages for doing petty works which are not of a regular nature. For workers engaged on daily wages basis, the mill is responsible for ensuring their safety and should insure against any loss due to accidents or injury while on work.

Workers may be engaged on overtime in case of short of people, however, by verifying the number of hours worked earlier.

The wages are normally paid on monthly basis for regular as well as substitute workers, whereas the daily wages workers are paid on the same day of employment.

22.4 Leave management

The workers are normally granted two types of leaves, viz. Earned leave (PL) and Casual leave (CL). The leaves entitled depend on the number of days of working in the previous year. There are other leaves like medical leave in case of ill health of a worker and maternity leave where a female worker is delivering.

In case of earned leave, a worker has to inform the management well in advance, at least 15 days, whereas for casual leave there is no need. The PL shall be normally for more than 4 days at a time whereas CL is limited to maximum 3 days.

The supervisor can refuse the casual leave in case of short of workers.

There is a normal practice of sanctioning leave to a permanent worker in case the production can be maintained by employing substitute workers. However, it is suggested to restrict such leaves if the applicant has utilized all the leaves entitled by him.

The medical leaves are to be approved by the mill's approved medical officer or the medical officer at Employees State Insurance dispensary to which that worker is attached.

The maternity leaves have to be informed well in advance, and should be approved by gynaecologist approved by the mills or Employees State Insurance dispensary.

Medical leave and maternity leaves cannot be refused by the mills.

The staff should have regular interaction with workers and discourage them from absenting or going on leaves without pay. It is not only the running of all machines, but getting required quality is also very important. The substitute workers are less likely to guarantee the quality as they are not regularly working on the same machine.

It is advised to keep a watch on the pattern of taking leave or remaining absent and get information on how the holidays were spent. This shall help in preventing employees getting engaged in malpractices or antisocial activities.

22.5 Maintaining skill matrix and competency records

It is necessary to have a record of all employees regarding the skills and talents they possess, their background of education, the knowledge and expertise they have, their physical and mental ability so that they can be utilized in the best possible way, not only to the benefit of the company but also to the employee. People shall work with heart when their competence is recognized and a job allotted as per their aptitude.

Skill matrix and competency records need to be updated every year by taking the worker into confidence. This is very essential as the workers also shall be upgrading their knowledge and skills on a continuous basis so as to come up in their life.

22.6 Managing harmony

Managing harmony at work is very important for getting required quality and productivity and for successful running of a spinning mill. The management plays a very important role by being a model in implementing good systems that can change the attitude of people working for the company. A set of organizational practices, operations, culture, environment and their interaction with products/services exhibit its management system. A good management cautiously works to stabilize good systems where people can be comfortable. A feeling of insecurity, lack of recognition, lack of scope for promotions, no challenge in the job, doing the same work monotonously, etc., demoralizes the people.

Any organization, if has to grow or at least survive, depends on how consistently it serves the customers by providing quality goods and services.

One needs to understand the changing requirements of the customers and convert them into technical parameters, design and develop the products and services and produce them at economical methods and serve the customers. This is possible when the people working are united, understanding each other, cooperating and jointly putting whole hearted efforts for achieving the company objectives. The biggest challenge in front of a spinning mill is retaining its workers and staff and developing them as one motivated team to work for the fulfilment of the company objectives.

If an organization can sustain the pressures of the market and economy, it can only be by whole hearted team work and not by any other means. One can invest huge money in technology, but for managing needs dedicated, skilled, matured and knowledgeable employees. If employees have to develop the above basic requirements, we need to work for them, understand their needs and treat them as our partners and not as slaves. The normal needs are wages to support decent living and to take care for the future needs of family, security, social status, dignity, growth and peaceful work environment.

The management should take active part in understanding the problems and work with the people to solve it. When people know that the management is with them in solving the problems, they get moral support, and shall involve more in the activities and come out with innovative ideas to come out of the crisis. They should encourage interactions with staff and workers to understand the problems and to evolve solutions to the problems on day to day basis.

23 Marketing yarns

23.1 Yarn marketing

The yarn marketing may be grouped into grey yarn marketing and dyed yarn marketing. The grey yarns might have been spun against a confirmed order or spun in advance anticipating sales. In case of dyed yarns, it is always against a confirmed order, and the quantities in each shade are depending on the number of yarns required to make a particular design. Normally grey yarn sales are in bulk. Spinning mills cannot concentrate on selling with small quantities like 100 g, 200 g or even 1 kg or 2 kg, but need to sell in terms of truck loads or container loads. In case a company is involved in manufacturing ready to use yarns like sewing threads, embroidery threads, twines, ropes, tags, etc., apart from wholesale marketing retail marketing also needs to be addressed. In retail market, the embroidery threads may be sold in small lengths of even 100 m or 50 m for hand embroidery applications. In this chapter we shall discuss only grey yarn marketing.

23.2 Grey yarn marketing

Grey yarn marketing normally involves bulk marketing either directly to a big customer or to a trader who purchases the yarn in bulk, stocks with him and sells to small buyers as and when they require. Grey yarn has to undergo further operations and hence cannot be sold directly to individual end users. The grey yarns may be sold either as single yarn or as doubled or multifold yarns. They may be sold in the form of cones or as hanks. The cones are preferred by companies equipped with high speed machinery, whereas handloom weavers and hand processing units prefer yarns in hank forms.

The yarn marketing can be done either by directly dealing with the customer or through agents or traders. In case of direct dealing, it may be from the spinner directly to the yarn user or the customers approaching the depot of the spinner. An agent shall bring the customer and introduce to supplier. The contracts shall be between supplier and customer; the agent gets a commission.

In case of traders, they purchase the yarn and keep in their godown and sell as per their convenience to small users at higher rates.

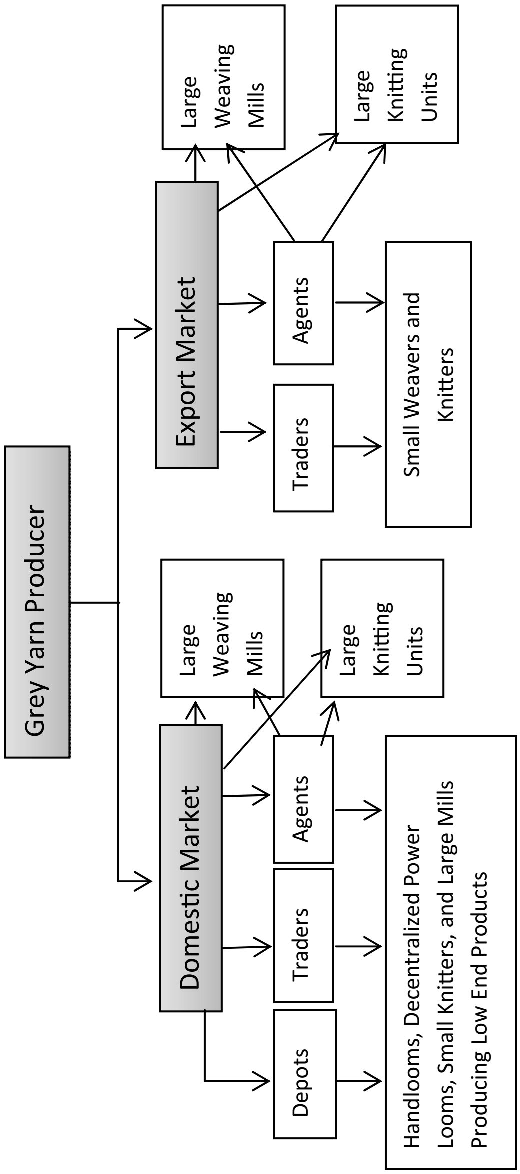


Figure 23.1 Grey yarn marketing channels.

The grey yarns are sold both in export market and local market. The local market for yarn in India is very big. The customers from various segments like decentralized handlooms, decentralized power looms, organized weaving factories with power looms, auto looms, shuttle-less looms of various types, hand knitters, decentralized small knitters, large knitting factories, and various technical textile manufacturers like tyre cord manufacturers, braiders, belt manufacturers, twine manufacturers, rope manufacturers, fishing net manufacturers, carpet manufacturers, and so on. In case of exports, normally big manufacturers or big traders procure yarns in large quantities, whereas in local market the volume purchased at a time is small compared the volume sold per order in case of export.

In export market, the requirement is normally for catering to high speed looms or high speed knitting machines whereas in local it may be for slow speed machines and hand operated machines also. India is the only country having handlooms and are producing novel varieties with the skill of weavers that cannot be produced on modern high speed automatic machineries. For an export order it is normal to use rich cotton and work on good machines concentrating on lower variations in count, strength, twist and lower imperfections. The export orders are normally accompanied with bank guarantee for payment and we get payment the moment the materials despatched and documents are produced to bank. In case of local market, the yarns are engineered as per the requirement of the user. Different standards of yarns are manufactured to cater to handlooms, power looms, and high speed shuttle-less looms, hand knitting, machine knitting, and so on.

In case of local market, although price realization is good, the sales are mainly on credit basis starting from 30 days to 90 days depending on the type of customers, the relations they have with the mills and the bulk they purchase. When yarns are manufactured for decentralized sectors of weaving or knitting, it is not possible to sell directly to the weaver or knitter as the quantity required by each are very small compared to the production rates of spinning mills. Therefore, invariably a trader comes in between, who procures yarn in bulk and distributes to small knitters and weavers as per their need. Some mills open their own depots in weaving and knitting centres like Bhiwandi, Ichalkaranji, Malegaon, Tiruppur, Kanpur, Solapur, Ludhiana, Bhilwara, Panipat, etc., so that they can distribute the yarn to small weavers and knitters. The big users, that too who are quality conscious do not prefer purchasing yarn from traders, but make direct agreement with spinners and specify the requirements. They book large orders and insist that there should not be any change in mixing in between a lot, as it leads to shade variations when dyed. Even the traders insist that there should not be change in mixing within a lot, but while selling in small quantities, some left out yarns from a lot shall have to be mixed up and given in another lot. In such cases, they normally target low end use product manufacturers, and the price realization shall be low.

The technical people concentrating on manufacturing do not get information on the real need of customers, whereas a marketing person who meets the customers shall understand the requirements to best of his ability and informs the technical personnel. Normally traders cannot give specific requirements, but give general requirement of the market. When we are dealing directly with a customer it is possible to arrange an interaction meeting between the technicians of the customer and the producers to make the technical specifications clear and agree on critical controls. Large and quality conscious manufacturers normally prefer visiting the supplier's site, analyze the conditions, the technology and competency of people working before deciding to purchase from that spinner.

A good marketing person first understands the capacity of his mill relating the quantity they can produce, the counts suitable for the machinery they have, the financial burden they can bear, and then decides whom to approach. It is not practicable to just sell to any customer, without understanding their back ground. It is always preferred to sell to a customer with good image in the market, so that we can claim that we are supplying to such customers and our quality and services are reliable.

The grey yarns are manufactured either against a confirmed order or to be sold as and when possible. When the manufacturing is against a confirmed order, delivering the material in time is very important, as the customer's factory can run smooth only when we supply material in time. In such cases, the marketing and production planning section shall have to follow up with the production people on day-to-day basis and ensure that the deliveries are made in time. This is more critical in export orders, as there are chances of vessels missing, and then we shall have to air-freight the material spending huge money.

23.3 Wholesale and retail marketing

The traders purchase the grey yarns in wholesale by quoting an ex-factory price. They normally purchase yarns on credit of 30 days to 90 days depending on their relation and reputation. The mills prefer to sell to wholesalers as it is convenient to manage. The wholesaler stocks the goods at his godown and sells when he gets good price. In case the yarn prices fall, the wholesaler holding the stock shall have to lose heavily.

Some of the wholesalers have multiple godowns at different locations and transfer the yarns between godowns depending on the market. They might incur additional transportation which shall be covered by the rate difference between regions. Similarly large mills have their own depots at different centres and transfer yarn from one depot to another.

The retail customers normally purchase yarn for one set or for one day's requirement as they do not have the capacity to hold stocks. Further they shall have less margin money to operate the process stocks. The retail sales are normally on cash basis excepting for some known customers, where a credit may be given. The price ruling on that day shall be charged. The customers normally make their own arrangement for transportation.

The retail marketers also appoint agents for getting orders and for collecting the dues. The agent takes the responsibility of identifying the supplier, booking order, delivering the materials to customer's place and collecting the money from customer. The agent gets commission from both.

In retail market, normally commodity yarns are sold which are suitable for low speed power looms or slow speed knitting machines. In case yarns are needed for high speed machines with specific yarn parameters, the agents take the requirement and place orders with the wholesalers to procure and supply from mills having stocks. Normally they target export rejects, which might be available at a slightly higher price compared to commodity yarns.

23.4 Studying markets and booking orders for yarns

Although market requirements are changing, one can see that it follows a pattern as per season. Good marketing team analyzes the trends in the market and compares with the season. They also study the changes taking place in technology, in economic scenario, the trends in fashion, the activities at manufacturing field as well as at customers and predict the yarn sales on a rough basis for the year and on a precise basis for the quarter.

In India, about four decades back, the finer yarns had more demand as people were using sarees, dhotis, turbans, etc., whereas now the trend is for coarse counts due to increased use of jeans, T-shirts, and dresses. Therefore, spinning mills had to switchover to coarse counts from fine counts.

In case of grey yarns for manufacture of technical textiles, particular blends have a limited but consistent market. Technical textile manufacturers do not purchase yarns in open market as they need to give consistency in their product quality. They fix some spinners and get the yarns engineered and spun with specified cottons and process parameters.

The demands in the market change as per season; may be due to change in temperature and humidity or due to some festivals. Normally during festival and marriage seasons, the sales of dress materials and sarees shall be more. It means, 2 months prior to that the yarn should have been spun.

A marketing person analyzes the yarns sold in the previous year in the same season and tries to find the reason for that demand. He analyzes the present situation to verify whether the same factor is prevailing now and then decides what can be sold in the market this year. As explained earlier, the dress materials, children wear and sarees shall have demand in marriage season and festival season. Similarly the underwear shall have demand in summer, although they are used throughout the year. In cold countries, the warm clothes shall have demand in winter.

A grey yarn marketing person should workout the normal process time in weaving or knitting, processing, garmenting and the time required for the completed garment to reach the shops and accordingly plan his spinning in advance. Although it is difficult to predict the exact count, it is possible to predict the count range which might be demanded and arrange for procuring cotton in time. Therefore, the role of a marketing person in yarn sales is not only selling the yarn but also guiding the mills to procure required cotton in season.

The yarns if not used for a long time, start losing strength. Fading takes place if they are not stored in cool place. Normally yarn godowns are not air-conditioned. They are constructed with corrugated roof sheeting which becomes hot in summer. A marketing man should therefore ensure that the materials are sold in first-in-first-out basis, and not to allow any material to lie in stock for a long time. Sometimes, he may have to sell the yarns at discounted rates to avoid deterioration.

The condition of godown is also an important factor. Number of yarn godowns does not have proper flooring and hence moisture can percolate from ground especially during rainy season. The problem is more with bag packing using woven hessian covers. This can damage the cones that are in the bottom. Further if the godowns are located at low lying areas, there are chances of water entering the godown in case of heavy rains. This may damage the yarns. Such damaged yarns need to be sold at discounted rates to low end market.

23.5 Understanding customer satisfaction

Understanding customer perception about our quality and services and taking timely corrective measures is important for keeping the organization alive. Achieving customer satisfaction is not a one time job. The level of satisfaction cannot remain same all the time; it may either increase or decrease. Therefore, one should be able to assess the level of customer satisfaction on a continuous basis and take actions to make the customer happy.

Different methods are available for conducting surveys, giving weightage for different criteria and arriving at an index in order to track whether the company is showing a positive improvement or not. The concept of presenting data of the customer satisfaction index in graphical form has become popular to claim that the company is customer focussed. However, these indexes alone are unable to help the organization to take actions for improvements.

In a spinning industry, it is very difficult to understand the real reason for a customer to become happy or to be unhappy. Following are some examples.

(a) A particular lot of yarn was rejected with some lame excuse as the market rates fell down after purchasing the yarn but before making payment.

(b) Demand for a particular count of yarn which was procured in anticipation of orders was reduced as the fashion changed.

(c) There was a sudden demand for a particular count, and even the rejected lots were sold with premium prices.

(d) The yarn was purchased from a stockist, who delivered old lot along with new lot, although from the same mills. The knitter had a problem of barre.

(e) The key person dealing with purchase did not get the commission demanded by him and hence held the bill for payment and put a claim for poor working.

(f) Customer wanted yarn for weft to be used on a high speed air jet loom, but took a normal weft yarn suitable for shuttle looms as it was cheap.

(g) Customer wanted yarn for knitting sports socks, but was given normal hosiery yarns.

There are number of such reasons, where a technician cannot take an action for improving the customer satisfaction. In case of materials going for specific end use, a technician can work and improve consistency in supply. The technicians should understand the impact of various technical parameters of the product on the performance at customer's end.

There are number of ways of getting the customer perception on the quality and services of products. They include sending a questionnaire requesting the customer to fill up, sending a third party for interviewing customers, a marketing representative visiting the customer and getting feedback, conducting customer meets and getting feedbacks, a team of technical and marketing personal visiting customer's technicians and having detailed discussions, etc. Normally the response from the customers for the questionnaire sent is found very poor. Only 10–15% of the customers respond. Even if they respond, majority of the ratings shall be in between 4 and 7 in a scale of 0–9. They do not want to tell anything as excellent and also as very bad. Further, we cannot understand the reason behind the ratings given. While the third party interviews can cover more customers, there is a basic doubt on whether they collect the information needed by the organization or not. The third parties normally have their own stereo type question and approach, and numbers of customers do not like them. As they do not have confidence about the actions taken on their feedback, they normally allot a junior person to respond to the interviewer. Also, it is very difficult to validate the opinions collected. When a marketing representative visits the customers, he normally gets more of negative feedback as the customers always doubt the intention of marketing person. The marketing people normally discuss more with the purchase people and very less with the shop floor technicians using the products. The customers are afraid of increase in prices in case the product and services are told as good or excellent. Also, the marketing person cannot really communicate the exact problems faced by the customers to the shop floor technical persons in their language. In the customer meets, some talkative customers raise their voice and others just support them. Only 10–15% of the customers talk. Most of the time is spent in lectures, introductions and on the new products launched.

Analysis of complaints and feedback give a good clue. It was observed that only 10–15% of the customers make complaints, whereas others keep silent in spite of the same bad quality material is given to them. We cannot assume that they are happy. It is found that normally the customers complaining regularly are the one lifting more materials. The analysis showed that 15% of the customers normally lift 65–75% of the production, and they are also the maximum complaint givers. Further, the numbers of complaints have a direct relation with the price at which it is sold. When the price is high, the complaints are more. In specialty products, the lot size will be smaller compared to commodity products. Each lot is having a potential to receive a complaint. Hence, with specialty products, the number of complaints shall be more. Further, when the quality is improving, the expectations of customers also improve. We get more complaints in a quality conscious mill compared to a mill producing cheaper variety yarns.

One of the best methods of collecting the customer perception is visiting customer's workplace in a team consisting of a technical person from production, a quality control person and a marketing person. Some companies even send senior workers in the team. The customer shall be happy to receive the production person as they can explain their problems clearly and get commitment from him to correct the same. The team should discuss with the people actually using the materials. A worker from the supplier's team can discuss with the workers in the customers team and understand the real problems. The workers discuss freely and hence the real problem is understood and action can be taken. The level of satisfaction increases as more useful dialogues takes place. This type of visit eliminates the probable communication mistakes and misunderstandings.

There are number of yarn parameters, and it is important to know as to which parameter is critical to that customer. It is also necessary to know as to why that parameter is critical for him, and what the normal complaints he gets from his customers are. Once it is clear, then we need to understand as to how much we are fulfilling it.

The following examples can clearly explain the concepts:

- A weaver normally wants the yarn count to be slightly on finer side whereas a sweater knitter wants it slightly on coarser side.
- A knitter of underwear prefers a low twist, whereas a knitter of socks prefers a slightly higher twist.
- A knitter is satisfied with a low strength yarn provided the yarn is uniform, but it should not break. Hence for high speed knitting machines, he demands yarns of higher strength.
- A knitter having flat knitting machines for sweaters can accept variations in length of yarn on cones, but not a knitter having circular knitting machines for T-shirts.
- Length uniformity of yarn in cones is demanded when yarn is going for warp, but not for the weft.
- A weaver prefers a yarn with less hairiness whereas a knitter wants some hairiness on yarn.
- Uneven yarn is not accepted where single yarns are used for weaving or knitting, but the same customer accepts the yarn if it is going for doubling.
- Uneven yarn is not accepted in case it is going for plain weave and single shades, but the same is accepted if it is going for printing, or for checks and stripes.
- Strength is more important than other parameters like count, twist and evenness in case the yarn is used for industrial purposes like canvas, belts, etc.
- The bulk of yarn becomes more important when they are used for tufted carpets, razed cloth like velvets, looped fabrics with designs like terry towels.

Apart from the yarn parameters, the packing and presentation also play a part in making customers happy. Some are interested in the materials inside, whereas some wants the presentation to be good. Depending on the culture of the customer's society, the expectations change; however, nobody likes if the material is not in line with requirement.

Another method of evaluating the customer needs from the past performance is by analyzing the data of complaints and feedbacks. For the same quality of yarn, different customers give different feedbacks. The feedbacks given or the complaints made indicate the real need of customer. The complaints depend on the type of machines and the infrastructure the customers have, the product quality demanded by their customers and their management objectives. It is therefore suggested to view each customer as separate, and do not try to combine them and workout indexes. It is good to make customer wise reason wise trend analysis of complains and feedbacks.

Some of the organizations have started a system of displaying the customer complaints prominently in their work area, so that all in the company can contribute for overcoming that complaint. Before starting production for a particular customer, the previous complaints and actions taken are reviewed, and the operators are educated.

24
Quality management practices

24.1 What is quality management?

There is a need to produce the yarns as required by the customer in time and maintain the costs as low as possible so that both customer and the producers are not burdened. For this purpose, one has to implement Quality Management System and do the right work right at first time and every time. Quality Management is the system of ensuring that the customers and stake holders get what they are supposed to get all the time without fail. It consists of Quality Planning, Quality Control, Quality Assurance and Quality Improvement. *Quality planning* deals with planning the activities to meet the customer needs, the *quality control* deals with monitoring the activities with different control points and checks to ensure bad quality does not go to customer, the *quality assurance* is focussed on establishing systems and procedures to ensure that quality is achieved all the time and the *quality improvement* concentrates on changing needs of the customers/stakeholders and proactively work for improving the levels of quality not only of the product, but also of the systems targeting reduction in costs, timely services and delivery in time while adhering to product quality, legal and regulatory requirements and ethical values.

In textiles, the ultimate consumers, and also the men involved in retailing are, normally, not technicians, and hence the requirements are not clearly explained as required to a shop floor technician. Although in some cases, technicians are employed for identifying the specific needs, the interpretation changes, and the production personnel get a different message. The over-specification is a common phenomenon adapted to ensure reliability, which is resulting in increased expenses.

In some cases, the customer gives a sample of yarn and asks the spinner to match the quality. The men in laboratory analyze the properties of the yarn sample and give report to the spinner. The spinner tries to keep the same parameters of twist and count at spinning stage. People forget that the samples given are not the ring frame cops but are cones, hanks or a piece of cloth from which the yarn is taken out.

We need to understand both the specified needs and intended but unspecified needs of a customer. The specific needs of a customer are easy to understand, while we need to work hard to understand unspecified needs, which are much higher compared to specified needs. The product specific technical parameters include the fibre, the count, carded or combed, for weaving or hosiery, the minimum strength required, the twist range, the permissible U% and imperfections, the cone weight, cone diameter and number of cones per package or per order. We also need to consider the instructions to users by means of care labels, packing and labelling, the other regulations like the markings as per statutory requirements, adhering to the norms of customs, imports and exports, ethical work norms, non-usage of harmful materials and controlling the effluents, etc.

We need to select and procure the raw materials and other accessories needed to produce the materials, inspect them and ensure to be of required quality, devise methods and develop procedures to produce the materials, follow the procedures and maintain records, inspect the materials produced and deliver them to customers in time. Ensure proper implementation of systems by periodic auditing.

Quality assurance concentrates on identifying various processes, their interactions and sequence, defining the objectives of each process, identifying the key result areas and measures to measure the results, establishing the procedures for getting the required results, documenting the procedures to enable everyone to follow the same, educating the people to implement the procedures, preparing standard operating instructions to guide the people on work spot, monitoring and measuring the performance, taking suitable actions on deviations and continuously improving the systems.

24.2 Procuring materials

Cotton is the major raw material for spinning, which has different grades and varieties. One need to decide the correct cotton required for the yarn to be produced. It is needed to ensure that cottons are not changed in between a lot of yarn, and there need to be consistency in yarn property including colour from lot-to-lot, and hence cotton need to be procured in bulk from selected stations.

Cotton being an agricultural product, the properties vary from field to field; however, cotton grown in a particular station maintains similar quality parameter as the farmers practice similar systems in a station. Good mills make agreement with farmers and take the help of agricultural specialists and get the required variety of cotton grown as per their requirement. Depending on merchants for getting the required cotton cannot guarantee the same shade and maturity properties.

Annual production programme should be made to get an idea of cotton requirement and accordingly purchases are to be made from reliable sources. The cotton procured need to be tested and ensured of quality.

24.3 Preparing process parameters, procedures and work instructions for process management

Once the orders are received, it is necessary to plan the processes from blow room to winding, and decide on the process parameters in each machine. The process parameters include the speeds of various parts, setting, hank fed and hank delivered, the draft and fix the rate of production. The procedures for working need to be established by conducting trials and are to be documented so that all work in the same style. Work instructions need to be prepared and given to all workers working on the spot.

24.4 Testing the produced materials

The quality control is the process of checking and monitoring the process and products with an intention of preventing non-conforming materials from going to customer. Various result areas are identified for each process, and studies are conducted to verify whether those results are being achieved. Normally a separate set of people designated as Quality Controllers conduct various studies and test and highlight the deviations. It is the responsibility of production and maintenance people to take actions and correct the deviations. It is normal practice to refer the quality standards. The control section normally has two separate sections: one for testing the product quality at different stages of production and also of final product, and the second one for studying the process, normally called as Process Control Studies.

Normal tests done in a spinning laboratory are as follows.

- Cotton – length, micronaire, strength, trash, neps level, colour grade (Rd and +b values), honeydew content, UV absorbency.
- Lap – trash %, fibre length, neps.
- Sliver – trash, neps, U%, hank variation.
- Roving – U%, hank variation. Some mills have developed system for measuring roving strength similar to lea strength testing of yarns.

- Yarn – count, count variation, twist (TPM) and twist variation, lea strength, single thread strength, tensile variation, U%, imperfections, Classimat faults, appearance, snarling tendency and hairiness.
- Cone – cone dimensions, cone quality, label inserted.

24.5 Process control studies

The process control studies normally include the performance assessment of the process or the machine being observed, deviations in set parameters, condition of various parts or sub systems of a process or the machine, the work practices likely to lead to poor quality and the quality or condition of the tools used for the process or maintenance of the process or machines. They can also be used for experimentation, assessing the performance of new trials or processes, etc. Normal process control studies in a spinning mill are as follows:

- **Mixing and blow room**: Randomly checking the bales issued and bales planned, checking the tuft size, synchronization study of different machines in a blow room, speeds of various beaters and fans, checking of air pressures, roller pressures at appropriate places, grid bar settings, mass variation in lap sheet, total length of lap, lap weight, cleaning efficiency, machine audit.
- **Carding:** Neps removal efficiency and neps per gram in sliver, breakages and snap efficiency, card cleaning efficiency and trash in card sliver, card-to-card waste variation, trumpet size and hank of sliver, feeding consistency, machine audit.
- **Draw frames:** Periodic machine audit, breakages, top roller diameters, functioning of stop motions, viz. delay in functioning and fail to function, functioning of auto levellers, top roller pressure
- **Combers:** Periodic machine audit, head to head noil variation, breakages, short fibre removal and improvement in mean length, neps removal efficiency.
- **Speed frames**: Periodic machine audit, breakages, idle spindles, stretch and draft, evenness.
- **Ring frames:** Periodic machine audit, breakages, idle spindles, ends down percent, pneumafil waste percentage, spindle wise monitoring, online monitoring of spindles.
- **Winding:** Breaks per cop, clearing efficiency, hard wastes generation, cone quality and length consistency.

- **Packing:** Calibration of balance, cone/hank inspection before packing, markings on the packages.

All the processes can also be audited by inviting Internal Quality Auditors, who apart from auditing the technical processes, also shall audit the management processes and records in the section, which are a part of Quality Management System. The auditors shall be from different sections, and shall have been trained to conduct an audit.

24.6 Quality improvement

The customer's needs and expectations are continuously changing depending on the changes in technology, economy, political situation, ambitions and dreams, competition, etc. One needs to go on analyzing the facts and identify potential problems in advance and take necessary precautions to survive in the competitive world. We need to consolidate all small steps taken for improving a situation and implement them uniformly organization-wide to get consistent improvement. We need to be always on the toe for facing challenges, benchmark the best and try to re-engineer the activities and the products to beat the competition. The use of Five Golden Questions for self-assessment and evaluation of the maturity of implementation of Quality Management system are essential to have continual improvement in quality.

The Five Golden Questions explained here are very simple questions, but highly effective if one makes sincere efforts to evaluate self and work for improvement. The questions are applicable to all the activities of any organization or person. The questions are

1. Do we have a procedure?
2. How do we ensure it as the best?
3. How did we implement?
4. Did we get the result as anticipated?
5. How do we compare ourselves with our competitors?

These questions need to be asked again and again in quality management as and when we achieve some results. It will avoid complacency and indicate as to where we need concentration. We should always understand that there is no limit for achieving quality, but competitor's performance is the judging factor, as to whether our quality is acceptable or not.

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