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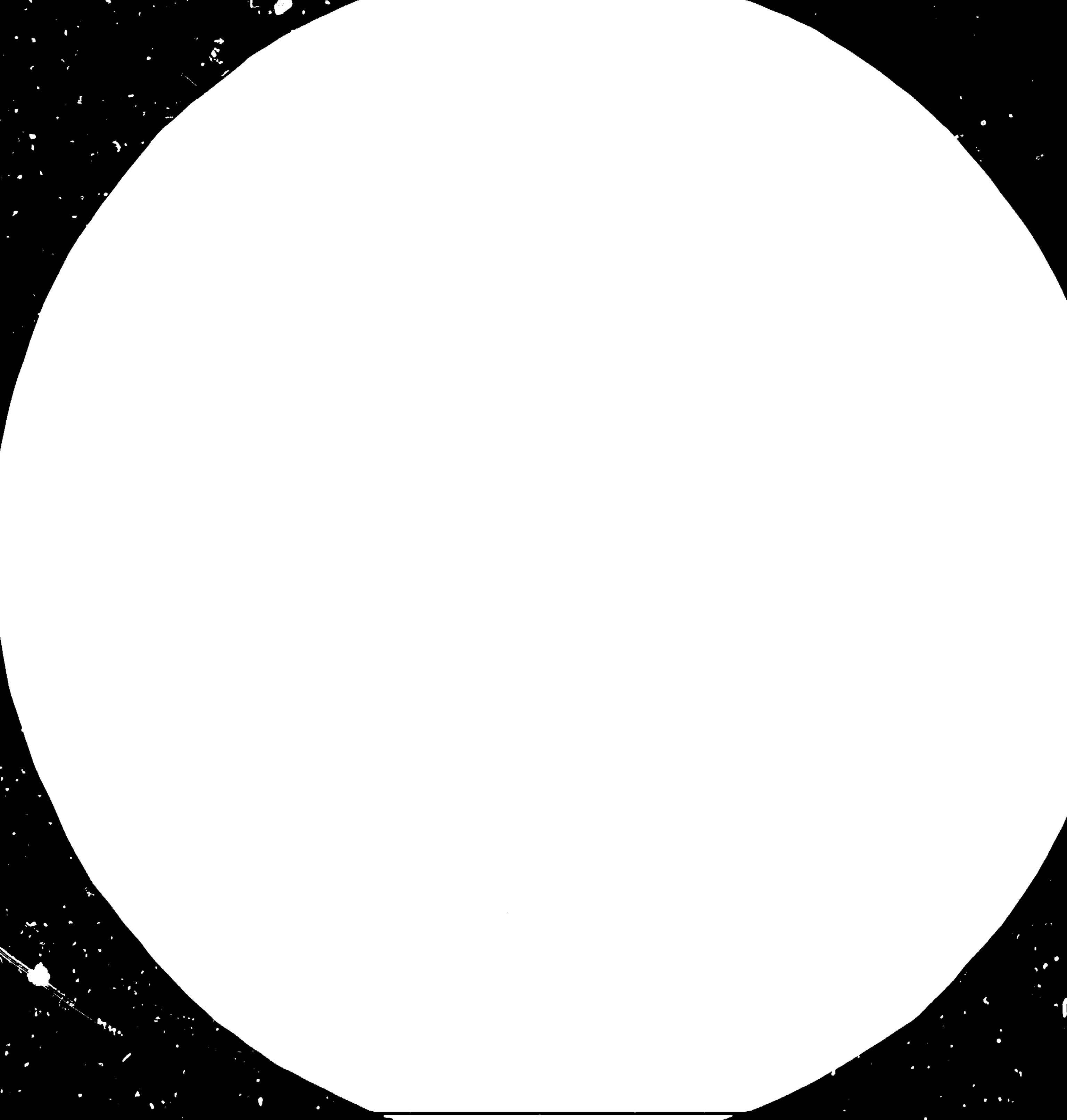

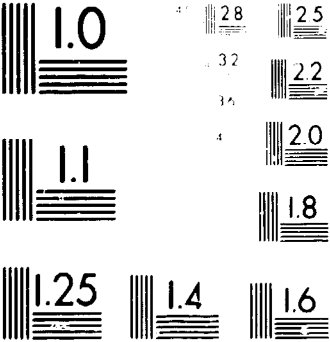

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NATIONAL BUREAU OF STANDARDS

STANDARD REFERENCE MATERIAL 1010a

ANSI and ISO TEST CHART No. 2

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TEXTILE INDUSTRY DEVELOPMENT PROGRAMME

DP/BGD/82/006

BANGLADESH

Technical Report: On Spinning Training*

Prepared for the Government of Bangladesh
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Ralph Flaherty
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Vienna

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INTRODUCTION

PURPOSE OF THE PROJECT

Assistance to the Bangladesh Textile Mills Corporation(BTMC) in improving the productivity and quality of production in the cotton textile industry and in establishing a central training and advisory services facility for the BTMC mills.

JOB DESCRIPTION

1. The Spinning Training Adviser will work in close co-operation with two Spinning Technologists paying particular attention to the training aspect.

The Adviser will be expected to complement the activities of the Spinning Technologists by organising and conducting theoretical classes and practical demonstrations to meet the training needs of the people working in the Cotton Spinning Sector.

In connection with the Balancing, Modernisation and Rehabilitation(BMR) program of BTMC financed by the International Development Association(World Bank), the expert will be expected to plan, execute and monitor, in conjection with the BMR Project Implementation Cell, the (i) preparation of bidding specifications for machinery, equipment and spares, (ii) bid evaluation, (iii) scheduling of erection and installation, (iv) trial runs and final discharge of the erector/supplier, (v) follow-up and entry into commercial production, and (vi) the general planning, execution and monitoring of specific projects.

1.1 METHODOLOGY

In any training situation, the first task is to determine, what training is required, who needs training and how the instruction is to be given. Before any courses were written or instruction given, primary training needs were identified. This enabled course content to meet the needs of the people concerned in the Spinning Sector.

However, it is the implementation of techniques and technical detail that is important, if people were to attend courses, take notes, take an active part in practical demonstrations and instruction, and return to their respective factories and do nothing, then it would be a waste of time. This was emphasised at every opportunity.

1.2 Following several visits with counterparts to BTMC Spinning Units, to observe the condition of machinery, and determine training needs by observing how the production of yarn was organised, the following courses were written:-

1. OPENING AND CLEANING - Mixing to Lap
2. CARDING AND DRAWING - Lap to Drawframe Sliver
3. COMBING
4. SPEEDFRAME - Sliver to Speedframe(Simplex) Material
5. RINGFRAME - Speedframe(Simplex) Material to yarn

In addition, three reports were written for assistance from Director Planning & Development and Director Operations, concerning :-

1. Raw Material Procurement and Distribution
2. Maintenance in Spinning
3. Spares Procurement

These essential functions required attention if the training was to be fully implemented in the factories, because it is not possible to obtain more yarn of better quality if there is no cotton or the only cotton available is dirty and weak, no spares and lubricants and no systematic maintenance schedules. An operative training scheme was also required.

We decided to hold seminars for labour leaders to keep them informed of our activities, why we considered such training necessary and how they could help.

The Chief Executives and Senior Managers of the mills were kept informed by direct approach or holding seminars in a district or zone and inviting all the senior people in that area to attend.

In this way we hoped to cover the mill organisation structure:-
Chief Executive, Management, Technicians, Supervisors, Quality Controllers, Shift-in-Charge, Fitters, Operatives and Labour Leaders.

2. TRAINING NEEDS

Using Asian Standards as a reference and keeping in mind the level of skill and knowledge observed in the mills, also the shortages of material and working habits of operatives, or the real situation in which the person producing yarn has to work, the following training needs were included in the course notes. These were later added to by the Spinning Technologists who requested the inclusion of additional topics, short special courses, or practical demonstrations under mill conditions in a particular section of the mill.

2.1 RAW MATERIAL

In order to obtain optimum output from the bales of raw cotton supplied, it is necessary to know:-

(a) Trash content
(b) Micronaire
(c) Effective fibre length and percentage of short fibre
(d) Pressley

It was noted that of these four values only (a) and (c) were available and quite often the given values bore no relation to the material received.(With the help of BTMC Executives this situation later improved).

2.2 MIXINGS

The greater the number of bales in a mixing and the less the spread of individual micronaire values, then the mixing of raw cotton will produce stronger yarn, with less faults, less breaks and therefore, more production per spindle.

Two or three bale mixings together with a large amount of reworkable waste were observed on occasions, usually because of a shortage of bales, or a recurring small order of a particular count. Whatever the reason the result is the same, high end breaks in-ordinate amounts of waste and low productivity. A number of demonstrations were conducted with 20:25 bale mixing of close or the same micronaire value. The result of each demonstrations were the same, less waste, less end breaks(reduced from 120 per hour to 30 per hour in one instance) and more production per spindle per unit time.

2.3 RE-WORKABLE WASTE

The persistant idea that using large amounts of re-workable waste in mixings, reduced the mixing cost because it was costed at Taka 5, instead of the original raw material price plus the added value of processing, was difficult to overcome. The following example put an end to arguments about mixing costs and re-workable waste.

Mill-A	Mill-B
100 Lbs Raw Cotton	100 Lbs Raw Cotton
80 Lbs Saleable Yarn	50 Lbs Saleable Yarn
20 Lbs Waste	50 Lbs Waste

Which is the most effective mill?

This example was used extensively and tended to make management look for ways of reducing waste.

2.4 LAP WEIGHT TOLERANCE

A lap weight tolerance of ± 8 ozs. is accepted to be sufficient to control between lap variation. To reduce the lap tolerance to ± 4 ozs. requires well maintained Opening and Cleaning machinery well supervised operatives and re-workable waste of approximately 5% of the total mixing. These points were often neglected the result being no lap weight control at all. The scutcher operator adjusted for almost every lap, or in some instances the laps were not weighed at all. A count survey conducted by students from the Textile College produced results shown in APPENDIX-I. Lap weight variation was one of the contributing factors.

2.5 CO-EFFICIENT OF VARIATION

The meaning of lap co-efficient of variation(CV%) was either unknown or ignored, usually the later because most factories have the equipment and knowledge to determine CV%. The problem appeared to be one of what action to take if CV% varied say increased. Many Quality Control Depts. produced weekly or even daily Lap CV% figures but it was the exception to find corrective action for an increase in CV%. The importance of this value was explained as " within lap variation " (and Lap Weight Tolerance as " between lap variation "). The effect of a CV of between 2:3% on count variation, end breaks, quality and waste, was noted on several oc sions, when the co-efficient of variation was reduced from 7% to 2% with subsequent improvements in ozs. per spindle per shift and quality.

2.6 OPENING & CLEANING MAINTENANCE

Maintenance on Opening and Cleaning machinery was generally neglected. Instructions from BTMC were clear on emphasizing the importance of maintenance. However, few maintenance systems involving complete stoppage of the line, after running the machines empty of material, then examination of beaters, beater bars, lattices, and level control devices were in operation.

The pedal feed motion and other levelling devices were particularly neglected which was a major contributing factor to within and between lap variation and subsequent production shortages and defects. Regular maintenance and control of soft waste will keep the CV% between 2:3%. In addition to the cleaning efficiency of the machinery can be kept at 60% which is important if the raw material is to be well opened and trash removed, that is the object of the equipment.

To achieve this:-

(a) Levelling devices must be fully operational.

(b) Beater maintenance must be regular and thorough, beaters sharpend or turned around. Re-pin Kirschner beaters and spiked lattices if they are damaged.

(c) The Pedal Feed motion should be checked weekly, for pedal movement and free movement of linkage.

(d) The above should be carried out during a weekly cleaning usually 6:8 hours per week.

The machinery over-produces sufficient laps to allow the cards to run for a minimum of one shift, with the Opening and Cleaning machinery stopped. This was an identified need, some factories did not have the technical knowledge to make the necessary adjustments, others know how but had no change wheels.

3. CARDS

Nep counting is a measure of carded quality, when nep count standards have been established for an installation of cards, re-setting and grinding should be based on the results of daily nep count checks. When the Nep count increases it should be re-checked if the increase is repeated the card should be stopped and examined. First check the lap, if the same nep count is obtained. Check the various settings, starting with Doffer to Cylinder. When all else fails the card should have doffer and cylinder grinding with a Horsfall Grinder and a good stone of correct hardness. This is particularly important for metallic wire, flexible wire requires grinding approximately every 21-days using the same nep counting system. The simple method of Nep Counting to determine which cards require attention, protects the wire flexible or metallic from over grinding. Each time a grindstone is applied to the wire it becomes shorter until a stage is reached when the hardead tip has been ground away and the wire needs replacing. The carding action is only as good as the wire, grinding by numerical rotation involves the use of the stone on wire which is alright and ignores wire which requires attention.

Card wire is expensive, grinding un-necessarily is a very expensive practice. In many factories the wire has been ground away in others with machinery of the same age the wire is in good condition because the people use Nep Counting.

The Care and Maintenance of Metallic Wire is still a TRAINING NEED and will remain so until technicians have sufficient "hands on" experience, sufficient guages and are using a Nep Counting System, or have access to Cmag type examining devices.

3.1 Topics like web draft had to be covered by courses due to:-

Web Draft varying from card to card causing count variation. A complete defii definition of web draft was prepared for BTMC Head office.

4. DRAWFRAMES

The object of the drawframe is to reduce sliver variation by doubling so that thick and thin places in a number of slivers come together at random. By drafting and doubling, the slivers become more regular and fibres are untangled.

This only obtains under the following conditions:-

(a) Drafting rollers must be buffed regularly and cots changed as required.
(b) Roller buffing equipment must be in good condition, with a good stone, used by a well trained operative.
(c) Sliver stop motions must work on the creel and at front roller delivery.

Due to a shortage of cots and electrical spares, damaged roller buffing equipment, defective stop motions (sliver detectors), some installations of drawframes were introducing more faults than they could ever correct. Obtaining spares was often a problem due to a lack of funds, or a lack of technical knowledge. Instances when the only remedy was complete replacement by new equipment were noted.

5. COMBERS

The condition of combers tended to vary considerably from mill to mill. If there was a comber fitter, with guages, needling equipment, and a manual, the equipment was usually in good condition.

The general situation tended to be a lack of maintenance, damaged combs and detaching rollers, and a lack of knowledge (and guages) of setting the combing cycle against the Index Wheel. Most comber technicians did not know-how to increase and decrease waste extraction and were often extracting unnecessary amounts of waste. Fault rectification was generally not possible because of a lack of spares and or knowledge. The waste extraction at each head should be checked daily this was not observed at any spinning unit. The basic problem appears to be the seasonal nature of the demand for 60's and 80's combed which never exceeds 15% of total yarn requirement. Therefore, unless the machine was completely stopped when required, funds tended to be directed to other uses. This together with the knowledge that quality was of secondary importance because anything "combed" could be sold resulted in generally neglected combing machines.

6. SPEEDFRAMES

An imbalance of material between speedframes (Simplex) and ringframes was frequently evident because all the ringframe supply packages were the same size usually half or quarter of a full package. The training needs identified were:-

(a) In-sufficient use of Speedframe capacity e.g. idle spindles, material too fine, mechanical defects.

(b) Defective builder motions and inability to correct the defects.

(c) Bobbin faults e.g. incorrect taper, soft bobbins incorrect spacing of coils.

Large stocks often sufficient to cover ringframe output for 6:10 days caused wastage because speedframe bobbins are difficult to store. The reason given was invariably, "if a machine breaks down, we may stop", the high cost of waste at this process and the difficulty of reprocessing was largely ignored.

6.1 Drafting Systems(Simplex)

Drafting systems most often required attention, aprons with faulty piecings, worn or damaged cots caused end breaks and faulty material.

Top arm weighting was often in-sufficient either because of worn cots, or damaged springs, back rollers missing, roller clearers not fitted or damaged. A lack of spares and maintenance was the cause, maintenance tended to be a cleaning function rather than examination and replacement of worn parts.

6.2 Weight Per Unit Length(Hank)

Instances of four different hanks of speedframes(Simplex) material for a count range of 20's, 32's, 40's, 60's were common. The resulting mixed bobbins in ringframe creels, caused count variation at ringspindle point and subsequent end breaks and waste. Produce as few hanks of simplex material as possible then supervisors should ensure they are used to produce, the required counts.

6.3 Cans and Springs

A shortage of cans and springs at drawframe and between drawframe and simplex (Speedframe) caused shortages. The operative would often put material on the floor to free cans, this often causes stretched sliver, as it is pulled from the floor over the creel to the back rollers. This practice will cause count variation, breakages bad piecings and waste. The absence of can springs has a similar effect. It was not unusual to find drawframes and speedframes stopped for cans, and speedframes for empty bobbins.

7. Ringframes

Ringframe creel packages Speedframe (Simplex) should have sufficient twist (turns per inch, t.p.i.) to enable the material to be withdrawn from the package without breaking or stretching. A guide to the t.p.i. suitable to achieve this is $\sqrt{\text{Hank} \times 1.25}$ this multiplier varies with the staple length but is applicable to most circumstances in BTMC. The only real difference is with new Speedframes which have high spindle speeds say in excess of 1200 r.p.m. when manufacturers recommendations should be followed. The t.p.i. in speedframe material is mentioned here because it is broken down in the back zone of the ringframe by the Breakdraft. The training need in this instance is that both t.p.i. in Speedframe material and ringframe breakdraft tended to vary from machineto machine in some instances the breakdraft exceeded that value normally accepted as maximum 1.5' and was causing irregularity. Conversely if the t.p.i. of Speedframes material is too high thummaterial will not draft in the break-draft zone which will cause end breaks.

7.1 DRAFTING

The condition of ringframe drafting systems tended to vary widely, the drafting rollers, top and bottom, are particularly vunerable to damage. If the end break is high say 50 breaks/100 spindles/hour upwards, the operative cannot hope to keep the machine running with an end-break in excess of 200-breaks per machine per hour because the material tends to wrap around the top or bottom rollers. Once this occurs the rollers will be damaged by a frustrated operative trying to keep the machine clean. The bottom fluted rollers are distorted or the top rollers damaged when the operator cuts the material from the synthetic roller. The cause of high end breaks can be one or more of the Training Needs so far mentioned, or the ringframe itself.

7.2 Rings and Travellers

If we are to spin at optimum spindle speeds at acceptable end breaks which is the only way of attaining optimum ozs/spindle/shift, then the rings and travellers must be in good condition. This involves changing the travellers to a schedule, one that avoids high end breaks due to worn or damaged travellers. However, travellers are a hard currency item, rings should also be changed periodically but again they are a hard currency item.

The problem then arises which hard currency items out of all that are required, do we purchase first. This is a Training Need, there are certain hard currency items which must be purchased on a regular basis because to run existing parts to the point of destruction and then purchase replacements means a loss of output and more waste.

Travellers and rings fall into this category, the life of a traveller depends upon traveller speed, condition of ring, the count, type of yarn being spun and the cleanliness of the machine. The ring should be changed periodically using an on-going program of changing say ten rings per frame per week.

With foreign currency difficulties this is one situation that should be dealt with from experience of availability, running time, lead time etc.

7.3 Spindles

The most important part of spindle maintenance is lubrication if the oil in the spindle bolster is changed regularly, with oil of the correct viscosity, the spindles will last indifinitely. However, if they are neglected because of oil shortages, or no equipment to draw the oil out of the bolster, then the bearings in the bolster break-up and damage the spindle balde.

7.4 Scouring and Gear End Maintenance

Approximately every 30-days the ringframe should be scoured. That is, taken to pieces, drafting, spindles and gearing. Each part should be thoroughly cleaned, and examined for wear and replaced if the spares are available. The scouring cycle is usually strictly adhered too, the problem lies in the availability of spares, as previously mentioned.

8.0 WINDING

Winding is basically a quality improving process which produces large packages from small ones and clears the yarn of faults in doing so.

This process has been neglected in every factory we visited to the point were no clearing was taking place because clearer mechanisms were either wide open or damaged. The only remedy would be complete replacement, which was proposed in the BMR studies.

9. Additional Training Needs

The Training Needs noted at each process were included in course notes together with formal instruction of the function of each process, why it is included and how it achieved its objective. Courses later added to those listed at 1.2 were:-

6. Production balance and control
7. Safety and Hygeine
8. Managing for effective supervision
9. Care and maintenance of metallic wire
10. Textile technology for non-technical executives
11. Textile technology for Higher School Certificate students
12. Textile technology for Secondary School Certificate students

Courses Nos. 10, 11 and 12 were added at the expressed wish of the Chairman of BTMC, No. 10 because too many executives know too little about fibre conversion in yarn and fabric. The level of Supervisor whilst important is largely ineffective, poor Supervision accounts for much of the poor output. The recruited H.S.C. and S.S.C. people were intended to replace some of the older Supervisors, and most ineffective ones.

QUALITY CONTROL

The use of Quality Control information tended to vary, in some instances lap tolerance was too tight resulting in too frequent adjustment of the weight control mechanism. Card sliver was wrapped daily often resulting in CARD side shaft pinion changes. Drawframe sliver wrappings varied from 4-hourly to 3-times per day pinion changes were carried out if the material varied from the "Standard" weight. In addition Speedframe(Simplex) material was wrapped daily and pinion changes effected if the weight varied.

The outcome of this "Over-Control" introduced variation which was the subject of a discussion with Director Operations on 31st May, 1982. The recommendations made to the Director Operations were confirmed in a letter dated 2nd June, 1982, and later to Mr. N. N. Chowdhury on Ist February, 1983. The text of the letter is given below and represents the opinion of the whole Spinning Section of the project.

10.1 Selection of Raw Materials

One attribute common to textile raw materials is their variation in quality. Fibres vary in length, colour, trash content, maturity, and fineness; yarns vary in count, twist, strength and regularity. Since it is necessary to determine raw material characteristics to obtain optimum process conditions, and prevention is better than cure, it is essential and sound policy to test the available raw materials.

Accurate and continuous testing will determine

(a) That the material is as per cotton brokers specifications, we must know what we have purchased.

(b) Machine settings necessary to process the material, roller settings amount of trash to be removed. We must know what we are producing.

In this way unsuitable material is detected, rejected or put to other use. Standards by which materials are accepted or rejected must be realistic, otherwise much that is good will be rejected or large amounts of inferior material will find its way into production and cause trouble.

10.2 Process Control

When processing goes out of control, the amount of waste and the number of seconds increase, costs go up and very often tempers too.

Higher end-breakages in spinning, winding and excessive loom stops due to warp and weft breaks affect the operatives as well as production. A plan of production requires certain standard levels to which materials in process must conform. The performance of production equipment must be mentioned to establish that the characteristics of materials produced, fall within limits acceptable to management and the customers.

For maximum effectiveness the "Process Control" should monitor material characteristics along the processes. Quick answers are required to prevent excessive amounts of faulty material getting through before faults are detected. If we could be certain that our choice of material was absolutely right, and that production processes never develop faults, and operatives never make mistakes we could dispense with Quality Control.

However until then we must measure Quality frequently and with sufficient accuracy to know, what we have bought and what processes are necessary to convert our raw material purchases into the material required by customers.

A. Blow Room

Lap Regulating Test

i) We question the value of taking yard to yard checks over three yards and suggest that this test should be dispensed with ii) A lap tolerance of ± 4 ozs., we feel is too tight, and should be modified to ± 8 ozs. even for the finer counts. Tolerance of ± 4 ozs. lead to very high lap rejection rates and too frequent adjustments at the cone drum regulator.

We would also point out that the laps, although within the specified tolerances should be scattered plus and minus about the mean weight. If there is a tendency for laps to be consistently heavy, but within tolerance, or consistently light, then adjustments should be made at the cone drum regulator to correct this. The results of tests on complete laps, tested yard to yard, for regularity should be treated statistically and expressed as either C.V% or as a mean deviation. (It is unnecessary to re-process off-weight laps through the whole Blow-room line. They can be used on a card adjusted for heavy laps and one adjusted for light laps and mixed at the drawframe.

Action

In addition to the points recommended for checking in the event of irregular laps. The following points should be added to your list of checks.

- Photo electric cells checked(where fitted)
- Swing door mechanisms and limit switches functioning correctly.
- All blenders operating.

Cotton Trash Content and Cleaning
Efficiency of the Blowroom

With each new consignment of cotton the cleaning efficiency of the line together with the waste content of the cotton should be checked. To check the waste content, all machines in the blowroom and the card should be thoroughly cleaned and sheeted with paper to collect all waste at the take out points. The weight of the droppings over a given period, expressed as a percentage of the total through put can then be used to calculate the waste percentage. Any minor difference being attributed to invisible loss which would include dust, moisture etc.

i.e. $\frac{\text{Weight of droppings}}{\text{Weight Produced + droppings}} \times 100 = \text{Waste \%age}$

The cleaning efficiency of the blowroom is

$$100 - \left\{ \frac{\text{Trash content of lap}}{\text{Trash content of Raw cotton}} \times 100 \right\} = \text{Cleaning Efficiency}$$

B. Carding

i) We believe that the wrapping of card sliver is sufficient at once/week but accepting your reasoning we would reluctantly accept a frequency of once/day(But under no circumstances should corrective side shaft pinion changes be made at the card). (Whilst we accepted Mr. A. Hussain's reasoning for a once per day safeguard test, our recommended frequency of testing is once per week. The results of these tests should not be used as a basis for draft pinion changes).

Action

The wording of this instruction should be changed to "Card sliver weight should be fixed by mill technicians in the light of their experience and the state of their card".

We would suggest the following as a guide:

10's - 20's - 0.12 hank
32's - 40's - 0.13 hank
60's - 80's - 0.16 hank
100's - 0.20 hank(availability of machinery may require coarser hanks, at Simplex Drawframe and card in certain cases).

ii) Central Testing should review nep standards for different growths of cotton and establish minimum standard nep levels and review periodically.

See addendum re-instruction for grinding which should be carried out only when absolutely necessary. Similarly stripping of metallic wire should be kept to an absolute minimum as stripping takes the edge from the wire.

E. DRAWFRAME

The drawframe sliver weight should be set to achieve an adequate production balance and a guide to sliver hanks would be(Availability of machinery may require coarser hanks, at Simplex Drawframe and card in certain cases).

10's - 20's - 0.12 hank
32's - 40's - 0.14 hank
60's - - 0.20 hank
80's - - 0.24 hank

(Assuming single passage speed frame with a maximum draft of 10)

Regardless of sliver testing the condition of drawframe roller cots and stop motions should be checked at least once/day and regular cot buffing schedules implemented (The drawframe should be the control point in the cardroom. Under no circumstances should pinion changes be made at Cards and Simplex machines. The draft pinions on these machines should be standard for a given hank).

F. SIMPLEX

A test for roving hank, taking 30 yards, should include two bobbins, back and front row. Our recommended, frequency of testing would be once/week but, again accepting your reasoning, we accept a frequency of once/day as a safeguard (Whilst we accepted Mr. A. Hussain's reasoning for a once per day safeguard test, our recommended frequency of testing is once per week. The results of these tests should not be used as a basis for draft pinion changes).

i) Under normal circumstances with well maintained ring frame drafting systems we would recommend maximum ring frame drafts of :

Carded - 33
Combed - 38

and hanks at the speed frame should be produced accordingly.

Twist multiplyers will depend on spindle speed, bobbin diam(max) and staple length. A general guide to twist multiplyers would be :

Carded 1.25 to 1.3 (Up to 1,000 r.p.m)
Combed 1.2 to 1.3
Polyester/Cotton 0.9 to 1.0

G. RING FRAME

c) Twist - We consider it unnecessary to carry out a daily twist test on each frame. A simpler procedure would be to have a standard front roller speed for each count spun and a check made on this or a physical check of the twist wheel on a daily basis.

End Breakage Test

We agree the necessity for end breakage studies. It is however not sufficient to simply record the results, investigations need to be instituted to find reasons for high levels of end breaks.

Our own observations are that breaks/100 spindle hours in most BTMC Mills we have visited are averaging 50 breaks/100 spindle hours, which compares with European average of 5 breaks/100 spindle hours.

TRAINING NEEDS - SUMMARY

The identified training needs enabled courses to be written which would offer solutions to technical and mechanical problems observed in B.T.M.C Mills. Each course involved visits to factories to involve the participants in practical work. If the course was in-company specific problems could be observed and corrected. The main disadvantage is that, it is impossible to cover every training need in a classroom situation, it is possible to cover individual problems completely in company. Therefore, to be meaningful the courses should be part notes but essentially practical in presentation, to enable the all important implementation of detail and knowledge gained on courses.

The factors affecting end breakage rates are yarn strength, traveller weight and spindle speed, and the main problem in Bangladesh seems to be that yarn strength (For whatever reason, cotton quality, excessive waste, unevenness etc) is not sufficient to sustain the traveller weight necessary at the specified spindle speeds (An end break guide with present raw material would be 10: 15% Spindle speed breaks be determined by end breaks. End breaks of 50% are not unusual in BTMC Mills with consequent losses in output increased costs and financial loss).

Idle Spindle Check

We would suggest a daily idle spindle check in both spinning and at the simplex machines. Our observations are that upto 10% of spinning spindles are idle in most mills and that daily checks would help to reduce this.

11. TRAINING

Before fibres can be converted into yarn, raw materials suitable for a predetermined end use is required, machinery in a condition capable of converting the fibre into yarn and obtaining a given quality standard is required, and suitably trained people are required. Assuming that electric power, buildings and water are available, then Raw Material, People, Machinery are the necessary basic requirements. By Western Standards the salaries of people employed in Asian factories are low. In Bangladesh Raw Material and Machinery must be purchased with hard currency which is limited. Salaries are paid in local currency the level of income is between Tks. 600 to Tk.1400 Spinning Operative to Spinning Manager. From this, it is reasonable to say, optimum use must be made of expensive hard currency items, raw material and machinery, even if many more people are involved than would appear to be required by Western Standards.

Local machine allocation, usually one machine per operative, will allow a higher end-break per machine provided the operative patrols correctly. For example if six machines per spinner is a Western Allocation, and one machine an Asian Allocation, then the end breakage per Asian allocation could be six times that of a normally accepted Western end-break, and still attain the same standard of output and quality.

However, in order to do this successfully people must be properly trained, from machine operator, jobber, fitter, supervisor to the Manager, they must be able to carry out their jobs properly because one depends upon the other.

Investment in people is as important as investment in machinery and raw material, unfortunately in Bangladesh, investment in the Training of Textile Technicians and Supervisors has experienced poor return.

11.1 The Bangladesh Textile Industry needs textile technicians and supervisors with the ability to rectify faults and successfully supervise the production of cotton goods in Yarn Manufacture, Weaving, and Dyeing and Finishing.

The Textile College should be producing trained people, able to work in a factory, diagnose production and quality faults, and provide remedies. However although B.Sc. and Diploma graduates have sufficient knowledge to recognise some defects the application of knowledge is a problem, there is a practical application gap. For example, the person may know how the machine should operate, and will say this is not correct, but the key fact is, he does not know where or how to start correction. It is surprising at first to hear them answer questions and subsequently in a factory not know what to do. The situation therefore is the Textile College is not training sufficient people with needs related textile knowledge, it is producing technologists who cannot apply their knowledge and many are of the opinion that a technologist sits in an office and gives orders without reference to what is actually happening in the factory.

11.2 The Industry needs technicians and supervisors with the ability to obtain optimum output per unit time, and the knowledge to act when the production/quality situation begins to deteriorate. In fact they must be able to anticipate problems and prevent them arising. Unfortunately, the BTMC and the Private Sector are chronically short of people of this calibre.

11.3 It should be realised that there is no way of producing " Instant " Yarn Manufacture, Weaving or Dyeing and Finishing Supervisors and Technologists, some of the Senior people in the industry do not realise this fact. It was suggested that people without textile knowledge be recruited, put into a class room for 3 : 6 months information " Crammed " into their heads, and then put into a factory situation. This will only produce confused people trying to remember and apply on week 27, lessons taken in week I. (It is encouraging to note thatthe present CHAIRMAN of BTMC does not agree with this cram method).

The Traditional Methods include:-

(1) A degree course at a University, followed by several years practical experience.

(2) A Sandwich Course say six months in college six months in company, thereby developing academic and practical ability together.

(3) A day realise system say 1½ days in College 3½ days in company again academic and practical ability develop together.

(4) A period as an apprentice or textile trainee in comapny.

11.4 These methods all take time, and are conducted in industries where there are sufficient technicians and experienced people, to provide a reference and a background of sound practical knowledge, which is not the case in Bangladesh.

The situation is a shortage now, and the quickest way to meet the shortage is a Modular System of instruction which if carefully and constantly assessed as the people progress through the Modules.

The people are in class for 20 days being taught one part of the process - Module I, they then go and practise in that one department for 30 days working with operatives and fitters.

When this Module is satisfactorily completed the people move onto Module-2 in the classroom and so on. (Appendix-I). The only place all the people come together is in the class-room(they work in pairs in different factories) then problems are discussed and the next Module commences.

This Modular System will work and fill the gap if properly organised and monitored, it is a Needs Related system, and can be used to replace the present vague academic outlook of the Textile College. A needs related situation is required; an Academic situation is a luxury the Bangladesh Textile Industry cannot afford until it has sufficient practising Supervisors and Technicians to provide a background of practical knowledge to support it.

11.5 Following discussion with Mr. N. N. Chowdhury, Chairman of BTMC, forty-four(H.S.C) Higher School Certificate people where recruited the object was to train them from scratch to Supervisor level in one year, using the Modular System of Instruction.

The course material was prepared Appendix-2 and training commenced at the beginning of September, 1983.

The process of converting fibres into yarn was broken into Modules Appendix and given as shown. It had just began to prove successful when the Project was discontinued. Counterparts are continuing to work with the recruits.

12. PEOPLE TRAINED

The Training Centre at Savar was not available until September, 1983. Therefore, courses were conducted in a guest house at Kohinoor Cotton and Spinning Mills at Savar, at the Textile College, in the offices of TIDC and in company.

12.1 The following table provides details of courses held, attendance and man-days. Sheet 12.1 is the attendance of Spinning Manager, Assistant Spinning Manager, Quality Controller, Assistant Quality Controller, Supervisor, Shift-in-Charge. We tended to take Senior people first to avoid the possible confusion of a subordinate trying to explain to his manager the technology of course detail.

13. FOLLOW-UP

The first course was held at the end of June, 1980. Participants were Managers, Spinning Managers, Assistant Managers and Spinning Masters, of the 16 people called only 10 attended. This was brought to the attention of the Director(Planning and Development) who helped with the next course and was to be of help with future none attendance problems.

Follow-up of participants has resulted in direct help to the factories. This was one of most rewarding parts of the whole job whilst not everyone implemented course content, it was good to see people trying and be of direct assistance to them. We tended to follow-up as many course participants as possible, and eventually received direct invitations to visit their mills. On occasions when no changes had been made and defects which could be corrected were still evident, we reported the detail to the General Manager and left it to him, only involving the Executives of BTMC, if things were really bad.

It is not possible to give full details of follow-up, one or two examples will be sufficient.

13.1 An Assistant Spinning Manager came onto a carding course, when the system of Nep Counting was explained, he took notes did some Nep counting and apparently understood the concept. However, on follow-up to his mill it was evident that cards were being ground to a numerical rotation, say today is Tuesday so we grind Nos. 5, 6 & 7. We introduced a Nep Counting System, and gave instruction on the correct way to grind metallic wire, first on paper, then a practical demonstration.

13.2 Nep Counting

The neppiness of a card web is expressed as follows:-

Nep count is the number of neps per 100 in^2 of card web, forming a standard hank of sliver of 0.12 on a card 40 in. wide. At a first inspection it would seem necessary to collect a web from the card, on a black board 10 in. x 10 in., count the neps and correct the number obtained to account for any difference in hand and card width. In practice, the task is not so simple. It is often difficult for the observer to decide whether a speck in the web is a nep or not. Repeated counts by the same observer may result in different nep counts. Investigation of the problem by the Shirley Institute led to the development of a simplified technique of nep counting. A fuller treatment of the test is described by Linnert from whose article the present notes are largely derived.

From each side and the middle of the card samples of web are collected on black boards, 11½ in. x 5 in., and over the top of each web sample a counting template is placed. This is a black painted metal plate, 11½ in. x 5 in. x 1/8 in., with 34 round holes in it, each hole or cell being 1 in^2 in area. During the collection of samples the card continues to run.

The number of neps in each cell is not counted. We do not, therefore, obtain the mean number of neps per square inch in that way. Instead, we employ a method based on the statistical characteristics of the Poisson distribution. In each cell there may be none, one, two, three, etc. neps. The frequency distribution of these "events" or "success" is of the Poisson form, the neps being randomly occurring events. Therefore, if N cells are observed, the number of cells in which no neps occur, i.e. no success, will be given by the first term of the series, N exp(-m). If the number of cells containing one or more neps is x, then N - x = N exp(-m).

In the test, the number of cells containing one or more neps is counted, thus giving the value, x. We can now determine, m, the mean number of neps per cell.

$$m = \frac{\log_{10} N - \log_{10}(N-x)}{\log_{10} e}$$

The Shirley template has 34 cell in it, hence N is 34. We have

$$m = \frac{\log_{10} 34 - \log_{10}(34 - x)}{\log_{10} e}$$

Therefore,

$$m = \frac{1.531 - \log_{10}(34 - x)}{0.434}$$

Having derived the mean number of neps per square inch, i.e. per cell, multiplying by 100 provides the nep count, n, for the card web sample. The labour of calculation is avoided by consulting a Table from which n is obtained when x, the number of cells with one or more neps, has been counted.

The nep count, N, has been defined as the number of neps per 100 in^2 of card web forming a standard hank sliver of 0.12 on a card 40 in. wide. If the sample web does not conform to this standard the nep count is given by:

$$N = n \times \frac{\text{hank sliver}}{0.12} \times \frac{\text{card width in inches}}{40}$$

$$\text{or } N = \frac{21 \times n \times \text{hank sliver} \times \text{card width in inches}}{100}$$

Even with the aid of the Shirley templates the test still depends on subjective observations, and therefore in order to obtain reproducible results a set of standard nep boards are available against which the observer can be checked and trained. It is recommended that the same observer be used for particular comparisons and that sample boards are examined in random order and preferably all counted on the same day.

The principle of nep counting just described has been extended to nep counting of the combed web.

13.3 Grinding Procedure

1. Check cylinder/doffer setting and record.
2. Mount grinder in card brackets and set the grindstone about 0.006"(0.15 mm) clear of the surface of the wire at each end of the traverse.
3. Lubricate the grinder end bearings.
4. Fit grinder drive band to give an open drive from the cylinder pulley; ensure that the grinder pulley will give correct grinding speed(4" barrel = 900 r.p.m.; 3" barrel = 750 r.p.m.)
5. Start the card, with cylinder REVERSED, and allow grinder to run for 3-5 minutes to spread the bearing lubricant.
6. Grducally set in the grinder at each bracket in turn and only when the grindstone is at the side receiving adjustment, until light sparking occurs across the entire width of the card.
7. Gradually set in the grinder until the correct grinding pressure is reached.
8. Maintain correct grinding pressure by setting in the grinder as required, i.e. do not allow sparking to reduce noticeably.
9. After 6-8 minutes'grinding, set the grinder clear of the wire and stop the card.
10. Use microscope to examine the tooth leading edges across the full card width. If 90% of the points are fully ground, this is sufficient.
11. If less than 90% of the teeth are correctly ground, start up the card and continue grinding for 4 - 5 minutes.
12. Stop card and recheck.
13. Repeat as necessary.
14. When grinding is completed, reset the card and start up in production.

Therefore, by explaining this system and demonstrating it to the course participant and his people it was adopted as the normal system of card grinding. The man established this method at his own mill and introduced it into two mills on being subsequently transferred.

13.4 A Spinning Manager was experiencing problems with Lap Co-efficient of Variation (CV%), after attending the Opening and Cleaning course he returned to his mill but was unable to reduce CV% from 6.7% to the stated acceptable level of 2:3%. We visited his mill and proceeded as follows:-

First we checked the CV% of three laps, the average CV% was 7.2%, we determined the Cleaning Efficiency of the line by -

$$100 - \frac{\text{Trash content of Lap}}{\text{Trash content of Raw content}} \times 100$$

$$= \text{Cleaning Efficiency}$$

which was 47%. We noted that of the four blenders two were running, and two stopped for parts. Spiked lattices were damaged, levelling devices out of order, the beaters were in reasonable condition, with the exception of the Kirschner Beater, which required new lags and pins, the Pedal Feed Motion was not operating properly, pedal movement was restricted by damaged links. We requested the General Managers' permission to stop the line and effect repairs, he agreed and offered to obtain spares locally. On receipt of the spares four blenders were made operable, the spikes straightend and sharpend. One beater was reversed and one other replaced, Kirschner Beater had the lags and pirns replaced, from stores supply. These changes took about a week, it was two weeks before parts were obtained for the swing panels.

The result of this work was as follows:-

CV% tested on six consecutive days was reduced from 7.2% to 2.3%, 3.1%, 2.7%, 2.9%, 3.4%, 3.2%, cleaning efficiency increased to 64%, thereafter the line was stopped for one shift per week cleaned and checked for wear, this systematic approach was used in other factories, with similar results.

14. EVALUATION

The effect of 3419 people attending courses some of them more than once Executives, Managers, Supervisors, Quality Controllers, Jobbers, Fitters and Mixing Men, is difficult to evaluate in terms of increased ozs. per spindle per shift and quality. Certainly technicians were more aware of the effects of waste, in-sufficient maintenance, production imbalance and count variation. The combined effect of courses, and the work of the textile technologists operations could only be beneficial. It has been noted that between April 1981 and October 1983. Capacity utilisation of installed spindles increased by approximately 10% and ozs. per spindle per shift increased by 19.5%. These figures have been obtained from BTMC monthly production reports for the period given.

14.1 TRAINING REQUIRED

Considering the training requirement industry wide say sixty spinning units. The following is the minimum staffing level for a 12,500 spindle unit.

1.	General Manager	1		
2.	Spinning Manager	1	General Shift	Management
3.	Asstt. Spinning Managers	3	One each shift	Management
4.	Shift-in-Charge	3	One each shift	Management
5.	Quality Controllers	1	General shift	Management
6.	Asstt. Quality Controllers	3	One each shift	Management
7.	Quality Control Asstts.	3	One each shift	Management

Supervisors

8.	Blowing Room	3	One each shift plus one general shift
9.	Cards	3	One each shift plus one general shift
10.	Drawframes	3	One each shift plus one general shift
11.	Simplex	3	One each shift plus one general shift
12.	Ringframe	3	One each shift plus one general shift
13.	Winding	3	One each shift plus one general shift
14.	Bundling	3	One each shift plus one general shift

That is a minimum of thirty eight people described as Senior Management, Management and Supervisors using Asian Staffing and Supervisory Standards as a guide.

Additionally the following Jobbers, Fitters and Mixing men are required:-

Mixing Men	3 One each shift plus one general shift
Blowing Fitters	3 One each shift plus one senior fitter general shift
Cards	3 One each shift plus one senior fitter general shift
Simplex	3 One each shift plus one senior fitter general shift
Ringframe	3 One each shift plus one senior fitter general shift

which is a minimum of 20 people, two more would be required if the factory has lap formers and combers.

The total installed spindles, Nationalised and Denationalised at December, 1983 was:-

Nationalised	686,770
Denationalised	407,888
	1,094,658 Spindles

Using 12,500 spindles as half a unit the Management, Supervisory, Fitters, Jobbers, Mixing men, staffing requirements would be:-

Sixty Personnel per half unit, multiplied by 87.6 half units provides a minimum requirement of 5256 persons. This does not include BTMC Executive Staff, Planners and department managers. It has been previously stated in this report that there is an acute shortage of technicians in the management grades with the ability to detect production faults and take corrective action at an early stage.

In his report titled "Manpower Needs in the BTMC" dated March, 1980, Mr. Jack Woolfenden makes the following observations which are relevant to this report.

1. It is most evident that there is desperate need for trained personnel at many levels from craft level upwards plus training of fitters, jobbers.
2. There is evidence that currently the cotton textile industry is deficient in junior and middle management to th amount of about 1300 people. This shortage is further aggravated when one considers replacement requirements and the training of un-qualified existing staff.
3. The industry will have to build-up its more senior staff from craft level after suitable training because the College of Textile Technology cannot meet the needs of the industries.
4. The main area of staff shortage is in Cotton Spinning.
5. The training required for craft level personnel i.e. supervisors, jobbers, fitters will be mainly of a re-training nature. The majority of these personnel have had no training whatsoever.
6. Very little operative training is done under properly organised schemes.

These points are still relevant the only points of disagreement are the members involved. We consider the required re-training of existing people to be in excess of 3000 persons.

The current shortage of people allowing for retirement, resignations, and sickness puts the intake of new people required per annum at approximately 500 for Cotton Spinning alone. We realise these figures are high, but when one has seen the lack of effective supervision, and the absence of one person adversely affecting the output of a 12,500 spinning unit the need speaks for itself.

Therefore, whilst we have spent 17,324 man-days training management(Attendance Course duration) (12.1) and 9537 man-days training fitters, jobbers(12.2) it has been retraining and improving the competence of existing personnel. The intake of new people for training has only gained importance because of the expressed wish of the Chairman of BTMC, Mr. N. N. Chowdhury. He has realised the chronic lack of skill in the important Supervisor grades, he has seen the results of their largely ineffective performance and has insisted something be done quickly, therefore H.S.C and S.S.C people have been recruited.

15. OTHER WORK

In August, 1982, BTMC Chairman, Mr. N. N. Chowdhury requested the Spinning Advisers to work in the Tongi Zone. The training team worked in Meghna Textile Mills from September until the middle of December, 1982. With the full co-operation and assistance of the management of Meghna Textile Mills, the following improvements were realised:-

(a)Ozs. per Spindle per Shift.

July	1.59 ozs.	
Aug.	1.93 ozs.	
Sept.	2.50 ozs.	Visited factory daily for minimum of 6 hours.
Oct.	2.35 ozs.	
Nov.	2.68 ozs.	
Dec.	2.43 ozs.	

(b)Increased yarn sales.

Sept.	23,111 lbs.	This represents an increase in cash flow of Takas 2,662,776.
Oct.	20,127 lbs.	
Nov.	30,728 lbs.	when compared with the previous three months.

(c)Actual efficiency improved by 20%, at its highest over the 3 months period.

It is apprent from these improvements that a greater degree of Supervision, detecting problems at an early stage and correcting them, and technical adjustment to the machines was beneficial. Our presence tended to motivate management and staff because they were interested to see how we would approach the problems.

The greatest difficulty management have to face is absentees, sometimes has high as 45%, and even greater before and immediately after local holidays, only the influence of the Director Audit had any affect at all on this problem which is persistant and very costly.

15.1 BALANCING, MODERNISATION & REHABILITATION(BMR)

WORLD BANK PROGRAMME

In May 1981 a request to check process balance and feasibility on fifteen proposed spinning BMR's was put to use. We checked them by calculator in the office. This was enlarged in January 1983 when the Training Section was requested to do technical appraisals, re-equipment plans, existing and projected spin plans for Satrang, Dost, Quaderia, Bengal, Meghna, Luxminarayan, Dhaka Cotton Mills and Sharmin Textile Mills. A report was written for each mill and copies passed to the World Bank, BTMC and file.

15.2 ASSUMPTIONS FOR BMR

The proposed outputs eventually agreed too in the spinning sections are attainable only if certain conditions are met. In order to cover this a number of assumptions have been made. For example speeds of the order proposed assume adequate yarn strengths, high level of maintenance in early processing and consistancy of cotton mix. Following discussions with the Spinning Advisers and BTMC Planning and Evaluation Department the following assumptions have been made: That:

1. Improvements of Spinning preparation equipment will provide sliver and roving sufficiently even to produce a yarn with the strength required to run at spindles speed of the order of 10,000 rpm to 11,000 rpm. This is a key point which makes the whole programme viable. Ballon rings are necessary to reduce end breaks at these speeds.

2. Ring traveller speeds will not exceed 92 ft/sec. in any mill unless the ring frames are fitted with: (a) Variable speed meters e.g. lower start up speed, high midway speed, lower full bobbin speed. (b) that suitable S.U. rings and travellers will be available for speeds in excess of 92 ft/sec.

3. In instances where rings are not being replaced those rings are suitable to allow high spindle speeds(Suitable = good condition).

4. Roller Buffing equipment is essential for the production of good quality yarns. Jt should therefore be purchased for each mill which does not have a suitable roller buffing equipment.

5. Sufficient consideration has been to the procurement of electrical spares.

6. The re-conditioning of cards involves taker-in, cylinder-doffer wire, bearings should be replaced with ball or roller bearings, flats and chains are replaced, i.e. complete modernisation.

7. Sufficient magnets are available to prevent damage by bale iron to metallic card clothings.

8. Adequate card grinding equipment, setting gauges, magnifying glasses of the OMAG type are purchased for each mill.

9. Card grindings and mounting equipment is available and in good condition.

10. Operatives can meet the level of skill required to run the machines, and maintenance staff will be trained and conduct maintenance as instructed.

11. Sufficient fast moving spares, travellers, cots replacement parts and lubricants will be available at all times.

(Continue on page 27)

12. BTMC has issued instructions that no spinning unit will use 2 bale mixings.

13. The range of hanks of blowroom material, card sliver, drawframes sliver and speed frame material will be kept to a minimum. Several different hanks will be mixed, no matter how careful we are therefore, produce less hank numbers and reduce count variation.

14. Sufficient space is available in mixing rooms for 10 : 20 bale stack mixings or bases around the lattice.

15. Re-workable waste is weighed into mixings, known quantities of soft waste are put back, and the amounts are not excessive(i.e. maximum 10%).

16. Quality Control procedures will detect faults and necessary corrective action will be taken. Pinion changes at Simplex and Card will be discontinued.

17. Air from Pnuemafils should be exhausted to outside.

18. When new drafting systems are purchased Pnuemafil tubes will also be replaced.

19. Maintenance Equipment will be procured and used according to machine manufacturers recommendations.

16. RECOMMENDATIONS

16.1 Future Training

It is essential to the future prosperity of BTMC that an active re-training program and the training of new people be persued. The longer the period of re-training the better, providing there is practical implementation in-company of class-work. The later is most essential and cannot be over emphasised. The basic reason for 10 days courses was to accommodate the shortage of people in the factories. We were constantly told that people could not be spared from their respective mills for periods longer than 2-weeks. However, longer periods are advantageous if the people can be spared, but class-work must be complimented by practical in Savar and in-company.

16.2 The training of personnel from all levels in the hierarchy Senior Management to Operative should be undertaken. No one is exempt, the non-technical Senior Manager should become a thing of the past.

16.3 COSTING

It is obvious that many key people have no knowledge of costing. The value added to the material by each process should be explained to all concerned in the manufacturing process. Waste is not just rubbish, its value is the raw material price plus the value added by each process. Costing expensive reworkable waste at Taka-5 per lb. hides its true value.

16.4 CONTROL INFORMATION

(a) Quality Control

The object of a Quality Control Department is to detect faults and changes that adversely affect output and quality. Conducting tests and having the book signed by a Spinning Manager is not enough. The information is gathered to detect faults, the Quality Controller and the Spinning Manager should act together to correct detected fault. They are too often ignored.

(b) Monthly Production Returns

The BTMC monthly production report is a valuable document which could be improved. In its present form it hides the reasons for low productivity in the figures used to calculate "Utilisation". During the time spent at Meghna, absentees of the order of 25% to 40% were accepted, consequently shortages and stoppages were incertable, if such is the case it should be stated. Every factory appears to have this absentee problem, but too often BTMC staffing policy is blamed and no action taken. Stoppages, downtime, shortages should be accurately recorded and reported. Action by a better informed executive could reduce such problems, but if the reasons are hidden, which is possible with the production return document in its present form, how can BTMC Executives take action?

16.5 Scholarships

The value of overseas scholarships to the BTMC should be considered very carefully before any employee of BTMC is allowed to go overseas. For example, several people have been to Ten-Cate in the Netherlands for six months to study Textile Technology. We had the opportunity to interview several of these people on their return to Dhaka. It was evident that because of the different stages of development between the Textile Industries in Bangladesh and the Netherlands, the information and knowledge gathered in Ten-Cate had little or no application to problems in BTMC.

The object of sholarships is surely to seek answers to problems arising in the Bangladesh Textile Industry, not to spend 6 months in an environment with problems that bear no relation whatever to BTMC problems.

To this end I wrote to Ten-Cate Appendix. The reply to this letter was that they had no facilities to cover the training needs listed. If the knowledge gained cannot be applied what is the point, the funds provided could be better allocated for the study of spécific problems which would be of immediate assistance to BTMC and the whole Textile Industry in Bangladesh.

ACKNOWLEDGEMENTS

During the four years working with Textile Industry Development Centre(TIDC) we have enjoyed the support of the Chairman, Mr. N. N. Chowdhury and the Directors of BTMC.

Without their assistance the work would not have been possible.

REFERENCES

In wiriting this report reference has been made to the work of:-

Mr. Robert Ashton	-	Textile Technologist
Mr. Basil T. Jackson	-	Textile Technologist
Mr. J. E. Booth	-	Principles of Textile Testing
Mr. K. Grimshaw	-	English Card Clothing
Textile Institute Publications		

12.1

Course	No. of Times Held	Attendance Called	Attendance Attended	%	Duration/Days	Man-Days
Opening/Cleaning	20	633	521	82.3	10	5210
Carding/Drawing	16	536	474	88.4	10	4740
Simplex	18	431	283	65.7	10	2830
Ringframes	16	396	326	82.3	10	3260
Combing	1	20	11	55.0	10	110
Health/Safety	2	44	19	43.2	3	57
Production Control	1	20	13	65.0	5	65
Spinning Technology for non-technical(Excess)	4	98	89	90.8	10	890
Textile Technology for Labour Leaders	2	54	54	100	3	162
			1790			17324

12.2 The table at 12.2 provides the number of fitters, jobbers, mixing men trained in the company.

12.2

COURSE	NO. OF TIMES HELD	ATTENDANCE		DURATION	MAN-DAYS
OPENING/CLEANING	7	416	416	6 days	2616
CARDING/DRAWING	9	428	428	7 days	2996
SIMPLEX	7	393	393	5 days	1965
RING-SPINNING	12	392	392	5 days	1960
			1629		9537

FITTERS, JOBBERS AND MIXING MEN IN COMPANY

SUMMARY OF COUNT VARIATION SURVEY

APPENDIX-1

			STRENGTH					
Count	Average Count	P.M.R.	S.D.	C.V.	MEAN DEVIATION	P.M.D.	C.S.P	REMARKS
30^s Cotton	28.50^s	10.70	4.28	7.81	3.41	6.24	1562	
32^s Cotton	30.59	10.49	4.43	9.52	3.53	7.58	1423	
32^s Viscose (80% Cotton & 20% Viscose)	30.83	11.86	3.63	8.70	.87	6.88	1287	
40^s Cotton	38.27	8.72	.47	8.82	2.76	7.01	1505	
40^s Viscose (80%Cotton 20% Viscose)	38.03	15.93	3.67	12.45	2.93	9.94	1121	

0s (Cotton)

Name of the Mills	Count Maximum	Count Minimum	Lea Strength Maximum	Lea Strength Minimum	Summary Count	Summary Lea Strength
	31.74	22.98	71.0	50.0	Maximum 33.90	69.00 lb.
	33.90	21.97	61.5	35.0	Minimum 21.97	35.00 lb.
	29.8	27.70	69.0	50.0	Standard	Standard
					± 1	51.5 - 63 lb.

2s (Cotton)

Name of the Mills	Count Maximum	Count Minimum	Lea Strength Maximum	Lea Strength Minimum	Summary Count	Summary Lea Strength
	33.3	30.3	70.0	46.0	Maximum 37.70 Minimum 23.00	70.00 lb. 25.00 lb.
	33.3	28.1	70	48		
	33.3	25.0	56	34	Standard + 1	Standard 48 - 59 lb.
	33.3	23.0	61	39		
	37.7	24.0	56	25		
	35.8	29.4	60	34		
	34.48	25.0	55	33		
	33.33	25.32	56	30		
	33.90	25.00	47	26		
	35.96	25.98	49	31		
	34.48	23.69	67	40		
	34.48	27.41	62	40		
	33.00	27.00	61	31		
	33.00	28.00	56	32		
	34.2	28.00	58	43		
	34.4	25.6	61	36		
	37.7	27.7	48	25		
	32.78	30.76	65.5	42		
	33.3	29.4	60	40		

40^{s} (Cotton)

APPENDIX-1(Contd.)

Name of the Mills	Count Maximum	Count Minimum	Lea Strength Maximum	Lea Strength Minimum	Summary Count	Summary Lea Strength
A	43.4	27.7	56	30	Maximum 51.3	61 lb.
B	47.6	26.3	40	24	Minimum 26.3	12 lb.
C	41.32	30.49	56	32		
D	51.30	33.20	32	12		
E	43.40	33.30	61	31		
E	41.60	34.40	58	31		
E	45.40	35.80	55	31		
G	41.70	30.20	47	26		
G	42.55	33.45	50	33		
H	41.66	34.48	48	28		
H	38.48	29.41	58	35		
J	41.00	36.50	36	24		
J	41.50	35.50	39	20		
K	44.44	35.50	50.5	32.75		
K	42.50	31.70	46	31		
M	43.4	36.3	48	38		
P	41.6	35.7	57	37		
P	41.70	37.7	56.60	39.50		
32's Blended(80% Cotton & 20% Viscose)						
B	35.70	26.3	52	32	Maximum 38.40	69 lb.
C	35.71	18.02	69	30	Minimum 18.02	30 lb.
E	38.40	25.80	50	30	Standard ± 1	Standard 48.5 59 lbs
E	36.10	26.30	54	31		
40's Blended(80% Cotton & 20% Viscose)						
B	52.60	33.30	40	21	Maximum 52.60	44 lb.
C	50.51	25.13	44	24	Minimum 25.13	15 lb.
D	46.70	28.10	40	15	Standard ± 1	Standard 43.00 47 lbs.

APPENDIX-1(Contd.)

30's(Cotton)

Name of the Mills	Count Maximum -	Count Minimum	Lea Strength Maximum -	Lea Strength Minimum	Summary Count -	Summary Lea Strength
F	31.74	22.98	71.0	50.0	Minimum 21.97	35.00 lb.
F	33.90	21.97	61.5	35.0	Maximum 33.90	69.00 lb.
H	29.8	27.70	69.0	50.0	Standard ± 1	Standard 51.5 63 lb.

32's (Cotton)

Name of the Mills	Count Maximum -	Count Minimum	Lea Strength Maximum -	Lea Strength Minimum	Summary Count -	Summary Lea Strength
A	33.3	30.3	70.0	46.0	Minimum 23.00 Maximum 37.70	25.00 lb. 70.00 lb.
A	33.3	28.1	70	48		
B	33.3	25.0	56	34	Standard ± 1	Standard 48-59 lbs.
C	33.3	23.0	61	39		
D	37.7	24.0	56	25		
E	35.8	29.4	60	34		
F	34.48	25.0	55	33		
F	33.33	25.32	56	30		
G	33.90	25.00	47	26		
G	35.96	25.98	49	31		
H	34.48	23.69	67	40		
H	34.48	27.41	62	40		
J	33.00	27.00	61	31		
J	33.00	28.00	56	32		
K	34.2	28.00	58	43		
K	34.4	25.6	61	36		
N	37.7	27.7	48	25		
P	32.78	30.76	65.5	42		
P	33.3	29.4	60	40		

Name of the Mills	Count Maximum	Count Minimum	Lea Strength Maximum	Lea Strength Minimum	Summary Count	Summary Lea Strength
40's (Cotton)						
A	43.4	27.7	56	30	Minimum 26.3	12 lbs.
B	47.6	26.3	40	24	Maximum 51.3	61 lbs.
C	41.32	30.49	56	32	Standard	
D	51.30	33.20	32	12	± 1	38.8 - 48 lbs.
E	43.40	33.30	61	31		
E	41.60	34.40	58	31		
E	45.40	35.80	55	31		
G	41.70	30.20	47	26		
G	42.55	33.45	50	33		
H	41.66	34.48	48	28		
H	38.48	29.41	58	35		
J	41.00	36.50	36	24		
J	41.50	35.50	39	20		
K	44.44	35.50	50.5	32.75		
K	42.50	31.70	46	31		
M	43.4	36.3	48	38		
P	41.6	35.7	57	37		
P	41.70	37.7	56.60	39.50		
32's Blended(80% Cotton & 20% Viscose)						
B	35.00	26.3	52	32	Minimum 18.02	30 lb.
C	35.71	18.02	69	30	Maximum 38.40	69 lb.
E	38.40	25.80	50	30	Standrad	Standard
E	36.10	26.30	54	31	32's ± 1	48.5 - 59 lbs.
40's Blended(80% Cotton & 20% Viscose)						
B	52.60	33.30	40	21	Minimum 25.13	15 lb.
C	50.51	25.13	44	24	Maximum 52.60	44 lb.
D	46.70	28.10	40	15	Standard	Standard
					± 1	43.00 - 47 lb.

APPENDIX-2

H. S. C.

I.S.C.T	Module 1a			
	Class Work	20 days	-	Counting system Mixing, Opening and Cleaning Supervision, Management Structure
I.S.C.T	Module 1b			
	Factory Work	(30 days)	-	Mixing, Opening and Cleaning Dept. Supervisory system, Quality Control
I.S.C.T	Module 2a			
	Class Work	(10 days)	-	Carding and Drawing
	Module 2b			
	Factory Work	(30 days)	-	Carding and Drawing Dept. Supervisory system Quality Control
I.S.C.T	Module 3a			
	Class Work	(20 days)	-	Lap Forming and Combing
	Module 3b			
	Factory Work	(30 days)	-	Lap Forming and Combing Dept. Supervisory system Quality Control
I.S.C.T	Module 4a			
	Class Work	(10 days)	-	Speedframes
	Module 4b			
	Factory Work	(30 days)	-	Speedframes Dept. Supervisory system Quality Control
I.S.C.T	Module 5a			
	Class Work	(10 days)	-	Ring Spinning, Winding and Bundling
	Module 5b			
	Factory Work	(30 days)	-	Ring Spinning, Winding and Bundling Dept. Supervisory system, Quality Control.

The course duration will be 9-months to 1 year, this will depend upon the ability and application of the participants.

The Class Work will involve visits to factories to explain the detail and illustrate the techniques involved.

In Factory Work will involve the participants working in pairs, in different factories. They will first do the operative jobs, (working with operatives) then assist the fitters and then work for the Supervisor. Whilst in the Factory they will be responsible to the Spinning Manager, who will check their factory work notes each week. They will be given a factory work module to study before they go into a factory. Safety aspects will be explained in detail at each stage.

There will be written test after each part (a) and (b) of each module. The participants will be continuously assessed throughout the program. Any participant not working correctly will be referred to TIDC and BTMC for an explanation. Participants who do not follow the line of work will be asked to leave the course after discussion with the proper authority.

SYLLABUS FOR I.S.C(H.S.C. Science Group)

SPINNING TRAINING

I.S.C.T Management

Module 1a.

Class Work

20 days

(a) Management Structure
(b) Division of Work
(c) Authority and Responsibility
(d) Discipline
(e) Unity of Command
(f) Unity of Direction
(g) Subordinate of Individual to General Interest
(h) Teamwork, "The principle that in unity of command there is strength".
(i) Manpower Planning

2. Managing for Effective Supervision

(a) Objectives and Plans
(b) The five needs of any Manager or Supervisor
(c) Job Specifications
(d) Profit Influencing Areas
(e) Analysis of Priorities
(f) Key Tasks

I.S.C.T 2 Opening and Cleaning

Module 1a

Class Work

Mixing the importance of number of bales, in mixing, micronaire, staple length, Pressley, trash content and colour of raw cottons.

Reworkable waste %, Machines in blowing room, description of each machine, settings, bars, tension of lattices.

Number beating points for given grades of cotton. Description of machinery consider best to open different grades and types of cotton. Pressure, Panels, Photo electric cells, Piano Feed Motion. The setting of each device and how wrong settings will affect laps.

Lap Weight Ozs. tolerances warning and action limits. Action necessary when variation is (a) Heavy (b) Light (c) Erratic. Trend to Heavy or Light laps. CV% of laps Yard to Yard variation 2 : 3% action if CV% increases.

Calculations: Change wheels, production per hour, weight per yard for given counts, speed of beaters. Changes required from time to time for optimum opening and cleaning.

Module 1b
Factory Work
30 days

Practical: Fault detection and correction settings of: Lattices, eveners, beaters, feed rollers. How to detect in-correct settings, action if settings are wrong.

Maintenance: Importance of maintenance schedule, lattice bowls clean, spikes sharp, beater strikers sharp. Re-setting of piano feed motion, re-location of Photo Electric Cells, re-setting pressure panels to ensure sufficient weight of material at critical pressure points.

General: Change weight per yard of lap, length of lap, number of beating points required for clean, less than 2% trash, average 2:5% trash, dirty 5% or greater. Work methods for operatives, supervisors, e.g. trash box employing cycle.

Viscose and Polyester: Opening points, processing details. Waste Types of waste, dropping too rich, re-workable waste, amounts of waste, Storage of waste. Laps Storage, levels of stock.
Staple length for count, BTMC recommendations. Baear Sorter Diagram. Effective Length. Micronaire, Pressley.

I.S.C.T 1
Module 2a
Class Work
10 days

Cards: Description of action of each part, taker-in cylinder, doffer flats, undergrinds. Importance of measuring carded quality. Nep counting, action when neps increase. Strippling Cycle, Grinding Cycle. How to strip, Type of Grinding equipment. How and when to grind. Settings and setting points, how to set. Increase and decrease carding action. How to increase or decrease flat strips speeds of component parts.

Practical: Setting, stripping, grinding, changing, weight per yard. Action, if nep count is high, if web is cloudy, if web is dropping, if gaps appear in web.

Calculations: Calculation of: lbs per hour, web draft, draft or card. Weight required to balance production. Speed of parts.

I.S.C.T Module 2b	Maintenance: Importance of regular maintenance and cleaning schedules grinding and re-setting. Life of wire.
Factory Work	General: Settings for: Polyester, Viscose, Clean Cotton, dirty cotton long staple, short staple. Operative duties, fitters duties, Supervisors duties. Types and amounts of waste at each point. Correct way to replace laps, doff cans.
Module 2a Class Work	2-Drawframes: Object of Drawframes Process: Importance of the drawframe process. Why it is important. Stop motions, their importance. Types of drafting, why drafting is necessary. Condition of drafting rollers, the absolute necessity of keeping top rollers buffed and in good condition and the reasons why. Sliver detectors and the cause of count variation.
Module 2b Factory Work	Practical: Roller setting, check condition of, rollers, sliver, detectors, change wheels. Detection of drafting faults. Operative duties, fitters' duties, supervisor's duties, Frequency of warping. Quality Control, Maintenance Schedules.
	Calculation: Speed of drawframe, lbs. hour to balance production. Calculations for hank changes. Action if sliver is light or heavy, warining units, action limits.
I.S.C.T	
Module 3a 1 Class work	Lap Forming: Object of Lap Forming: Importance to combing of the lap forming process. Types of machine and principles involved. The importance of Sliver detectors. Weight per unit length of lap effect on combing of lap faults.
Module 3b Factory Work	Practical: Roller setting, check stop motions. Detection of faults. Operative duties, fitters' duties, Supervisor's duties. Frequency of checking shape and density of lap. Maintenance Schedules.
Module 3a 2 Class Work	Combing: Object of Combing: The object of combing, the use of the Index Wheel. The combing cycle. Basic principles, the action of the top comb. Action of cylinder. Index of cycle of combing actions. Increase and decrease waste extraction.
Module 3b Factory Work	Practical: Comber settings use of gauges. Fault detection, operative duties, fitters duties, supervisors duties, Calculations. Maintenance Schedules.

Module 4(a) 1 Class Work

Speed Frames: Object of Speedframes: The function of builder motion, how it works. Identification of primary drivers, spindle, bobbins, cone drums. Type of drafting flyers, wraps around flyer paddle. Tensers, twist, why it is instead twirst multiplyers. Angle of draft maximum, minum minimum twist flyer speed.

Module 4(b) 2 Factory Work

Practical: Fault analysis, identifying causes of mis-shapen bobbin and how to rectify. Increase and decrease, twist draft, taper, hardness of bobbin, distance between coild, lift. Causes of defects, soft bobbin. Measure ends breaks.

Calculations: Twist constant and twist, Draft constant and draft change wheels, which wheels to change of hank is to be consider or finer. Pounds per hour to balance output of drawframes and speed-frame.

I.S.C.T

Production Calculations

Module 5(a) 1

Maintenance Schedules

Class Work

Ring Frame: Object of Ring Frame: Types of Creel, Drafting Systems, limits of of drafting, Break Draft, What it is, what it should be. Tensers, Aprons, rollers, condition of an effect on yarn quality.
Periodic variation, use of black board, and wrap reel. Traveller speed - maximum, Traveller changes, frequency. Correct traveller weight, how to determine. Use of count strength product(CSP), Count Variation causes, acceptable limits. Roller settings, from effective staple length.

Module 5(b) 2 Factory Work

Practical: End Breaks, fault detection, Work load, change, draft and twist Change counts. Doffing procedures.

Calculations: Change wheels to go finer or coarser TM. and TPI limits of TPI. End breaks per 100 spindle hours. Production balance: Draft constant, Twist constant. Starting from required weights of material:

Calculates: Number of spindles required at Ring Frames, Speed frame. Number of drawframes, Cards and Blowingroom, determine output necessary fram each process to balance production and to produce counts required.

I.S.C.T

Module 5(a) 3

Winding and Reeling: The Object of Reeling

Size and shape of package, patterning clearing devices, why winding is necessary, labour loading. Reeling object of and methods employed.

Module 5(b) 4 Factory Work	Practical: Cone setting to winding drum. Clearer setting, use of waxing devices, Operative duties, Supervisors duties. Production, Balance, Maintenance.
Module 5 a 5 Class room	Bundling: Object of Bundling: Methods involved in bundling. Length and weight of bundles, bundles per bale.
Module 5 b 6 Factory Work	Practical: Calculation to obtain production balance, operative duties, Supervisors duties.
General	Quality Control: Process control and the use of Quality Control Depts. will be given in each module. Mr. Alam of Central Testing can give a ten day course on methods used in Quality Control and the organisation of a Quality Control Depts.