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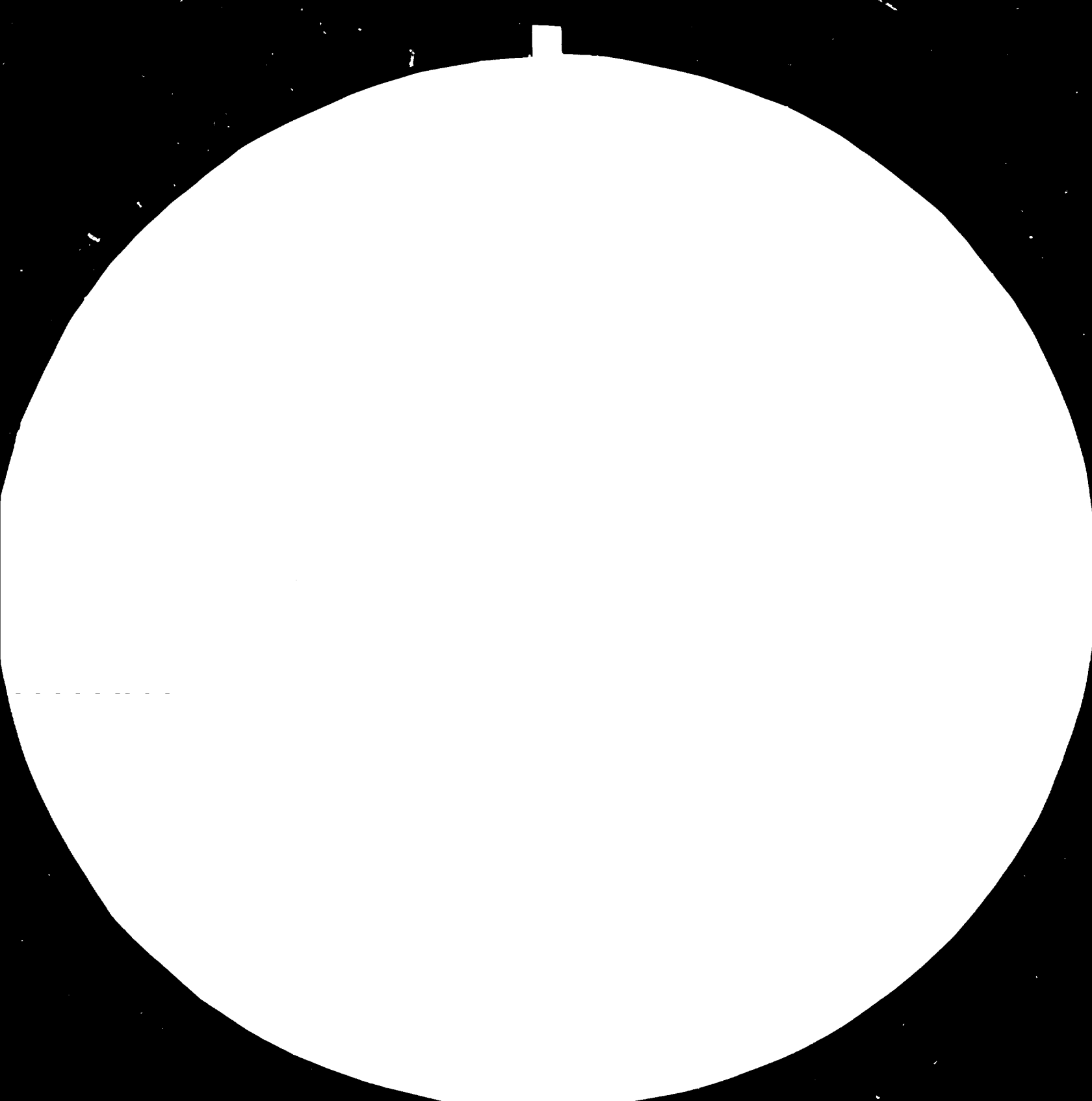
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CENTRAL TESTING LABORATORIES
FOR JUTE GOODS

DP/SGD/79/010

BANGLADESH

Terminal report *

Prepared for the Government of the People's Republic of Bangladesh
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of E. J. Gordon, expert in quality control

United Nations Industrial Development Organization

Vienna

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I. INTRODUCTION

This report refers to the work of the project consultant who has completed a short service agreement lasting three months.

The project which was originally conceived in 1979 arising from a proposal by the World Bank did not commence until September 1982 when the project adviser took up his post. A large proportion of the country's export trade comprises jute and jute products and the government were concerned that much of this export market might be lost if the quality of the goods did not improve. To encourage quality improvement the government proposed that an export certification scheme be introduced and charged the Directorate of Inspection for Jute Goods with responsibility of implementing the decision.

A previous project BGD/73/043 (S. L. Leang) had contributed to an improvement in Q.C. methods by introducing standard methods to four mills as a pilot scheme. No spread of the standard methods occurred and the seeding of these mills proved to be ineffectual. This project was financed by UNIDO.

A. Abstract

Project DP/BGD/79/030

Purpose:

To assist the Directorate of Inspection for Jute Goods, under the Ministry of Jute, to set up quality control measures, to operate quality control equipment in testing laboratories, and to establish appropriate standard procedures for issuing Export Inspection Certificates.

The Mission was of three months duration to:

1. Recommend quality control methods and standards for test operations in the laboratories;
2. Recommend a channel for technical communication between central testing laboratories and the manufacturing industries;
3. Prepare instructions for process control methods to be used as a guide to quality control measures;
4. Develop systems for the standardisation of jute goods.

It is concluded that the main purpose can be contributed to marginally only as the laboratories are incomplete. Standards have been recommended but not introduced and the Directorate has been advised to publish its standards to encourage uniformity of Q.C. methods among mills.

The recommendations include the preparation of standard cloth faults for quality assessment with specimen definitions, the introduction of a classification scheme with a discussion paper and the setting up of standard laboratory methods based on practical trials of adapted foreign standards and after consultation with local industry.

B. Explanatory notes

During the period of the short service agreement the exchange rate was on average T 24.2/- = \$ 1.

In the text of this report reference is made to both metric and British units and the local units have been converted into one or other. The industry uses a mixture of the two systems and the government is moving towards the introduction of metrication.

The units which require definition are:

- X Lb/sp - Yarn count; X = weight in lb of 1 spyndle (14,400 yds)
- X Tex - Yarn count; X = weight in grammes of 1000m.
- Q.R. - Quality Ratio expressed as a percentage; $\frac{\text{lbf X 100}}{\text{lb/sp}}$
- CBC - Carpet Backing Cloth
- QC - Quality Control
- 1 Ton - 2240 lb; 1000 kg.
- CV% - $\frac{\text{SD X 100}}{\text{mean}}$
- TSP - Tamarind Seed powder
- TKP - Tamarind Kernel Powder
- MPH - Miles per hour
- E - Machine efficiency; Actual output/maximum output
- PPM - Picks per minute; Loom speed
- P. A. - Personnel Administration; Business consultants
- BJTRA - British Jute Trade Research Association
- BJRI - Bangladesh Jute Research Institute
- H.S. - High Speed
- O.H. P. - Over Head Projector
- SD - Standard Deviation
- LBF - pounds force
- MR - Moisture Regain.
- PICK - One Weft Thread.

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II. RECOMMENDATIONS

The three recommendations made in this section are basic to the setting up of the inspection system and have been communicated to the Director of Inspection for Jute Goods. It was considered good policy to keep the Director informed of the progress and the recommendations which were likely to be included in the final report and thereby maintain good relations between the international staff and the national counterpart. As a result of this the first recommendation has been accepted by the counterpart as a progressive step in preparing the ground for the introduction of compulsory certification and he has agreed to put the work in hand. Some specimen definitions and descriptions of cloth faults have been prepared as an aid to the staff of the Directorate. As these were prepared subsequent to the recommendation being made they appear therefore to repeat in detail the outlines of faults contained in the recommendation.

The second recommendation was not welcomed by the Director and the discussion report states the reasons for and against. The objections are understandable and no attempt has been made to press him into accepting a recommendation to which he is opposed. Nevertheless it is considered essential that some progression in the introduction of a scheme be built into it to avoid the introduction of slack standards, which might be used to prevent interference with exports during the initial period, followed by a tightening of standards to improve quality. The scheme should have this possible change incorporated from the start.

The third recommendation is very tentative and no work in the laboratories was possible as the chapter on the laboratories explains. It is a further essential ingredient to the scheme of certification and requires a great deal of detailed work to be done on it.

A. Cloth faults

It is recommended that a standard method of assessing fabric quality in relation to weaving faults be introduced to avoid variations between inspectors. To do this it is suggested that the Inspectorate obtain specimens of the various types of fault found in woven fabrics and that these specimens along with a written description for each become the standards upon which all assessments are based. To preserve the standards it is further suggested that they be photographed and reproduced in facsimile for distribution to the three testing laboratories and to other persons who might require to make use of them. In some cases a number of examples showing a fault in various grades of severity may be used and identified by a number to indicate severity.

Members of the inspectorate staff will require to be trained to identify and record the various faults and by reference to acceptable levels for the different types of fabric will be able to classify fabrics into quality levels.

To implement this recommendation it might be necessary to manufacture faults and to make them in different types of fabric. In assessing the quality of the fabrics tables of permissible faults and their grades for each type of fabric would require to be prepared in consultation with industry and levels fixed for each class of quality within that type of fabric. For example, a weft bar is a minor fault in CBC but it detracts from the appearance of the cloth and finished carpet while on the other hand a gaw is a serious fault. It might be permissible therefore to allow, say, 10 per 100m of the former and only 1 of the latter. Reed marked cloth is serviceable but its appearance is impaired and again cloth would not be rejected for this fault but may be down graded to a lower class if it occurs over a substantial area of the fabric. In identifying low shotting and gaws it is suggested that shots be measured over 10cm in the under-shot part and if the shots are within X% of the correct number no undershotting

is recorded, between X% and Y% undershotting has occurred and beyond Y% a gaw has been formed. The levels of X, Y and Z would be those agreed after consultation with industry. Standard samples and photographs showing examples of the three grades of undershotting should be included in the standards. Broken warp threads can be recorded in a similar manner where an occurrence would be defined as a location where one or more threads are broken. By agreeing to a suitable number for each of, say, four grades the severity of the fault may be graded. Where the warp ends have been darned in satisfactorily no fault would be recorded but for the purpose of quality control it might be recorded. Photographic standards of the grades should be included with the others.

To assist in the writing of standards sample definitions and descriptions of some cloth faults have been prepared and are attached to this report as annex 2. These show one method of defining and are offered on a tentative basis as some of the values chosen are arbitrary and require to be confirmed or altered in the light of experience. It is clear that a full definition of all the likely faults is required as the present form issued by the inspectorate to inspection staff recently is already giving rise to confusion. It is not enough to give a fault a name and expect each inspector to make his own interpretation of what constitutes an occurrence of the named fault.

In conclusion it is recommended that the collection of specimens of faults be commenced immediately and where specimens of known faults are not available steps be taken to have these manufactured.

B. Classification of jute goods for export

The stated purpose of the project is to set up testing laboratories for the purpose of issuing export certificates to mills which have goods ready or almost ready for dispatch to foreign buyers. To do this the Central Testing Laboratories for Jute goods must prepare a series of specifications against which the goods can be tested to check whether or not they conform. If the inspectorate finds that the goods do not meet the specification requirements no certificate will be issued but the mill may apply again for a re-examination. Failure of a second test would mean that the goods are condemned for export and must presumably be used in the home market.

At present all goods for foreign buyers are exported and only a very small quantity is questioned on the subject of quality. It would not be in the best interests of the country to reject goods for export as foreign exchange would be lost and the company concerned would suffer a reduction of profits. On the other hand it is a waste of time and money to set up these well equipped laboratories with a trained staff and expect them to test to specifications which have been set with standards which are so easy to pass that no rejections would occur nor would this serve the purpose for which the project was originally started, namely the improvement in general of the quality of the goods produced by the jute industry in Bangladesh.

It is recommended therefore that a system of grading be introduced whereby the specifications will have two levels of tolerance written into them which will allow the inspectorate to issue certificates showing a classification for the goods inspected. It is envisaged that those goods which are equal to or better than the first level of tolerance would be first class, those which are below the first level but are equal to or better than the second level of tolerance would be second class while those below the second level of tolerance would be third class.

It is realised that the setting of these levels of tolerance will not be easy as agreement with manufacturers will require to be sought and in the applying of the classification considerable dispute might arise over individual cases. With good will on the part of both the inspectorate and the manufacturer involved these differences can be resolved. The inspectorate must at all times show itself to be objective in its tests and where a second or third class certificate is issued the reasons should be made known to allow the manufacturer to concentrate his efforts on the appropriate processes to effect an improvement in the quality produced.

While no goods for export would be rejected for failure to pass the standards of the inspectorate (they may fail to pass a customer's standard) the issuing of a third class certificate should be a sufficient condemnation to cause the manufacturer to look long and carefully at his processing and perhaps take a policy decision to aim for a higher classification in future.

Before approaching the manufacturers it is recommended that the inspectorate prepare tentative standards with the two tolerance levels as a basis for discussion and in this respect my previous recommendation is relevant.

The inspectorate has been collecting data on the performance of mills and should be in a position to judge the levels which are desirable. However as the testing will be done in the new laboratories when they are ready it would be politic to carry out a series of check tests on materials in the new laboratories. This series of checks will allow the inspectorate to convert the subjective knowledge gleaned over the years of its operation into objective terms.

C. Standard test methods

It is recommended that a series of methods of conducting the various tests be arrived at and that these methods become the standards for the staff of the inspectorate by which all tests will be conducted. It is essential that testing in each of the three laboratories and by the different inspectors be consistent to give industry the assurance of and confidence in the impartiality of the inspectorate. It will not be possible to devise these methods until the laboratories are operational and it would be inadvisable to do so before the three assistants who are at present in the UK under training return to Bangladesh. This would ensure that the techniques which they have learned would be incorporated into the standard methods.

In drawing up these methods reference should be made to existing specifications and the methods described in publications such as B. S. Handbook No. 11, the ASTM handbook and any other publication that the project adviser recommends. At the writing of this report these two handbooks were not available although orders have been placed for them. While it is recommended that these handbooks be consulted they should not be followed slavishly as many of the tests do not refer specifically to jute or jute fabrics. Modification may require to be made to take account of the peculiarities of jute and the local conditions in the laboratories.

It is also recommended that these methods of test be completed in tentative form in the first place as they may require to be revised in the light of experience. If they are numbered to identify the method and dated to indicate the latest edition the staff would be aware of the existing standard. It would be convenient to issue these standards in loose form and keep them in a ring binder.

As this is a time consuming and meticulous task it is recommended that the Director delegate it to a senior member of his staff while still retaining

an overview of its progress. As the Director has been made responsible for grading of raw jute in addition to the inspection of jute goods for export it is unreasonable to expect him to carry out the day to day work involved. The task may also entail spending periods of time in the laboratories in Chittagong and Khulna which if conducted by the Director would make contact with the Ministry offices more difficult for him.

III. THE JUTE INDUSTRY

A. Raw materials and costs

During the period of the short service mission the supply of raw material to the jute industry was in process of change from the old crop of jute to the new crop and from the end of August 1982 to the early part of September 1983 the prices of new jute rose steadily to an average price of:-

White jute \$ 21 per 100kg (Estd)

Tossa \$ 27 per 100kg (Estd)

and in spite of a carry over of 1,350,000 bales some mills were experiencing difficulty in obtaining jute of the correct quality to continue with the normal batch.

Prices for old stock for the three months April to June 1983 were:

	White	Tossa
April	\$ 17.25	\$ 18.30 per 100kg.
May	\$ 17.28	\$ 21.00 per 100kg.
June	\$ 17.50	\$ 22.17 per 100kg.

This shows an increase of 17.4% in white and 24% in tossa jute prices of the new jute over the old. A large purchase of jute by China is likely to ensure that the trend will not reverse even if the supply of new jute coming on to the market increases.

In addition to the increase in raw material the industry has already been burdened with a 15% wage rise dating from March 1983.

B. State of trade

The specialist yarn market appears to be healthy and a number of new mills have come into production with the latest being commissioned as recently

as 31 August 1983.

The hessian and sacking mills are not so well off as the selling of sacking has been sluggish and stocks in the country at 30 June stood at 23,757.33 tons \$ 10,657,809 in value. There are signs that this burden is beginning to move but a number of mills have switched to other qualities which can be made against orders instead of for stock.

The carpet mills are experiencing difficulty in spite of the excellence of their product and a vigorous selling policy is perhaps required to get the mills back to full production.

The most vulnerable are the CBC mills as they are in direct competition with manmade fibres and have lost out to them in the primary backing market. An increase in jute prices might push the secondary backing price above that of its rivals and no improvement in quality can offset an adverse price difference. By increasing productivity and offering first class goods these mills may delay the inroads made by manmade fibres and a general upturn in carpet sales throughout the world would help.

Export of jute goods during the year ending June 1983 was:

Hessian	222,764 tons
Sacking	192,508 tons
CBC	90,067 tons
Yarn and Twine	28,095 tons
Others	1,270 tons
	<hr/>
	534,704 tons

which represents about 60% of the total jute crop.

C. Disinvestment

During the year the Government returned a number of mills to private ownership and the division between the private and public sectors at the

end of August 1983 was:-

Public	37 units
Private	54 units

The private sector includes disinvested mills and the new yarn mills. In addition however there are a few mills which are not at present functioning as manufacturing units.

(Figures obtained from the bulletins of the jute division, Ministry of Industries and Commerce).

IV. MILL SURVEY

A. Introduction

It was not possible in the time available to carry out a complete survey of the mills in Bangladesh even if it had been necessary to do so. In fact the adviser had already done this in some detail and the aim therefore was for the expert to gain an impression of the industrial practices and the methods of quality control exercised by the process supervisors and the services offered by the quality control officers to aid in this exercise. Coupled with the information gleaned from the adviser and with reference to his interim report it was considered that an adequate insight into the problems facing the inspectorate when export certification was introduced would be gained by a sample survey. Particular attention was paid to the quality of the finished products with a view to the setting of standards in the testing laboratories.

The start to any real work on the project was delayed by the Eid-ul-Fitr holiday which including the weekend lasted from 9 to 13 July inclusive. This meant that the first group of mills in the Chittagong area were visited during the week 17 to 22 July.

B. Chittagong area

Nine mills were visited in this area varying from specialist yarn mills to carpet mills but as all mills were not visited it would be unfair to give identities

In general the small yarn mills are well run and have high standards of quality control. In one the quality control samples are taken from bobbins on the frame using random numbers to ensure that the whole frame is

covered over a period of time and no personal bias exists. The samples are taken 5 each from 6 bobbins to give 30 samples each of 50m which are weighed individually to give the mean count, standard deviation over the 30 readings and the corresponding CV% which in the records examined was less than 3%. This represents a good quality control system as it embraces the between bobbin and within bobbin variations and readings less than 3% are considered to be very good. The values are corrected for moisture based on metered readings of the samples.

By contrast a mill working on mixed hessian and sacking based the quality control on samples taken from frames at random but without using random number tables. Five bobbins are selected from each frame, 60 yards are reeled from each and weighed to calculate the average count. Five sets of these bobbins are used to produce the mean count, the standard deviation and the CV%. As this is a CV% of means it can be expected to be low but as the records show it to be less than 1.0% it throws the whole system in doubt. The quality of the fabric produced in general from these mixed mills is low but is apparently adequate to satisfy the customer. The yarn is spun from poor jute with cuttings forming a proportion of the batch. This does not always mean poor spinning conditions and one mill appeared to enjoy adequate spinning conditions. The beaming and weaving machinery is generally in poor repair with frequent loom stoppages.

The CBC mills use a better quality of jute than the hessian and sacking mills and produce yarn with a higher quality ratio as a result. In one mill however the yarn had excessive slubs caused by poor apron drafting at the spinning. In another mill the fabric had an excessive number of weft bars and reed marking. The carpet factories visited use good quality jute but the levelness of the yarn in one was poor. This did not detract from the finished carpets as the cut pile disguises slubby yarn and when used in the body of the carpet there was no apparent pile disturbance. The methods of dyeing and preparing the pile yarn differed. One mill used stock dyeing

and blending during spinning with bleaching carried out for pale colours only. Another mill used spun and twisted yarns in hank form and bleached all the yarn prior to dyeing. The second method produces more brilliant colours but with a greater risk of hank to hank variation.

Designs are mainly traditional and only one "Modern" design was seen. One mill had a very well equipped laboratory which was rarely used. The quality control methods are similar to many others. A group of bobbins are selected at random and a length removed from each to make up 900yds. The weight in ounces of this length is equal to the lb/sp.

C. Khulna area

Eleven mills were visited in this area covering specialist yarns to CBC but with no carpet mills. Like Chittagong the specialist yarn mills are using all cut jute of good quality and the spinning performance is generally good. The quality control tests vary from using 10 individual readings showing a CV% count of 3% - 4.5% to 60 tests each of 90 yards showing a CV% count of 1.5%. Both based on individual readings and not means.

The hessian and sacking mills show a much poorer performance but use lower quality jute generally uncut and the batch including cuttings. The quality control tests were without exception based on groups of bobbins selected to make up 900yds weighed, corrected for moisture and the count calculated. In some cases the bobbins from several frames were used to arrive at a CV% count.

The CBC mills varied very widely in the quality of yarn and cloth produced. In one mill using good quality cut jute the preparation was very poor giving poor spinning with many ends down. The beaming and weaving were poor in quality with slubby yarns and many "Loose Runners" at the weaving. The

QR of 95% was poor when the quality of the jute used was considered. The quality control in each case was well organised but using groups of bobbins which mask the between bobbin variations. One mill used a 1% addition of starch (TSP) and the loom performance was good with few broken or missing ends.

D. Dhaka area

In the Khulna area many CBC mills were visited and few hessian and sacking mills in Dhaka the reverse was true.

In these hessian and sacking mills generally the condition of the machinery and the quality is poor. The quality control methods varied more widely than in the other areas. One mill used 3 tests each of 6 bobbins to give 18 test results which were used to give the mean and standard deviation. Another used 5 tests of 5 bobbins to give 25 test results while others used the more common method of selecting 5 or 6 bobbins to make up 900yds. and using the mean count calculated in this way to give an overall mean and standard deviation. The yarn knots in these mills were poor as many used the knotter on roll winder. Winders knots badly tied were common and in one mill the poorest knots ever experienced were being used. The dressing beaming and weaving were of average quality but in one mill the shuttles were in need of repair or replacement.

The CBC mills were producing yarn of good quality but had a number of weaving faults. In one mill frequent snarls could have been caused by the blunt nosed cops being wound.

The specialist yarn mills were like the other areas producing good yarn by using a combination of selecting good jute, keeping machinery in reasonable repair and applying strict quality control measures in spinning and winding. In this area nine mills were visited.

E. General

In every case the hospitality extended by the senior staff of the mills was of the highest order. The Bangladesh Jute Mills Corporation was particularly helpful to the extent of housing the expert while in Khulna in addition to making him welcome at the mills under its jurisdiction. In return for this hospitality the expert offered advice and guidance in the use of quality control techniques when it was requested. This advice and help extended to the actual processing.

V. THE LABORATORIES

The complete project is made up from two inputs. UNIDO supplies the equipment, advice in setting up the certification scheme and training fellowships and the host government supplies the three buildings complete with services and furnishings and the personnel to run the scheme.

At the time of writing this report the laboratories are not ready for occupation and about 70% of the equipment is in store in the country awaiting installation in the buildings. The two engineers who have been on a fellowship for two months have just returned from the UK where they received training in the care and maintenance of some of the more complex pieces of equipment.

The completion date of the buildings was estimated to be December 1982 and this date was subsequently altered to March 1983 and again altered to July 1983. The expert arrived in July to find that the fabric of the buildings was complete but no furnishings or services were available.

Since then the furnishings have been completed at Khulna and Dhaka and the Chittagong furnishings are expected to be complete within a short time.

Apart from temporary connections no power is available at the three laboratories in spite of vigorous efforts by the Directorate of Inspection for Jute Goods. Water is available at the Dhaka laboratory but difficulty is being experienced at Khulna and Chittagong.

As a result of this situation no work was undertaken at the laboratories.

The three assistant directors who will be in charge of the laboratories left Dhaka for the UK on 5 August 1983 to take up fellowships and are not expected to return until early December 1983 when they will have completed

their training.

The laboratory buildings stand each in its own ground with a surrounding wall. They are identical in layout and are more than adequate to house the equipment and staff both executive and administrative. They have been sited convenient to groups of mills in the three areas but visits to the more remote mills will involve the inspectors in travel over considerable distances. Although no greater than at present.

VI. THE WORKSHOPS

These were undertaken to lay the basis of communication between the inspectorate and the persons who would be involved in manufacturing the goods to meet the requirements for export and those in the quality control laboratories who would be applying in-process checks to ensure that the goods are up to standard.

The material presented by the project adviser and the expert on mission was of a very practical nature and was based on the impressions gained by visiting mills in the country. The texts of the presentation by the expert are included as annex 3 to this report and some specimen questions are included (annex 4).

It is clear from the latter that the project supervisors and the quality control personnel are seeking standard values for practically every facet of manufacture to which they can aim and upon which they can rely for answering every problem which might arise. They are dissatisfied with answers which involve the use of personal selection or judgement and many are unaware of the basic cause and effect situations in the processing of the material.

This attitude is more prevalent in the nationalised sector where the person on the shop floor has a number of levels of supervision above him and therefore feels inhibited in exercising any personal judgement.

The workshops were organised in the three areas coinciding with the locations of the three laboratories namely Dhaka, Chittagong and Khulna. The programme for one of these areas is included as annex 5 and the others followed the same pattern. The intention was to hold the first in Dhaka on 17/18 August, the second in Chittagong on 23/24 August and the third in Khulna on 30/31 August. The Chittagong workshop was held eventually on

6/7 September as the weather on the original date prevented the transport of the speakers to Chittagong. It is a common hazard of the monsoon season to experience heavy rainfall but on this occasion it was reported that 14 inches (356mm) of rain fell in a 24 hour period in the Chittagong area causing severe flooding and disrupting traffic to and from the area.

The original plan was to divide the topics between the adviser, the expert and two of the inspectorate staff but through discussion it was decided to make use of the wider experience of the adviser and expert and the subject matter was divided between these two with the emphasis being on the practical aspects of processing for quality coupled with practical sampling and testing procedures. Using the two experts only as speakers made the allocation of the lecture material simpler and unnecessary duplication was avoided. In spite of this simplification the discussion and preparation took a great deal of time.

The workshops covered all aspects of manufacture as the project adviser has experience of jute spinning while the expert is experienced in cloth manufacture. This blend of experience coupled with a wide knowledge of textiles offered a special opportunity to those present to have their questions answered in theoretical and practical terms.

The attendance at the workshops was reasonable in the case of Dhaka and Khulna but less so in Chittagong. The reason for the last named was perhaps because of the enforced change of date. It was in Chittagong however that the visiting Minister of Manpower and Labour saw fit to interrupt his programme to visit the workshop and offer some words of advice and encouragement to those participating as well as expressing his governments appreciation of the assistance UNIDO was providing in fitting out the testing laboratories and making available the services of two experts to instruct and guide the personnel in these laboratories and in the industry itself. This visit was well reported in the National press and on Bangladesh Television.

VII. CONCLUSION

A. Workshops

As the laboratories are so far behind the original and modified completion dates it was not possible to make a full contribution to the main purpose of the project, namely to set up quality control measures and to establish standard procedures for issuing Export Inspection Certificates. The workshops undertaken by the expert on mission and the adviser at the request of the Directorate went quite far along the way to establishing technical communications with the manufacturing industry and the texts of the lectures laid the foundations of the process control methods which should lead to improved quality control. These workshops require to be followed up to reinforce the instruction in the methods advocated and in many mills this follow-up might require more concentrated guidance from personnel conversant with the day to day running of a mill.

B. Standards

The lateness of completion of the laboratories and the absence of the Assistant Directors in the UK rendered the preparation of permanent methods of test impossible and tentative recommendations were therefore made. The work involved in carrying out these recommendations and producing permanent procedures is considerable hence the suggestion that some of the work be delegated. This raises also the subject of delegation of some responsibility to a senior member of staff of the Directorate located in each laboratory as decisions regarding doubtful cases of certification which may arise during the operation of the scheme must be taken quickly. If such cases require to be referred to the director in Dhaka the delay will be a source of friction between the Directorate and industry.

C. Quality Control Methods

The variation between quality control methods adopted by the mills is such that inter-mill comparison is impossible. The Directorate might be encouraged to use its influence to bring about a degree of standardisation by publishing the methods which it adopts as standard in the testing of products for export certification.

Discussion of Recommendations

Report of meeting held at the office of the Inspectorate for Jute Goods on 27 August 1983.

Present:	M. S. H. Khan	Director
	S. M. Hoque	Deputy Director
	R. R. Atkinson	Project Adviser, UNIDO
	E. J. Gordon	Expert on mission, UNIDO

The meeting was called by Mr. Gordon to discuss the recommendations made to the inspectorate on 14 and 24 August 1983.

Recommendation of 14 August 1983:

It was explained that no standards exist which detailed faults in cloth but in the interests of uniformity between inspectors and the assessing of cloth for faults it was recommended that standards be adopted. It was accepted that the recommendation was practicable and the Director agreed to institute action in collecting or manufacturing specimens of the various faults. These specimens would be assessed for severity before selecting those to form the basis of standards. In this respect Mr. Gordon said that he was preparing a number of definitions and descriptions of cloth faults related to jute fabrics as much of the literature described faults applicable to other branches of the textile industry. Those covered so far using similar names of those on the Inspectorate check list are undershotting, weft bars, missing weft, broken warp, missing warp and reed marking. Before arriving at standards the director agreed that consultation would take place with interested parties to seek their views. The Director pointed out that the work of collecting the specimens would have to be done in addition to other work and activities in which the staff of the Inspectorate is engaged. This would take a few months and the Director expressed the opinion that it would be completed before Mr. Gordon returned to Bangladesh for the second part of his mission. He also expressed the opinion that as the

completion of the laboratories was taking such a long time the project would require to be extended in time.

Recommendation of 24 August 1983:

Mr. Gordon reiterated the reasons for recommending a system of classification of jute goods for certification purposes namely that at present no goods are rejected, it would not be in the best interests of the country to reject goods for export as foreign earnings would be lost and companies would suffer a loss in profits. The Director disagreed with this view as the compulsory minimum price fixed by the government would mean that all goods would be offered at the same price thereby making classification meaningless. He explained that mills were permitted to negotiate premiums on the minimum with certain customers who were prepared to pay extra for the assurance of quality. The expert pointed out that a pass/fail test would mean that the standard would require to be slack or the rejection rate, at least initially, would be high and once a standard was set it would be difficult to change it. The expert expressed the opinion that slack standards would not bring about a general improvement in quality and indeed might be counter productive. The Director agreed with that part of the recommendation which stated that assessments should be objective as far as possible.

BGD/79/030

Annex 2

The following are tentative definitions and descriptions of some cloth faults.

Cloth - A fabric woven with warp threads and weft threads at approximately right angles to one another and interlaced in regular order.

I. Grading of cloth faults (tentative)

A. Undershotting

1. Undershotting - A part of the woven cloth where the weft thread count is less than that specified when counted over 100mm.
2. Weft thread counts which fall on or within the following tolerance limits when counted over 100mm at the undershotted part shall be deemed to conform to the specification.

	Tolerance limit
Carpet Backing Cloth	- 3%
Hessian	- 3%
Sacking	- 6%
Tarpauling	- 6%

3. Weft thread counts which fall outwith the tolerance limits shown at A2 but lie on or within the following limits when counted over 100mm at the undershotted part shall be deemed to be undershotted and shall be recorded as a cloth fault.

	Limit
Carpet Backing Cloth	- 6%
Hessian	- 6%
Sacking	- 9%
Tarpauling	- 9%

4. Weft thread counts which fall outwith the limits shown at A3 when

counted over 100mm at the undershotted part shall be deemed to be a gaw and shall be recorded as a cloth fault.

N. B. For the purpose of counting the undershotted part the 100mm gauge shall be placed on the cloth in such a way that the counting is done along a line perpendicular to the weft threads and the undershotted part lies in the centre of the 100mm gauge.

B. Weft bar

1. Weft bar - A part of the woven cloth where the weft thread count is greater than that specified when counted over 100mm.
2. Weft thread counts which fall on or within the following tolerance limits when counted over 100mm at the weft bar shall be deemed to conform to the specification.

	Tolerance limits
Carpet Backing Cloth	+ 3%
Hessian	+ 5%
Sacking	+ 7%
Tarpauling	+ 6%

3. Weft thread counts which fall outwith the tolerance limits shown at B2 when counted over 100mm at the weft bar shall be deemed to be a weft bar and shall be recorded as a cloth fault.

N. B. For the purpose of counting the weft bar the 100mm gauge shall be placed on the cloth in such a way that the counting is done along a line perpendicular to the weft threads and the weft bar lies in the centre of the 100mm gauge.

N. B. Weft bars are easily detected in cloths which have low weft

cover factors. Where the weft cover factor is 0.40 or greater weft bars will either be difficult to detect or their occurrence will be impossible. High cover factors are found in sacking and tarpauling cloth.

The cover factor is calculated by the following formula:

$$\text{Cover factor} = \frac{\sqrt{\text{Tex}} \times \text{Threads/dm}}{2670}$$

The maximum in this case is unity (1.0).

4. Where undershotting, gaws or weft bars occur within 100mm of each other they shall be recorded as a single cloth fault.

N.B. Where an irregularity has occurred in the loom uptake mechanism a weft bar may be formed adjacent to a gaw or undershotted part.

C. Missing weft

1. Missing weft - One or more weft threads missing from the cloth causing the regularity of the interlacement to be interrupted.

N.B. In plain weave two adjacent weft threads will lie together in the same shed and in twill weave the twill lines will be interrupted.

2. Where one or more weft threads are missing such that the regularity of the weave is interrupted it shall be deemed to be missing weft and be recorded as a cloth fault.
3. Where weft threads are missing but the regularity of the weave is not interrupted it shall be deemed to be undershotted and dealt with under A2, A3 or A4.
4. Where part of a weft shot is missing as a result of the weft breaking or the malfunction of an automatic weft loading device it shall be deemed to be missing weft and be recorded as a cloth fault.

N. B. Where the automatic weft loading device has been set to reload the shuttle when the previous weft package has run out the fault of missing weft will occur on most occasions when a new weft package is loaded. In this case missing weft may be assumed to be normal and will not be deemed to be a cloth fault and will not be recorded.

D. Broken warp

1. Broken warp - Where a warp thread has broken causing the regularity of the interlacement to be interrupted.
2. Where up to five warp threads are broken adjacent to one another it shall be deemed to be a warp break and be recorded as a cloth fault.
3. Where more than five but fewer than twenty warp threads are broken adjacent to one another it shall be deemed to be a major warp break and be recorded as a cloth fault.
4. Where twenty or more threads are broken adjacent to one another it shall be deemed to be a smash and be recorded as a cloth fault.
5. Where warp breaks have occurred and have been satisfactorily repaired and no interruption of the weave or thread spacing is apparent it shall not be deemed to be a cloth fault but may be recorded.

E. Missing warp

1. Missing warp - One or more warp threads missing from the cloth causing the regularity of the interlacement or the regularity of the warp spacing to be interrupted.

N. B. In plain weave two adjacent warp threads will follow the same pattern of interlacement and in twill weaves the twill lines will be broken.

2. Where one or more warp threads are missing for 50mm or less it shall be deemed to be a broken warp and be dealt with under D2 or D3.
3. Where one or more warp threads are missing for more than 50mm it shall be deemed to be missing warp and be recorded as a cloth fault.

N. B. In double warp cloths where one thread of the pair which is drawn through one mail eye is missing it shall not be deemed to be a cloth fault but may be recorded.

F. Reed marking

1. Reed marking - The irregular spacing of warp threads caused by the reed.
2. Where the warp spacing is irregular such that a group of warp threads appears adjacent to a space caused by bent or misplaced reed wires and that the grouping occurs at fewer than five places per 1000mm of width it shall not be deemed to be a fault but may be recorded.
3. Where the warp spacing is irregular such that a group of warp threads appears adjacent to a space caused by bent or misplaced reed wires

and that grouping occurs at five places or more per 1000mm of width it shall be deemed to be reed marking and be recorded as a cloth fault.

N. B. For widths other than 1000mm the number of occurrences for F2 and F3 shall be calculated by proportion.

4. Where the warp threads are lying in groups which coincide with the order of drawing the threads through the reed and this grouping extends for more than one quarter of the width of the cloth it shall be deemed to be reed marking and be recorded as a cloth fault.
5. In F4 where the length exceeds 5m of continuous reed marking it shall be deemed to be continuous reed marking and be recorded as a cloth fault.

1. Inaugural session

Quality control is not testing and it is not statistics although it may employ both of these as techniques in its operation.

Quality control is practised by well trained and conscientious workers under the discipline of good supervisors who have been instructed by management to recognise quality and have the knowledge and expertise to achieve it. The quality control department is that part of the process supervision team which collects information on materials and processing by sampling, testing and direct observation and presents it in digested form to the process supervisors. In some cases the information is required quickly but in others a more detailed analysis is required.

Quality control action is taken by the process supervisors, if required, as they are the people who know the process details and the ways in which changes may be made.

Management must accept the responsibility of setting the specification for the products. A specification should contain all the relevant details to enable manufacture to proceed but should also contain realistic tolerances within which the process department can work. Management takes policy decisions on the level of quality it would like to achieve for the reputation of the company and the level acceptable by its customers.

Commercial standards. Very often these are not written down standards but have been arrived at as a result of the experience of the sales staff. There is no point in saying to the production department that they must produce perfect goods because that is what the customer requests. The sales staff knows that the customer has accepted deliveries at a level lower than perfection, has made complaints when the level is too low and may have had claims for a price reduction granted because of low quality.

Based on this experience an acceptable quality level can be arrived at.

Mill standards. These must be more precise than the commercial standards but reflect them. The mill standards should contain details such as width of cloth, ends and shots, counts of yarn, quality of raw material and so on. In addition however the tolerance and acceptable level of faults should also be indicated.

Technical standards. These are standards which are quoted in machine makers handbooks and guides and in scientific papers submitted to learned societies. They indicate the maximum level of achievement in the current state of knowledge and expertise. They frequently refer to experimental conditions which cannot be matched in a mill and as a result cannot be achieved. They should be noted and used as an ideal the reaching of which efforts should be made but the products cannot be rejected because they do not approach the levels indicated in such standards.

Whatever the standard it must be agreed to by the processing department staff members who convert it into practical instructions and communicated to the quality control department which requires to plan sampling, testing and a method of reporting.

Communications. There should be full communication between departments both oral and written. A good dialogue requires that both parties speak the same language to prevent misunderstandings. e.g. "out of control" or "off count but in control" have certain meanings to me but do they mean anything to you?

Personality clashes must be avoided and each must realise that his contribution is equal to that of his colleagues: not more important nor less important. Is the goalkeeper who saves an otherwise certain goal less important than the forward who scores one? Both are members of the

team and if it were not for the former the efforts of the latter would have been set at nought.

In closing I would like to stress again that quality is achieved on the shop floor, not in the quality control department and certainly not in the board room.

2. In-process quality control

Cop winding is a source of stoppages in weaving and faulty cloth and stems from badly made cops and poorly maintained machines. To avoid trouble cops must be wound to the correct size in diameter and length. The shape is important as the nose should be about 3mm longer than the diameter and should be sharp in outline. This shape is achieved by ensuring that the reciprocating guide lays the new coil on the bare spindle on each traverse and not on top of the previous coil. If the cop is blunt nosed there is a tendency for the weft yarn to slough off when the shuttle enters the shuttle box. On the next pick the coil of yarn comes out of the shuttle in a tangled form making a "SNARL" in the cloth. These snarls frequently appear about the same distance from one selvedge forming a line along the length of the cloth.

Cops which are too large may cause split shuttles when being forced into the shuttle well. A shuttle is accelerated to about 22/25 MPH and brought to a halt 160 times every minute of running time in a 37 inches R. S. loom. The punishment it has to absorb is therefore very high. Cops which are too small are slack in the shuttle and move with each pick thereby trapping and breaking the weft.

Cop spindles should be smooth and undamaged or cut weft will result when doffing occurs. If the winder does not release the starting end from the cap before doffing the cop the end will be drawn into the centre of the cop and the weaver in finding the end pulls the base off the cop causing waste.

I see in some mills the winder stacking the cops carefully in a box while in others the cops are thrown into a box. In the interests of good house-keeping the former method is recommended.

In indirect warping the object is to assemble a number of back beams, or

reels behind the dressing machine each with a proportion of the warp threads wound on them. Thus in a 4m wide cloth with 35th/dm the total threads would be about 1400 which if spaced over four beams gives 350 threads or over five beams gives 280 threads.

The fewer the threads the longer the length available but if the threads are too far apart the beam becomes ridged and the threads may become trapped in the hollows.

The method of assembly requires the use of a stop motion as missing threads cannot be tied on in the same way as those in direct warping. The brake must stop the machine before the thread has been wound on to the beam and this demands that the beaming head be placed at some distance from the bank.

Stop motions should be kept in good repair and be working efficiently or beams with missing threads will be produced.

The method of assembly is based on tag-ending of the new spool to the previous one. If this is not done unnecessary stoppages occur. It is argued that many breaks occur at the change from one supply package to another hence tag-ending is a failure but I can assure you that there are many more transfers occur without a break. It is sometimes claimed that the reserve package accumulates caddis which is carried on to the beam at transfer. If the bank is supplied with fans and these are kept working this is not a problem.

A good check on yarn performance is obtained if the breakage rate on the H.S. warper is recorded. If this is checked from time to time and the reason for the stoppage recorded the information can be used to reduce or eliminate the causes of stoppage.

The speed of the machine should be that which gives the best production. If the breakage rate per length wound is taken at a number of speeds the information can be used to find the optimum speed. The H.S. warper must keep pace with the dressing which if it is running at 22m/min at 80% E with four back beams requires that the H.S. warper runs at 176m/min at 40% E or 240m/min at 30% E. These efficiency figures are not unusual with high breakage rates experienced. The higher the speed the greater the braking distance required.

Dressing of yarns by the application of a starch or gum to the warp yarn assists weaving by laying the protruding hairs and giving the yarn a smoother shape. It may add strength to the yarn but as most jute yarns are stronger than many yarns which are woven successfully the addition of strength is not of first importance. Jute yarns break because they are relatively inextensible and for many reasons other than strength. If a clean open shed is to be formed in the loom the hairy yarn must be modified to streamline its shape. A high viscosity starch which forms a coating on the yarn into which the protruding fibres can be laid and held is the best type. Hence raw starches are favoured. They must have sufficient adhesion to prevent dusting off too readily. The BJTRA recommend a penetration of one fifth the yarn radius. Both TSP and TKP have a high viscosity and good adhesion according to the BJRI hence the satisfactory results obtained with low application rates. I would have expected a 5% addition by weight of maize corn starch and BJRI suggest that 4% by weight of TSP should be added but many mills are weaving satisfactorily with $2\frac{1}{2}\%$ of TSP and I would leave well enough alone.

I would suggest however that starch batches should be used the day they are made and not carried over to the next day. Starch retains its properties for a certain length of time and either gels into a solid or if an enzyme is present reverts to a solution. I am not familiar with TSP and cannot quote its cooked life as a starch.

Cleanliness in starch preparation is essential as chance enzymes present may render a batch unusable in a short time. I saw some very poorly maintained starch plants during my visits to mills. Adding an antiseptic such as salicylic acid or metallic salts may inhibit mildew but will not protect starch from enzyme degradation. Adding tallow or wax emulsion to the size helps to lubricate the passage of yarn through the loom by coating the back rest, droppers, mail eyes, reed wires and breast rail with a layer of lubricant. When making up a starch mix the metric system expresses the concentration in g/l. Thus a $2\frac{1}{2}\%$ concentration is say 75lb in 300 gallons of liquor which is equivalent to 33kg in 1320 l of liquor or 25g/l.

Cooking by using an open steam pipe is the easiest way to prepare the starch and provided the total quantity is not reached until all the condensate has been absorbed excessive dilution will not occur. High speed stirring or paddle stirring is satisfactory but the former tends to break down the initial viscosity much quicker. This is not important with TSP preparations.

Many mills use the lick-up method of application while others use the immersion method. There is little to choose between them as coating occurs at the squeeze roller in the presence of the starch paste. Pressing is important as the excess paste must be removed and limited penetration encouraged. The pressure used is not important as it makes very little difference to the pick-up rate but the roller must be even throughout the width of warp and pressure applied equally to both arbors.

Wet splitting is an advantage over dry splitting as it lays the outer hairs before drying thereby giving a better finish on the yarn. In a four beam set three splitting rods can be inserted for both wet and dry splitting. If space is limited at least one rod is better than none.

Building of the beam should be done with a higher tension and pressure on

the layers nearer to the beam tube to prevent crushing but the whole beam must be hard to prevent the ends sinking into the beam under tension. It is fortunate that machine design brings this about by accident as the torque on the small diameter is greater than on the large diameter. This is why the friction on the driving plate is increased as the beam fills and on modern machines this is done automatically. In direct beaming constant vigilance is necessary to prevent missing ends and in this respect good spools with no cobwebbing and few knots are preferred.

The control of moisture in beams is not a feature of any of the mills which I visited and I would suggest that any method be kept as simple as possible. If the finished cloth has an acceptable moisture regain level and this varies in specifications from 16% for CBC to 22% for sacking it is best to retain the existing level. If the moisture is measured at the dressing and by trial and error a satisfactory regain level is arrived at the drying rate of the machine can be adjusted by altering the speed to maintain this level. If the warp is changed the machine speed can be changed to maintain the same drying rate.

The drying rate can be expressed in kg/min thus in a warp with 45th/dm 4m wide with 260 tex yarn running at 20m/min the drying rate is 9.36kg/min.

The drying rate is influenced by the efficiency of the machine and the steam supply. The removal of condensate and air from the cylinders and steam trapping must be efficient. The cylinders should have no variation in the surface and the yarn tension should be sufficient to ensure intimate contact with the cylinder surface.

Looms and fittings must be kept in good repair if weaving faults are to be avoided. The bearings should not show excessive wear particularly those related to the reciprocating parts, the crank shaft, rocking shaft and connecting rods.

The shuttle race should not be worn or pitted.

The shuttle boxes and swells should be in good condition and the use of Matheson springs helps to spread the wear over the back of the shuttle and protects the swell.

Cams and reeds require to be serviced and I noted that the general practice is to knot a new web on to the previous one. This means that the same reed and cams are used over and over without receiving attention. It is good practice to redraw the web from time to time and remove the reed and cams for servicing. I have seen plenty of reed marking caused by bent reed wires.

As shuttles receive very hard wear they should be inspected regularly and repaired when necessary. Drag springs require to be replaced, cover pins and covers checked and catches kept in repair. Shuttles on hand changing looms should be paired but I have observed many weavers using only one shuttle and the reason given is the difficulty experienced in getting replacements.

Loom tuning is also important to obtain good quality cloth. Shedding early to beat-up on a crossed shed to avoid reed marking, trimming the healds to ensure that the bottom shed rests on the race, raising the back rest and positioning the lease rods correctly are all common points of trouble. Picking into an open shed to avoid selvedge damage and picking just hard enough to ensure that the shuttle enters the opposite box without rebounding. The adjustment of the box front, check straps and buffers contributes to the smooth picking and thereby reduces the risk of a smash.

Sometimes selvedges are dragged in because of irregular yarn or a malfunction of the shuttle tension. The cure if it is persistent is late shedding which may cause reed marking and a choice must be made of the

lesser of two evils.

The general aim should be to avoid cloth faults and to this end a study of loom stoppages along similar lines to the H.S. Warper study will help to highlight the main causes and the frequency of stoppages. Armed with this information the supervisor can tackle the problem of removing the causes starting with the most frequent. On some occasions the cure is simply a case of discipline and on others a case of training.

As mentioned in my remarks to management the specification must be known beforehand and should contain tolerances. You must ensure that the cloth is made to specification by checking when a newly drawn web is started thereafter sample readings of cloth width to check the correct setting of the let-off motion and examination for the presence of reed marking is sufficient.

If production is to be maintained and improved stoppages must be avoided. Shortages of beams or weft are obvious ones but warp breaks, smashes, weft breaks and scobs which require pick backs are examples of stoppages which are less obvious. If an analysis of the stoppages is carried out it will show where the lost production goes, and account for the low efficiency or activity. The lb/hour of loom production is a favourite method of indicating production and with so few sorts of cloth being woven in the country it is a figure which can be compared mill to mill. It measures inefficiency in some respects as the accepted norm is low.

e.g. A 76cm R.S. loom at 170 PPM on 76 thds/dm of 276 tex and 31 picks/dm of 1180 tex will at 100% efficiency produce 13.4kg (31 lb) of cloth per hour. Thus

14 lb/hour = 45% Activity

18 lb/hour = 58% Activity

22 lb/hour = 71% Activity

(The P.A. report on Adamjee Jute Mills set a target of 22.8 lb/hour)

In finishing hessian and sacking some mills damp the cloth while others do not. Calendering is sometimes done hot and sometimes cold. In my remarks earlier I made no reference to finishing but I did say that if the final regain is satisfactory you should note the conditions and preserve them. Note the regain of yarn in spool and cop, regain of dressed beams and of woven cloth. The moisture regain can be adjusted during finishing by intelligent use of damping. Hot calendering will drive off about 5% of moisture at 22/24% R but only about 2% at 12% R as the drier the yarn the more heat input is required to drive off moisture and the calender has a constant heat capacity. This means that for hot calendering you may require to add moisture in the damper cold calendering may require no added moisture. If the finished cloth is very wet cut down on water at the damper and vice versa.

Weighing before and after damping and again after calendering will show whether moisture is required and if the amount added is adequate.

The most frequent cause of stoppages in warping and weaving is knots. Either good knots badly tied or poor knots. To let you see the types of knots I have prepared samples and have illustrated them. The only knot I would allow is the weavers knot as it is small and lies on the yarn. The winders knot lies on the yarn but is larger and has a small protruding loop when well tied and a large untidy one when poorly tied. The half hitch as I have called it is tied on the knotted attached to many winders and is the poorest knot as it is large and lies alongside the yarn offering an obstacle to smooth passage through guides, reed and mail eyes.

In summarising I have stated the obvious in most cases and I am sure all of you know what needs to be done. The knowledge is there all that is required is constant vigilance, checking, analysing, disciplining, retraining and where deserved, commending.

The analysis I have mentioned can be done as studies of one hour duration on a number of occasions and the results summarised before any action is taken. Subsequent studies can then be carried out measuring trends. These studies may be done by the quality control personnel who with some practice should become adept at identifying the faults and analysing the results.

(This talk was illustrated using an O.H.P.)

3. Shop floor quality control in dressing, beaming and weaving

In the talk to the process control personnel the subject of studying breakage rates was touched on and it was suggested that it might be a task which the QC staff could undertake. The three studies mentioned were

H.S. Warping stoppages and causes

Loom stoppages and causes

Fabric faults

The technique is similar in each case and involves the observation of the machine performance for an hour at a time or the examination of a number of pieces or rolls of cloth for the faults. Some training in the recognition of the faults or the reason for the stoppage is necessary. A chart as illustrated is prepared and shows the essential information about the process, carries a serial number for identification and recording and has spaces for a description of the occurrence and the number thereof. The descriptions shown are common causes and in addition a space for unknown causes is provided. All the stoppages must be recorded to obtain the breakage rate and to guess the reason would give a false picture hence unknown cause is allowed for. The unknown section probably contains stoppages caused by those named but the evidence required to identify them has been lost and as each of the causes is reduced by improved processing the number of 'unknowns' will fall by proportion.

The information from the study sheet is transferred to a summary sheet as illustrated where a number of studies can be shown side by side. The breakage rate is based in this case on 200 ends and 10,000m length. If each study irrespective of its length is by proportion converted to this base a direct comparison can be made.

If loom stoppages are studied the same procedure is followed but some of the causes will be different and the common base may be expressed in

stops per 10,000 picks per 200 warp threads. A time base is unsatisfactory as the loom speeds vary. If used for cloth faults the chart would be similar but more descriptions would be required. It is expected that a comprehensive list with definitions and descriptions of cloth faults will be prepared by the inspectorate for jute goods.

If a web is knotted on to the previous one it is unlikely that there will be anything wrong with it. Any change in the number of warp threads would be apparent if the tier was short of ends or had a number left over. As the reed is unchanged it must be correct and the warp threads/dm will also be correct. If the shotting pinion has not been changed the only possible error is wrong weft which is a risk at all times. A newly started web must be checked against the specification and this should be done as routine. Loom checks at other times might be done to inspect for reedmarking and measure the cloth width to check on the let-off motion.

If a 5% sample of looms is checked on a random number basis this will indicate whether the check is worthwhile. If a high proportion of faults appears the process control must be informed and the sample size adjusted.

Fabric weight may be checked on a 100% basis or a sample basis. Two factors might determine which, namely time available and the number of pieces or rolls involved. If a sample check is used the weight of each should be corrected for moisture and length to bring it to a standard. Calculate the mean weight of the sample piece. Calculate the standard deviation by the long method. Then the standard error (SE) of the mean is obtained.

$$\text{SE of mean} = \frac{SD}{\sqrt{N}}$$

$$\text{Then } t = \frac{\text{Nominal weight} - \text{mean weight}}{SE}$$

Consult t tables for $\nu = N-1$ and check at 1% level. If difference is greater then the bulk is likely to be off weight.

The nominal weight can be obtained from the specification and is sometimes given with tolerances.

IS 4900/1969 gives $\pm 5\%$

IS 2818(Pt II) gives $\pm 3 - 2\%$

In the first case on a 271g/sqm 4m wide fabric 800m in length the roll weight (corrected) would be 867kg \pm 43kg. A similar tolerance on the yarn would with a count of 7.5 lb/sp be \pm 0.3 lb/sp. This is not a difficult task for a well run mill. I have ignored the relative size of the samples. In the second case the mean weight would be taken as 843kg \pm 43 thus giving the same tolerance as 817kg + 69kg - 17kg. It is easier to aim for a mid point and allow the normal scatter about the mean than try to create a biased scatter.

Complementary to using statistical methods a chart using a running average might be used to damp some of the more violent fluctuations which occur in individual readings and show up trends more readily. The illustration shows this effect in numerical and graphic form.

I would suggest that each technique should be considered and the one most suited to the circumstances adopted. It may not be necessary to continue tests or checks on a permanent basis and if it has served its purpose discontinue it. Tests can be restored at any time.

It is difficult to recommend quality control checks for sizing which would be of any assistance. Process control certainly. If a refractometer is available the concentration of the starch can be checked by removing a sample from the starch box. The consistency of preparation from batch to batch can be examined or the extent of dilution which occurs during the life of a batch would also be useful but not recommended as a routine test.

Moisture content of the dried yarn is another test which might be done and done on a routine basis. If at the completion of a beam some of the thrums

are removed they can be dried in an oven and the regain calculated. If in addition samples are selected at intervals across the width of the warp the drying consistency can be checked. Alternatively a moisture meter may be used to take readings on the dressed beam but this should not be done until the beam has cooled to room temperature as the meter readings are influenced by heat.

In addition to the moisture in beams it is necessary to keep a record of regain of finished goods. If this is taken just prior to baling the regain should not change by very much thereafter. Specifications quote 16% R for CBC and as high as 22% R for sacking. The maximum figure for safety is usually 18%R where dressed yarn is present but undressed sacking can probably stand a higher figure.

If damping is done it is worthwhile measuring the moisture addition from time to time by weighing some pieces before and after damping to calculate the addition per cent by weight. This is a check on the machine performance. A similar exercise can be done at the calender and the moisture pattern in finishing can be established for each quality.

These are the types of observations, tests and checks which might be undertaken by the quality control personnel in fabric manufacture and finishing.

(This talk was illustrated using an O.H. P.)

4. Laboratory tests - weaving

Tensile strength of cloth can be tested either by the strip method or the grab method. The strip test must be done according to the specification but the technique of placing the strips in the grips of the testing machine is important and the wider the strip the more difficult it is to avoid variations arising from poor technique. The strip should be inserted in the upper grip with no tension applied and hanging vertically. The tension on the strip is applied using a clip as wide as the strip and attaching of standard weight to it before closing the lower grip. The clip can then be removed. As jute is relatively inextensible the application of a standard weight is not important but applying tension by gripping it at one point distorts the sample and gives a lower breaking strength than it should. The length of the strip should be sufficient to include the distance between the grips, the depth of the two clamps and another 50mm to allow for manipulation of the sample above and below the grips.

The fringe size may be specified but should contain at least five threads which are continuous throughout the length of the strip. It is convenient when teasing out the fringe to use a board with two pins driven through as shown. The distance between the pins is equal to the width of strip specified. Marking fabric for cutting into strips is easily achieved if a chisel point is made on the wax pencil and is drawn along a line between adjacent threads of warp or weft.

The capacity of the machine should be such that the load recorded should lie within 10% - 90% of the total scale deflection. The degree of accuracy of the scale should be as specified and should not be less than 0.1%. If the load measured is small the accuracy may be reduced. For example, if 10% of the scale with a total deflection of 200N in steps of 0.2N is used the accuracy is not 0.1% but really 1.0% for that load.

In the grab method the grips have a raised square 25 x 25mm on one face and a flat face opposed to it. The cloth is therefore gripped over this small square only. The sample is cut to size, but has no fringe, clamped in the upper and lower grips and the load applied until it breaks. The Indian standard for jute quotes a sample size of 6 x 4 inches with three inches between grips and the relationship between the four inches wide strip and the grab test is given in the IS standard.

$$\text{Grab test value} = \frac{\text{Strip test value}}{3.1}$$

The BDS 813 (Pt 1) 1975 indicates speeds of 460mm/Min (18 inches) for the strip test and 300mm/Min (12 inches) for the grab test. British Standards abandoned these speeds in favour of 100mm/Min to give more consistent results and would probably use CRL or CRE type testing machines.

To count the threads per dm with reasonable consistency the counting gauge should be placed on the cloth with its LH edge at the RH edge of a thread. The space and threads are counted as units until the RH edge of the gauge is reached. If the last unit comprising a space and thread is incomplete the proportion is estimated and taken as a whole unit if more than half or ignored if less. Alternatively, the part unit can be counted as a half unit. Over 100mm the error will be small as thread counts are mostly in excess of 30/dm. Where DW cloths are involved the count may be expressed as single or double threads per dm. It is customary to take at least five tests of warp and five of weft spread out over the test area.

The width of cloth is unlikely to be measured in the laboratory as the sample would be very small. It is better done in the finishing department.

The mass per square metre is best tested with as large an area as possible and would be done away from the laboratory. If it must be tested on a sample use the largest area available but trim it to form a rectangle as the calculation of the area is easier.

Count of yarn from cloth is tested by cutting a flap in the cloth as illustrated with the long side a convenient length and parallel to warp or weft. Make a fringe in the long edge by pulling out a few threads and discarding them. Remove one end of a thread and place in the clamp of the crimp tester or hold it on the steel rule at the zero mark. Take the other end and gripping it to prevent loss of twist pull the thread from the flap and insert it in the moveable clamp in the tester or stretch it along the steel rule. The crimp tester is necessary for extensible yarns but jute may be done on a steel rule.

The crimp is calculated:

$$\text{Crimp}\% = \frac{\text{Uncrimped length} - \text{crimped length}}{\text{Crimped length}}$$

using the mean of 10 threads extracted and measured in this way. To obtain the count another 90 threads are added to the 10 and weighed correct to 0.5%. The length of the 100 uncrimped threads is used and the count obtained by proportion.

$$\frac{\text{Mass (g)}}{\text{Uncrimped length (m)}} \times 1000 = \text{Tex}$$

To test bags in the laboratory each bag should be weighed, measured, the stitches per dm counted and the sewing thread identified. Measure the bag once in the centre of the short side to get the length and once in the centre of the long side to get the width. The important measurement is that which excludes the seams as this gives the effective size. To calculate the volume which a bag will hold this formula may be used.

$$V = \left[L \div \left(\frac{0.772}{0.602} + 1.012 \right) \right]^3 \text{ CV. CM.}$$

V = Volume

L = Inside length

0.602 is a ratio width/length and may lie between 0.5 and 0.8.

To the length must be added allowances for hemming, seaming and closing before the bag is cut.

The seams may be assessed by counting the stitches in the length and width and expressing them in stitches per dm. The strength is obtained by using the "T" test cut as illustrated with a strip 50mm wide and the seam 100mm wide. One strip is placed in the upper grip of the strength tester and the other in the lower grip. The strength recorded must be qualified to indicate whether the seam or the cloth ruptured. The seam should be strong enough to withstand the load met in use and if it ruptures at a load far below that of the cloth it is unsatisfactory.

(This talk was illustrated using an O. H. P.)

5. Laboratory management

The procedures for carrying out all the tests in a quality control laboratory should be written down and contained in a handbook or loose leaf binder.

Each member of the quality control staff should be capable of carrying out all of the tests which are described but the various tasks would be allocated by the chief quality control officer to spread the load evenly over the staff.

Each person should know his daily task without requiring to await instruction and a back-up arrangement should exist for each officer to avoid loss of information because of absence. The chief quality control officer should make special arrangements with tests which are time dependent, e. g. the 24-hour test of emulsion stability, to ensure that the results are not nullified by failure on the part of the officer to complete the test on time.

Each test should have a consecutive number which appears on summary sheets to enable the various tests to be traced in the records. In this respect standard test forms ensure that the officer carries out all the details of a test as he is required to fill in all the spaces in the form and an omission is easily checked.

The summary sheets should contain only that information which is needed to make a judgement on whether the process is "in control", "out of control" or whether it meets the specification criteria.

Record sheets may be used to show a number of summaries in digested form in order to note trends in the product and in this respect charts are particularly helpful. Charts must be complete and up-to-date or they may prove to be more of a hindrance than a help.

It is often useful to retain a reference sample of the material under test in

case any question arises regarding the test results. These samples need not be retained for any longer than is necessary to ensure confirmation of the results should it prove necessary to do so.

Working sheets likewise should not be retained for long periods. It is sufficient to keep summary sheets without having the problems of storing a large number of detailed working sheets. An intelligent appraisal of the number of times to which a record or worksheet is referred should give an indication of the length of time they should be retained.

Reporting procedures should be carefully worked out to ensure that without delay the information required is passed to the person who is required to take corrective action if required. The chief quality control officer should not be accumulating information awaiting an inquiry from the process personnel. The service offered should cover the means of communication either by written or oral means.

Training

Just as machines are calibrated and kept in repair so too must personnel be trained and checked upon to ensure that they do not develop unwelcome methods of testing which are different from those laid down in the standard handbook. It is possible in some cases to have the same test done separately by two persons and check the results to see if they vary significantly. It is also possible to have the same test conducted by the same person at different times to check consistency of the tester. This can be done in tests which are not destructive such as inspection of cloth for faults but is not possible in destructive tests such as tensile strength of yarn as the variability of the material would mask any variability of the testers. In the latter cases the chief quality control officer would have to rely on his own experience in observing his staff at work. If the initial training is done thoroughly deviations from the standard methods should be rare.

Laboratory tests - weaving

Question:

What role does cover factor play in finishing and how can it be measured?

Answer:

Finishing is aimed at improving cover but the calculation of the cover factor plays no part in this and is a theoretical value. BJTRA produced an instrument for measuring cloth cover using the principle of the selenium cell. It was used experimentally but never developed on a commercial basis although a similar instrument is available.

Question:

What is the "Standard" size of specimen for (a) grab test, and (b) strip test?

Answer:

The specification gives this information and with jute fabrics the grab test uses 6 x 4 inches (300 x 200mm) and the strip test specifies either two or four inches (50 or 100mm) fringed with 8 inches (200mm) between grips.

Question:

Is there any method or formula to estimate the strength of a fabric knowing the counts and Q.R. of the yarn?

Answer:

A number of questions on similar lines have been asked and the answer is "No". There is certainly no formula but if you have enough data on your present cloth strength it is possible to estimate the breaking load on a new construction.

Question:

Should the measurement of bag sizes be made including or excluding the seam?

Answer:

Some specifications quote overall sizes which include seams others do not. The vital size which determines the capacity is the one excluding the seam and in the absence of a clear indication this is the one which I would use.

Question:

Should a bag be considered sub-standard if the seam depth is $7/8$ mm when it is specified $10/12$ mm?

Answer:

It would not meet the specification and should be rejected. In some seams the width is not critical for example "M" seam fold over and counter laid but in others it is. Plain on a raw edge requires a wide seam and overhead and "heracles" sometimes have a minimum width specified.

Question:

What do you suggest the average seam efficiency should be for a good bag?

Answer:

The seam/cloth strength ratio should be equal to or greater than 1.0 in my opinion but I have seen it quoted as low as 0.75 in specifications.

Question:

Cop lengths increase when in transit to the buyer. What allowance should be made for this?

Answer:

I have no information on this problem and I suggest you ask your customer to let you know the length on receipt and adjust accordingly. The regain should be kept constant throughout one delivery and from one delivery to another to prevent variation in the changes of length.

Shop floor quality control in dressing, beaming and weaving

Question:

Having both traditional and modern cylinder dressing machines using steam pressures in the range 30-80 lb/sq. ins. and producing beams from 26 in. to 83 in. width, what should the limits of steam pressure be for (a) narrow and (b) wide beams?

Answer:

In machines with copper covered cylinders the steam pressure should not exceed 30 lb/sq. in. but modern s/s small diameter cylinders can withstand much higher pressures. Consult the makers handbook for the limit on the modern machine.

Question:

Where no meter for steam exists how can it be determined that the beam produced is dry or wet?

Answer:

A meter which records steam pressure is no help in this respect but if the steam consumed can be metered it might help. A better way is to use a moisture meter to check the regain of the dressed beam or remove samples and take them to dryness in a drying oven. The rate of kg per hour of yarn produced can be calculated when the moisture regain is satisfactory and this can be used as standard for all qualities.

Question:

Is starch necessary in $6\frac{1}{2}$ oz CBC when using a good quality batch?

Answer:

If the yarn produced from the good quality batch has a high QR it might be possible to omit dressing. I have seen at least one mill doing this apparently successfully but I suggest that you take a careful break study at the looms using starched and dry warps if you intend to compare both methods.

Question:

What should the minimum QR and CV% be to ensure a weaving efficiency of 75% on Sulzers?

Answer:

A QR in excess of 105% and a CV% of 3% using at least 30 individual tests would be the limits recommended but I cannot relate either QR or CV% to loom efficiency.

Question:

If instead of using starch would not an increase in yarn twist give better weaving conditions?

Answer:

I doubt if it would give improved weaving but extra twist would make the yarn more costly.

Question:

Is it better to use moisture content or regain when checking moisture at the various processes?

Answer:

If it is to establish a moisture pattern either would do but regain is preferred as it is based on the net fibre content.

Question:

How many minor faults of various types are allowable in CBC?

Answer:

Minor faults have not been defined and the acceptable level has not been decided. The Directorate are working on the former and no doubt the latter will follow after.

Question:

A tolerance of $\pm 5\%$ was quoted, is this for rolls or a cloth sample?

Answer:

The specifications quoted refer to rolls which is fortunate for the weaver. A small sample would be subject to a much greater variation than a sample as large as a roll.

Question:

How can the standard moisture regain or content be fixed at different stages in processing?

Answer:

I do not think it needs to be adjusted at different processes unless moisture is critical to that particular process and there are no "standard" regains involved. In most processes there is a range of about 3 - 4% within which it is possible to work effectively but each process must be considered separately when arriving at the "optimum" regain.

Question:

How can scubs be rectified or removed?

Answer:

Scubs or scobs cannot be rectified when they are in the cloth. They should be prevented by good yarn and warp preparation and by good loom adjustment.

Question:

What will be the standard breaking strength for 10 oz/40 inch hessian with 8 lb/sp warp and 10 lb/sp weft with all long jute in the former and 10% cutting in the latter?

Answer:

"Standard" breaking strengths do not exist. Specifications give the test details and the minimum load at breaking point. There are many factors involved in estimating the breaking load but relying on experience and making a very rapid calculation the minimum breaking loads would be in the region of 112 LBF warp and 138 LBF weft on a 5cm x 20cm strip. The QR assumed are 85% warp and 70% weft.

In process quality control

Question:

The standard density of packing goods for export is 3.5 cu. m/1000kg and is accepted by the international market. Buyers are favouring mills which can pack to higher densities to save freight. How can the standard density be increased in rolls and bales?

Answer:

In rolls two factors control density, namely the cloth tension and roll pressure during rolling the former having the greatest influence. By increasing both the density will increase but excessive tension will bring about the risk of tearing the cloth. In bales, finished cloth will pack denser than unfinished but as many of the bales contain sewn bags this has little effect. Experiment with the assembly of the bundles of bags making up the bale might help but increasing the pressure in the baling press is likely to damage the goods. The density quoted is about 0.29g/cc which is very low in my opinion. A figure of 0.65g/cc stirs in my memory but I would have to check it.

Question:

To avoid mildew in hessian and CBC beams what percentage of moisture regain should be aimed at in (i) the dry season and (ii) the wet season?

Answer:

In (i) and (ii) the limit I would recommend is 18% and in Dundee any figure above this would be liable to encourage mildew. In Bangladesh I have seen only one case of mildew staining and in many mills the M.R. has been 22% or more. It may be that the tamarind seed starch is a poor foodstuff compared with, say, maize corn starch or the local spores require higher levels of moisture than those in U.K.

Question:

What is the minimum strength required to avoid breakage when the shed is fully open, (a) in hessian and (b) in CBC ?

Answer:

The weaving tension in any loom is lower than that required to break normal jute yarns from 7 lb/sp upwards. The minimum strength even in a yarn with a QR of 50% is more than adequate to survive weaving. Warp breaks result from knots, splices, slubs, roots, poor loom adjustment, faulty reeds and shuttles and not from low yarn strength.

Question:

What should the QR of yarn be after dressing and beaming ?

Answer:

A good starch dressing will increase the yarn tensile strength by up to 14% and the count by about 2 - 3%. Hence an 8 lb/sp yarn with a QR of 100% would have this raised to about 111%.

Question:

Does the hardness of water affect starch preparation ?

Answer:

It may have a slight effect but not enough to require adjustments in the recipe or cooking time and temperature.

Question:

What should the duration of starch cooking be and is excessive cooking detrimental to viscosity and adhesiveness ?

Answer:

Cooking time is not so important as cooking temperature. Normal starches swell in water and as the temperature rises they reach the bursting temperature when the starch mix thickens and becomes very viscous. With time and agitation the viscosity falls to a stable level. The time varies with amount of heat available and type of agitation, H.S. stirrer or paddle. Excessive cooking is not advised as it is wasting energy although it will not affect the property of the starch unless by dilution if an open steam pipe is used.

Question:

What steam pressure is required to run a dressing machine at, say, 50 yards/minute with 1400 ends?

Answer:

The steam pressure will influence the temperature but the drying rate is governed by the quantity of steam available. Assume the yarn to be $7\frac{1}{2}$ lb/sp then 2187 lb/hour of yarn will be the drying rate. In an efficient cylinder machine the ratio of steam/yarn is about 1.6 therefore the boiler output must be at least 3500 lb of steam per hour.

Question:

Does the difference in machine speed affect the starch pick-up due to the shorter time of immersion?

Answer:

The pick-up rate is not influenced to any great extent by the normal speed changes in dressing.

Question:

What should be the standard viscosity of starch?

Answer:

There is no standard viscosity that I am aware of and most mills arrive at the recipe which suits by a mixture of applied knowledge and trial and error without measuring viscosity.

Question:

Are there any instruments available to measure starch viscosity? If so please discuss their use.

Answer:

Viscosity can be measured by a number of laboratory methods but no instrument is available to do this. I would not advise the introduction of viscosity checking as a normal QC exercise.

Question:

What should the standard starch composition be and the standard rate of application?

Answer:

There are no "Standards" for starch composition or rate of application. Each mill must arrive at its own "standard". For guidance, 5% maize corn starch or 4% TSP are reasonable levels for both concentration and add-on. Tallow or wax emulsion about 5 - 10% of the dry ingredients and antiseptic about 1 - 2%.

PROGRAMME

- 10.00 a. m. Chairman: Mr. A. Hakim Mia,
BJMC Zonal General Manager, Chittagong.
Welcome address by Mr. M. S. Huq Khan,
Director of Inspection for Jute Goods, Dhaka.
Speech by (1) Mr. E. J. Gordon:
Speech by (2) Mr. R. R. Atkinson:
Speech by (3) Mr. T. D. Mitra, General Manager,
M/s Amin Jute Mills Ltd.
Inauguration speech by Mr. M. A. R. Talukder,
Director, (Quality Control) BJMC, Dhaka.
- 10.30 a. m. - 11.00 a. m. Tea Break.
- 11.00 a. m. - 12.30 p. m. Working Session - Chaired by M. S. Huq Khan
In-Process Quality Control in Spinning and
Winding by Mr. R. R. Atkinson.
- 12.30 a. m. - 2.00 p. m. Lunch Break
- 2.00 p. m. - 3.30 p. m. In-Process Quality Control in Dressing,
Beaming & Weaving by Mr. E. J. Gordon.
- 3.30 p. m. - 4.00 p. m. Summary by the Chairman, Mr. M. S. Huq Khan
- 9.30 a. m. - 10.30 a. m. Working Session - Chaired by M. S. Huq Khan
Shop Floor Quality Control in Spinning- and
Winding by Mr. R. R. Atkinson.
- 10.30 a. m. - 11.00 a. m. Shop Floor Quality Control in Beaming and
Weaving by Mr. E. J. Gordon.
- 12.00 noon - 1.00 p. m. Laboratory Tests - Spinning
by Mr. R. R. Atkinson.
- 1.00 p. m. - 2.00 p. m. Lunch Break
- 2.00 p. m. - 3.00 p. m. Laboratory Tests - Weaving
by Mr. E. J. Gordon.
- 3.00 p. m. - 4.00 p. m. Laboratory Management
by M/s. E. J. Gordon and R. R. Atkinson.
- 4.00 p. m. - 4.30 p. m. Summary - by the Chairman,
Mr. M. S. Huq Khan.
- Vote of thanks by one of the Participants.

Personnel engaged on project BGD/79/030:

International Staff

Atkinson, R. R., Ctext, ATI.	Project Adviser
Gordon, E. J., Ctext, ATI.	Project Consultant

National Counterparts

Khan, Md. Serajul Huq	Director of Inspection for Jute Goods
Hoque, Syed Moinul	Deputy Director of Inspection for Jute Goods.

