Research Record No 173

The Processing Of Knitted Fabrics On A Dornier Mercerising Machine

Trials Carried Out At Empresa Textil De Barcelos Sarl (Tebe) Barcelos, Portugal, July 1983

by

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CONTENTS

1. Introduction

Towards the end of 1982, Mr Francois Gros, Technical Director of Tebe, visited the Technical Research Division in Manchester to learn something of our work on knitgoods finishing and in particular of the STARFISH predictive model. During discussions it became apparent that trials could be carried out at Tebe on IIC fabrics which would yield information which could be of mutual benefit to both Tebe and IIC.

The field of common interest was that of knitgoods mercerising since Tebe possess a Dornier tubular mercerising machine. A contract was subsequently drawn up between the two parties which outlined a programme of work and assigned responsibilities to the two parties. Briefly, the work was broken down into two distinct stages.

Stage 1 was an evaluation of the Dornier mercerising machine itself and the effect of making alterations to machine settings on the *Reference State* of two fabric qualities, namely 1x1 rib and single jersey. Hopefully, this would yield information which would be beneficial in processing fabrics for stage 2 of the project.

Stage 2 will eventually be the processing of a range of single jersey fabrics through the Tebe plant both with and without mercerising with the aim of producing a unique set of equations applicable to the Tebe plant for predicting a number of fabric properties. This set of single jersey fabrics will comprise of three gauges of knitting machine, singles and two-fold yarns and a range of five stitch lengths.

This report describes the *Stage 1* trials carried out to evaluate the Dornier merceriser during July 1983. No results or final conclusions are given; this is simply a record of the operations carried out and of measurements taken during processing.

2. Preliminary Observations

The Dornier merceriser at Tebe is a three-cigar version, the third cigar being a fairly recent addition. Preliminary examination of the machine to determine the range of variations possible revealed the following.

	Min Circumference	**Max Circumference**
Cigar 1	116	148 cm
Cigar 2	Damaged and non-variable. Stuck at a circumference of 120/121 cm at widest part	
Cigar 3	112	204 cm

Since cigars 2 and 3 are of different design they are not interchangeable and therefore it was necessary to run the machine with the damaged cigar in position and, in the event, cigar 3 was not used at all although we were advised that it could be run if necessary. It was felt however that under the circumstances any alterations in width stretch should be confined to cigar 1 since the level of caustic soda remaining in the fabric prior to cigar 3 should be relatively low.

The opportunity was taken to observe a Tebe production run of 1x1 rib and single jersey fabrics and to make timings as fabric passed through the various sections of the machine. These measurements are given below and were obtained at a machine speed of 11

metres/minute.

Section	Accumulated time, sec	Delay, sec	Function
Saturator entry	0	0	~
Saturator exit	10	10	impregnation time
Accumulator entry	28	18	111 sec storage time
Accumulator exit (top of cigar 1)	121	93	
Exit of cigar 2	174	53	53 sec washing time

Using these timings it was established that the fabric capacity of the machine using cigars 1 and 2 only was 32 metres.

The grey width of the 1x1 rib being processed was 86 cm and, for this fabric, the circumference of cigar 1 was set at 140 cm and cigar 2 was utilised at its fixed width of 121 cm.

Under these conditions the fabric ran perfectly satisfactory. The single jersey was of a similar grey width and no alteration to the machine was made to process this quality. Again the fabric ran smoothly with no problems.

3. Outline Of The Trials

A quantity of fabric was sent from Manchester on which comprehensive grey testing had been carried out. Two basic qualities were involved: 10 pieces of 28 gauge single jersey purchased from Setacrepes and 10 pieces of 14 gauge 1x1 rib purchased from Meridian. Fabric details are given below.

	Single Jersey	1x1 Rib
Machine diameter, needles	28”, 2280	24”, 1056
Yarn, Ne	1/30	1/30
Nominal Stitch length, cm	0.280	0.285
Grey width, flat, cm	91	63

The full grey test results are given in *Tables 1 and 2*.

After the fabric had been despatched to Portugal, information received from Tebe regarding the sizes of the cigars on the Dornier merceriser threw some doubt as to whether the 1x1 rib fabric would be too narrow to enable it to be mercerised. As a contingency, arrangements were made to purchase a quantity of 1x1 rib fabric knitted by Tebe from 1/30's yarn which was made on a larger diameter knitting machine. Approximately 800 metres, 40 rolls of 20 metres length, were made available and these in fact were used for the evaluation of the merceriser. The 10 pieces of IIC 1x1 rib fabric were therefore available for unscheduled trials and a decision was taken to attempt to mercerise five of the pieces at the minimum cigar

settings, with the remaining five unmercerised pieces, to carry out a wet stretching exercise using the Tubetex Tripad.

This will be discussed later in the report.

4. Preparation Of Fabric

4.1. Tebe 1x1 Rib

The 40 rolls of fabric were marked individually at both ends from 1 to 40 after a three-metre grey sample had been removed from each piece. The grey samples were similarly marked and will be subjected to full testing in Manchester.

The 40 pieces were sewn up in running order for presentation to the mercerising machine. Piece No.1 was separated as an unmercerised control piece, but was eventually augmented with pieces 36 - 40 which were not required in the mercerising evaluation.

4.2. IIC Single Jersey.

The 10 pieces of IIC single jersey were given stock numbers in Manchester before despatch, these being 21 to 30.

During changes to the cigar size on the merceriser, approximately 30 metres of fabric is stopped at various points through the machine and to be able to identify the "suspect" fabric is a very important consideration, particularly for the final sampling operation.

To enable this to be done with certainty each full piece of single jersey was marked in thirds so that piece 25, for example, was marked 25/1, 25/2 and 25/3 with distinctive yellow and also black ink so that they could be identified both before and after dyeing. Piece No.21 was allocated as CONTROL and was for processing in a similar manner apart from the fact that it would be unmercerised.

4.3. IIC 1x1 Rib

As with the single jersey grey stock numbers had been allocated to the rolls of rib fabric in Manchester.

Roll numbers 11-15 were designated as CONTROL fabrics and were simply marked clearly with the roll numbers at both ends of the piece. Roll numbers 16-20 were allocated for mercerising at a standard cigar setting and were clearly marked in thirds as for the single jersey. Not all of the fabric was in fact mercerised due to problems which are discussed later in the report, and that which was not mercerised was added to the CONTROL run.

5. The Mercerising Stage

5.1. Tebe 1x1 Rib

Following the observations of the Tebe production run on the merceriser, and after considering the limitation of the machine in terms of range of width stretch, it was decided to attempt to process the rib fabric at 5 width settings of cigar 1: the maximum of 148 cm, the minimum of 116 cm, and three intermediate settings: 140, 132, and 124 cm.

Cigar 2 was, of course, fixed at 120/121 cm at its widest point for all of the run.

With end cloth threaded through the machine and with cigar 3 disconnected, cigar 1 was taken out to 148 cm. Lye was pumped into the impregnation trough and was of a concentration of 31° Bé.

The temperature was measured as 24°C and the additives were:

4g/l Akramerce GA - Hoechst

2g/l Ladit - Hoechst

For the grey width of 86 cm the pre-impregnation stretcher was set to 93 cm which was sufficient to present the fabric crease-free onto the first roller.

The machine was started and the speed adjusted to 10 m/min.

The fabric width was measured after the impregnation nip and also just prior to stretching on the first cigar and was found to be 68 and 57 cm, respectively. Processing was continued until the sewing joining pieces 4 and 5 cleared the second washing tower. The machine was stopped, the washing sprays switched off and cigar 1 adjusted to a circumference of 140 cm. Pieces 5, 6 and 7 were therefore stopped at various places through the machine, which are recorded in *Table 3*.

The sprays were switched on and the machine started and run until pieces 8, 9 and 10 had completely cleared the machine without stopping. Again the machine was stopped and cigar 1 altered to a circumference of 132 cm. After starting, pieces 11, 12 and 13 were ignored and piece 14 passed through the machine satisfactorily. During the passage of piece 15 juddering occurred on cigar 2 and slack developed between cigars 1 and 2. The reason for this was found to be a drop in the temperature of the washing water caused by the operation of an adjacent machine. After the temperature had again risen, which took approximately 10 minutes, the machine was restarted.

A further two pieces, 19 and 20, were run at the 132 cm cigar setting. The machine was again stopped and cigar 1 adjusted to a circumference of 124 cm. Pieces 24-26 were satisfactorily processed at this setting. Cigar 1 was then taken into its minimum setting of 116 cm and the machine was restarted.

It was noted that the fabric was quite slack on cigar 1 but nevertheless ran satisfactorily. As soon as piece 32 cleared the second cigar the machine was stopped and the sewing between pieces 35 and 36 was broken prior to the impregnation bath. End cloth was sewn on and run through the machine.

Pieces 33-36 therefore were subjected to a relatively long delay, 7-8 minutes in various parts of the machine, although they were washed off at the correct width. The remaining 5 pieces of fabric, numbers 36-40 were used to augment the control fabric. Details of piece numbers and treatment widths are recorded in *Table 3*.

5.2. IIC Single Jersey

For the nine available pieces of single jersey fabric it was decided to use the same five settings of cigar 1. Since these pieces were of a length of approximately 100 metres, only one third of any piece would be stopped in the machine during an alteration to the cigar circumference.

The operating procedure was exactly the same as for the Tebe 1x1 rib fabric. For the grey width of 86 cm the pre-impregnation stretcher was set to a width of 94 cm. The speed of the machine was again set at 10 m/min. Width measurements taken at various places along the machine indicated:

Width after impregnation nip	67 cm
Width after storage/entry 1st cigar	62 cm

Apart from stoppages to alter the circumference of cigar 1 the machine ran continuously with

no problems and approximately $1^2/_3$ pieces of fabric were processed at each cigar setting.

A number of 50cm marks were placed on the grey fabric in the length direction prior to impregnation. These were remeasured as the fabric left the second wash tower.

Cigar 1 size	Change in fabric length, %
132 cm	+ 28½ (extension)
116 cm	+ 21 (extension)

Details of the piece numbers and machine settings are given in *Table 4.*

5.3. IIC 1 x 1 Rib

The grey width of the IIC rib fabric was only 62 cm flat (circumference 124 cm). It was considered worth the risk to try and process five pieces of fabric with cigar 1 set to its minimum size (116 cm). The pre-impregnation stretcher was set to 75 cm and measurements were taken during processing which indicated the following width changes:

Width after impregnation nip	44 cm
Width after storage/entry 1st cigar	36 cm

Length marks placed on the grey fabric indicated a length extension through the machine of 37½ %.

Although the fabric was very tight on cigar 1 it appeared to be running satisfactorily for $1^2/_3$ pieces when drive problems occurred. The chain which drives the bottom rollers in wash tower 1 jumped off the sprocket. To reposition the chain entailed draining the wash tanks which resulted in a delay of approximately 30-40 minutes. Pieces 19/1 and 18/3 were threaded through the machine during this stoppage.

After replacement of the chain and refilling of the tanks the machine was re-started and again appeared to be running satisfactorily. Piece 18/2 was satisfactorily processed when during the processing of pieces 18/1 and 17/3 the chain again jumped off the sprocket. It was therefore fairly clear that further processing would be foolhardy and the sewing between pieces 17/3 and 17/2 was broken prior to the impregnation mangle. All of piece 16 and one third of piece 17 were therefore added to the five pieces of control fabric. Pieces 18/1 and 17/3 spent several hours on the merceriser until the chain could be re-positioned and fabric run through. Details of the treatments are given in *Table 5*.

6. Dyeing

The main dyeing machine operated at Tebe is the Barriquand "Gyrostock". There are six of these machines installed and they are the GK01 version with a fabric capacity of 200 kg with the fabric transported as a single rope.

For the shade to be used a pre-bleaching treatment was not considered necessary and therefore the fabric was given a pre-scour in the dyeing vessel.

The navy shade was obtained using a mixture of Levafix Brilliant Red and Remazol Black at a temperature of 40 or 50°C. The fabric speed was 135 m/min and the cylinder was rotated at 0.3 revs per minute. After dyeing the fabric was soaped off and after-treated with a cationic softener.

With the Tebe rib fabric the mercerised and unmercerised controls were dyed together in competition whereas with the IIC fabrics, mercerised and unmercerised fabrics were dyed

separately to the same dye recipe.

Total time in the dyeing vessel was said to be of the order of 8 hours. A computer print-out for one of the dyeing operations is given as *Table 6*.

7. Finishing

The finishing equipment at TEBE is of TubeTex manufacture. Water extraction following dyeing is carried out on a Tripad mangle equipped with driven spreader mechanism. Drying is carried out on a 4-drum Super-relax Jet dryer. Calendering is carried out on a Duplex Convertor Finisher.

7.1. Tebe 1x1 Rib

From the samples of finished fabric sent to Manchester for evaluation, target widths for the mercerised and unmercerised rib fabrics were calculated from the relaxed wales allowing for a width shrinkage of 10% by the IIC relaxation test. These targets were 74 cm for the unmercerised fabric and 66 cm for the mercerised fabric. This of course is the target width at the testing or garment manufacture stage and allowance has to be made for dry relaxation after calendering.

These targets were therefore increased by 2 cm making 76 cm and 68 cm respectively. The driven expander on the Tripad is altered in width by changing spacer bars which increase in increments of 1 inch (2.5 cm). The ideal stretcher width was something of an unknown quantity and therefore it was decided to attempt to wet stretch the fabric by approximately 25% on the Tripad. In the case of the mercerised rib the nearest spacer size gave a stretcher frame width of 83.8 cm (27% over finished target). In the case of the unmercerised control fabrics the frame was set to 91.4 cm (23.5% over target).

As much overfeed as was practical commensurate with an acceptable fabric appearance was applied and fabrics were plaited to await drying.

Width measurements were taken where convenient but it was impossible to count courses at this stage. Drying was carried out with the request that as much length relaxation as possible be allowed. Although the fabric was very slack on the first two drums and on the conveyor band between the two drying sections it did not appear to be as relaxed on the second two drums. When we asked if more relaxation could be applied it was intimated that the fabric would wander laterally and cause difficulties at the plaiter. Fabric width and courses were measured where convenient at the dryer exit.

Calendering was carried out and adjustments made to the stretcher to ensure that fabric was rolled at target width. Maximum overfeed possible was applied and the fabric was rolled as single pieces. Following calendering, fabric width and courses were measured at 2-3 metres in from the end of the roll.

All measurements are recorded in *Table 3*.

7.2. IIC Single Jersey

The Tebe single jersey fabrics submitted to Manchester for testing were of a very similar construction to the IIC fabric and therefore the relaxed wales gave a good guide as to what the target widths ought to be for the IIC fabrics. A width shrinkage of 12% at the testing stage was considered to be suitable and allowance was made for dry relaxation after calendering. Calendar targets of 89 cm for the control and 79 cm for the mercerised fabrics would hopefully result in final testing widths of 87 cm and 77 cm respectively.

Once again the ideal wet stretch width was somewhat of an unknown quantity but the fabric appeared to stretch to 30% over target width without too much difficulty. The nearest available spacers gave a stretcher width of 101.6 cm (32% over finished target) and 111.7 cm (28% over target) for the mercerised and control fabrics respectively.

Width measurements were taken when convenient after the Tripad and also after drying. Courses were also measured after drying.

No difficulties were experienced at the calendering stage and target widths were easily achievable. Because the fabric was taken into Portugal as 10 rolls on a temporary import certificate, it was felt advisable not to break these rolls down into thirds. This will therefore have to be done when the fabric is returned to Manchester.

Width and course measurements recorded during processing are given in *Table 4*.

7.3. IIC 1x1 Rib

The small amount of IIC rib fabric which was mercerised was wet stretched to a width of 63.5 cm which was approximately 30% over the final target width. After drying it was calendered to 51 cm to allow for a final target width of 49 cm.

The seven pieces of unmercerised control fabric gave us the opportunity to carry out a systematic wet stretching exercise. Using the available spacer bars the following amounts of stretch were applied at the Tripad. These were based on a final target finished width of 55 cm.

Piece No.	Stretcher frame, cm	Wet stretch, %
17/1/2	60.9	10.7
16/1/2/3	63.5	15.5
15	66	20.0
14	68.5	24.5
13	71.1	29.2
12	76.2	38.5
11	78.7	43.0

Widths and courses were measured after the Tripad and also after drying. Calendering was carried out in a straightforward manner and width and course measurements were obtained immediately after calendering.

All measurements are recorded in *Table 5*.

8. Conclusions

Even though the cigars on the Tebe machine had a lower range of adjustment than was at first expected, the series of treatments carried out should enable a number of at present unknowns to be answered. Certainly, if differences to the *Reference States* cannot be found in this range of treatments then it would be fair to conclude that machine tuning is not critical.

The machine itself is in need of an overhaul and the addition of temperature sensors and warning devices to enable the washing water temperature to be maintained would seem to be a sensible idea.

The accessibility to the upper part of the machine could be greatly improved which would

facilitate easier and safer alteration of cigar sizes without having to climb over spray rings. It is understood that the machine will eventually be moved into the new dyehouse and this would be an opportunity to build a gantry around the machine.

Alteration of settings to the merceriser did not appear to affect fabric to an extent that difficulty was experienced in obtaining target widths at the finishing stage. There may be an indication that there is an optimum cigar setting for obtaining maximum courses but this is just a casual observation at this stage. Detailed testing should prove or disprove this.

Table 1

TEBE PROJECT 1x1 RIB - GREY FABRICS - TEST DATA

Sample no.	1	2	3	4	5
Length shrinkage	19.61	18.74	18.36	19.19	13.26
Width shrinkage	20.31	21.86	20.95	21.67	31.79
Weight (gsm) BW	148.71	149.45	147.86	144.12	142.14
Weight (gsm) AW	230.49	241.83	239.00	229.81	233.42
Courses per 3cm BW	45.10	45.90	46.10	45.70	51.00
Courses per 3cm AW	56.40	57.10	57.00	56.30	58.70
Wales per 3cm BW	26.00	25.70	26.10	25.40	23.20
Wales per 3cm AW	33.00	33.30	33.00	33.00	33.00
Stitch length (mm) BW	2.92	2.88	2.88	2.92	2.82
Stitch length (mm) AW	2.87	2.82	2.82	2.87	2.80
Burst strength BW	543.50	524.00	525.90	506.80	503.60
Burst strength AW	508.50	536.30	537.70	491.50	495.40
Distension at burst, mm. BW	13.91	13.78	14.25	14.83	14.57
Distension at burst, mm. AW	16.37	16.27	16.59	16.20	16.16
Spiral angle BW					
Spiral angle AW					
Width BW (open-width)	1056.00	1056.00	1056.00	1056.00	1056.00
Yarn strength, BW	233.10	252.97	260.59	250.44	232.44
Yarn strength, AW	232.25	247.65	226.07	234.56	236.78
Yarn extension at break, BW	6.61	7.23	7.40	7.46	6.49
Yarn extension at break, AW	8.51	8.54	8.08	8.11	8.14
Yarn count, tex BW	20.18	20.67	20.50	19.99	20.33
Yarn count, tex AW	19.60	20.22	20.42	19.64	19.92
Fabric thickness, BW	814.20	808.60	775.70	828.00	817.40
Fabric thickness, AW	1206.90	1205.00	1281.90	1257.90	1277.30
ROLL NUMBER	11	12	13	14	15

TEBE PROJECT 1x1 RIB - GREY FABRICS - TEST DATA

Sample no.	6	7	8	9	10
Length shrinkage	19.82	19.00	17.59	18.63	18.01
Width shrinkage	20.24	19.43	21.70	18.66	19.32
Weight (gsm) BW	149.96	155.37	149.90	167.02	160.24
Weight (gsm) AW	235.19	236.92	231.68	235.70	234.11
Courses per 3cm BW	45.60	45.30	46.70	45.70	46.20
Courses per 3cm AW	56.40	56.10	57.00	55.60	55.70
Wales per 3cm BW	25.80	26.20	25.80	26.60	26.60
Wales per 3cm AW	33.20	33.20	33.30	32.80	32.80
Stitch length (mm) BW	2.92	2.92	2.87	2.93	2.91
Stitch length (mm) AW	2.86	2.86	2.83	2.87	2.87
Burst strength BW	514.10	529.40	491.60	535.20	483.60
Burst strength AW	535.80	520.10	533.60	528.10	522.20
Distension at burst, mm. BW	13.87	14.33	14.48	14.58	14.07
Distension at burst, mm. AW	16.55	16.58	16.33	16.63	16.50
Spiral angle BW					
Spiral angle AW					
Width BW (open-width)	1056.00	1056.00	1056.00	1056.00	1057.00
Yarn strength, BW	260.84	239.00	224.29	226.87	244.48
Yarn strength, AW	243.31	246.63	226.11	237.54	245.05
Yarn extension at break, BW	7.86	6.67	6.37	6.33	6.85
Yarn extension at break, AW	8.37	8.64	7.89	8.18	8.39
Yarn count, tex BW	20.20	20.69	19.82	20.23	20.38
Yarn count, tex AW	20.07	20.24	19.82	20.27	20.11
Fabric thickness, BW	773.80	794.50	827.50	837.90	861.30
Fabric thickness, AW	1281.40	1216.10	1241.80	1262.50	1258.80
ROLL NUMBER	16	17	18	19	20

Table 2

TEBE PROJECT SINGLE JERSEY - GREY FABRICS - TEST DATA

Sample no.	11	12	13	14	15
Length shrinkage	17.05	15.50	12.75	15.00	16.03
Width shrinkage	10.12	11.77	11.22	11.98	11.62
Weight (gsm) BW	119.32	121.00	120.17	118.55	119.28
Weight (gsm) AW	162.14	160.75	162.88	160.84	162.88
Courses per 3cm BW	50.40	51.00	52.40	50.60	51.00
Courses per 3cm AW	59.90	59.40	59.60	59.70	60.00
Wales per 3cm BW	40.30	39.10	40.70	39.80	40.40
Wales per 3cm AW	46.20	46.40	46.80	46.90	46.30
Stitch length (mm) BW	2.89	2.89	2.89	2.89	2.89
Stitch length (mm) AW	2.88	2.82	2.90	2.90	2.87
Burst strength BW	551.10	565.30	588.40	581.60	573.10
Burst strength AW	559.60	586.50	547.20	545.10	546.10
Distension at burst, mm. BW	16.45	15.61	16.99	16.93	17.12
Distension at burst, mm. AW	15.81	15.66	15.91	16.10	15.88
Spiral angle BW	10.61	12.04	11.35	12.86	11.04
Spiral angle AW	17.92	17.24	17.67	18.31	18.90
Width BW (tubular)	85.83	85.70	86.20	86.73	86.17
Yarn strength, BW	239.93	251.31	248.25	244.52	261.60
Yarn strength, AW	246.26	248.88	241.43	239.25	232.67
Yarn extension at break, BW	6.78	7.02	6.79	7.83	7.37
Yarn extension at break, AW	7.95	8.12	7.52	7.98	8.03
Yarn count, tex BW	19.06	19.22	19.28	19.23	19.23
Yarn count, tex AW	19.06	18.97	18.98	18.97	18.92
Fabric thickness, BW	614.90	624.30	630.10	622.80	620.80
Fabric thickness, AW	915.50	902.40	903.50	899.60	939.20
ROW NUMBER	21	22	23	24	25

TEBE PROJECT SINGLE JERSEY - GREY FABRICS - TEST DATA

Sample no.	16	17	18	19	20
Length shrinkage	15.12	12.46	15.76	15.81	15.77
Width shrinkage	10.52	10.45	10.18	11.36	11.24
Weight (gsm) BW	120.60	122.27	122.08	120.79	119.34
Weight (gsm) AW	161.47	162.29	164.28	161.62	163.08
Courses per 3cm BW	50.90	52.50	52.00	50.70	51.10
Courses per 3cm AW	59.40	59.60	59.80	59.90	60.00
Wales per 3cm BW	40.50	41.40	41.10	41.30	40.20
Wales per 3cm AW	45.40	46.30	46.20	45.90	45.40
Stitch length (mm) BW	2.88	2.90	2.89	2.88	2.89
Stitch length (mm) AW	2.88	2.82	2.87	2.88	2.87
Burst strength BW	609.30	566.70	589.70	548.30	582.00
Burst strength AW	564.00	568.90	540.70	580.60	562.50
Distension at burst, mm. BW	16.08	17.00	17.03	15.85	16.44
Distension at burst, mm. AW	15.86	15.85	15.88	16.01	16.19
Spiral angle BW	12.82	12.93	12.38	14.45	12.35
Spiral angle AW	17.72	17.56	18.28	17.65	18.56
Width BW (tubular)	85.23	85.97	85.70	84.90	83.80
Yarn strength, BW	262.56	264.51	278.35	274.91	261.64
Yarn strength, AW	232.80	241.84	241.47	237.56	243.24
Yarn extension at break, BW	7.80	7.44	7.97	7.21	7.71
Yarn extension at break, AW	7.55	7.94	8.00	7.86	7.89
Yarn count, tex BW	19.27	19.17	19.07	19.21	19.31
Yarn count, tex AW	19.52	18.69	18.78	18.89	18.88
Fabric thickness, BW	621.40	647.70	640.30	617.10	627.60
Fabric thickness, AW	886.40	911.10	917.80	924.50	914.20
ROW NUMBER	26	27	28	29	30

TEBE 1×1 RIB

TABLE 3

	MERCERISING DETAILS			FINISHING DETAILS							
PIECE NUMBER	SIZE CIGAR 1	SIZE CIGAR 2	COMMENTS	TRI-PAD STRETCHER WIDTH	WIDTH AFTER TRI-PAD	COURSES/3CM AFTER TRI-PAD	WIDTH AFTER DRYER	COURSES/3CM AFTER DRYER	WIDTH AFTER CALENDER	COURSES/3CM AFTER CALENDER
2	148	121	OK	83·8					68	46
3	148	FIXED	OK						68	46½
4	148		OK						68	46
5	140		STOPPED ON CIGARS						72	47½
6	140		STOPPED ON DELAY		77		61	47	68	47½
7	140		STOPPED PAD/WAGON		77		58		68	47
8	140		OK						68	47
9	140		OK				58		68	47
10	140		OK		77		60	47	68	47
11	132		STOPPED ON CIGARS						68	47
12	132		STOPPED ON DELAY						VARIABLE 68	47½
13	132		STOPPED PAD/WAGON						68½	47
14	132		OK						68	47
15	132		MACHINE STOPPAGE DUE TO TEMPERATURE DROP OF RINSE WATER						68½	47
16	132								68	46½
17	132				82		61	49	68	47½
18	132				82				68	47
19	132		OK						68	47
20	132		OK		81		61		68	47
21	124		STOPPED ON CIGARS				60		68	47½
22	124		STOPPED ON DELAY						67½	49
23	124		STOPPED PAD/WAGON		83		61	49	68	48
24	124		OK						68	48
25	124		OK						68	48
26	124		OK						68	47

(continued)

TEBE 1x1 RIB

TABLE 3 (CONTINUATION)

	MERCERISING DETAILS			FINISHING DETAILS							
PIECE NUMBER	SIZE CIGAR 1	SIZE CIGAR 2	COMMENTS	TRI-PAD STRETCHER WIDTH	WIDTH AFTER TRI-PAD	COURSES/3CM AFTER TRI-PAD	WIDTH AFTER DRYER	COURSES/3CM AFTER DRYER	WIDTH AFTER CALENDER	COURSES/3CM AFTER CALENDER
27	116	121 FIXED	STOPPED ON CLOTH	83.8					68	46
28	116		STOPPED ON DELAY						68	47
29	116		STOPPED PAD/WIDTH						69	48
30	116		OK						68	48
31	116		OK				60	48	68	47
32	116		OK						68	47
33	116		STOPPED ON CLOTH							
34	116		7/8 minute							
35	116		delay				59	47	68	48
	UNMERCERISED		CONTROLS	91.4						
36									76	49
37							68	49	76	49
38					81				76	50
39									76	49½
40					81		68	51½	76	50
1					81		69	50	76	49

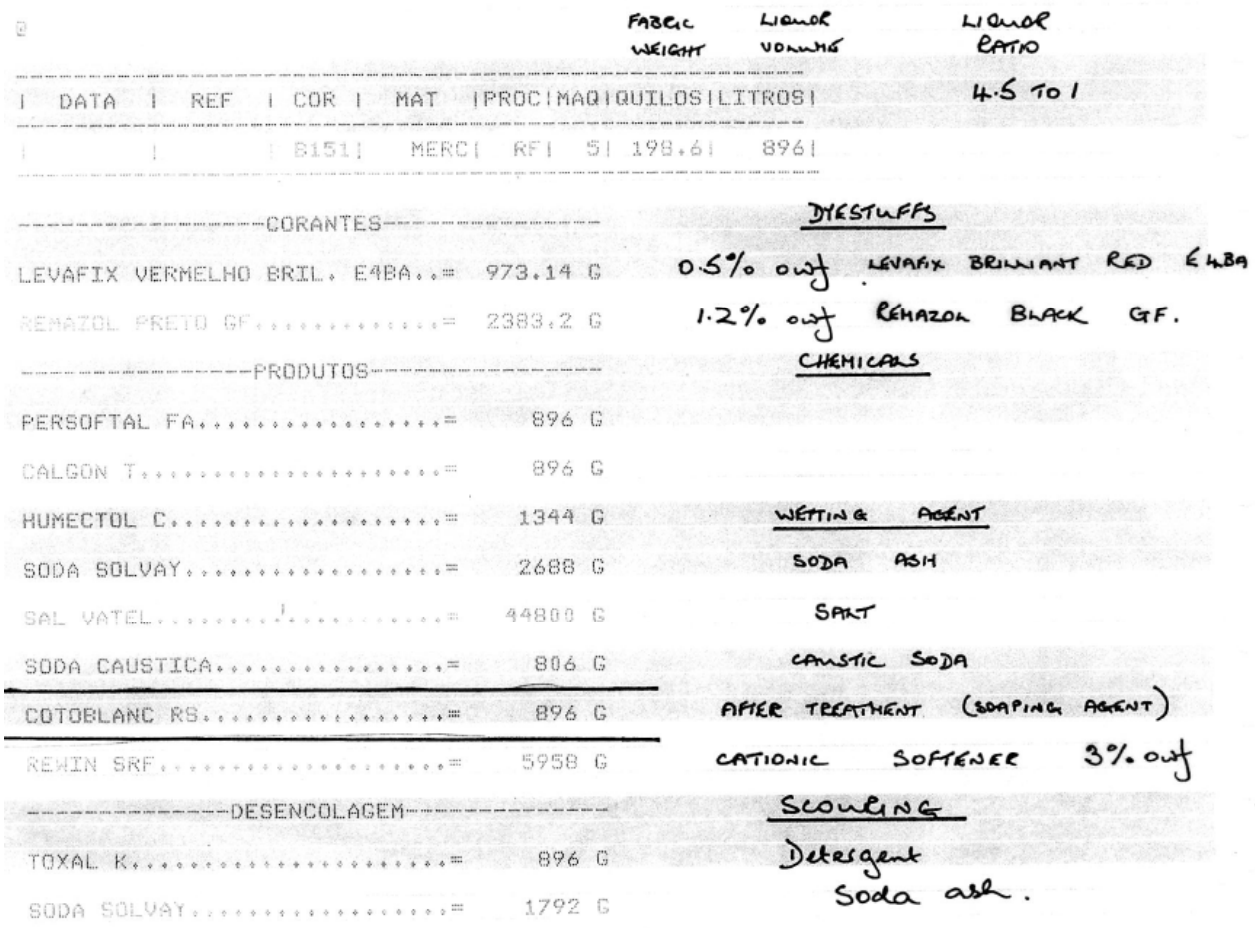
IIC SINGLE JERSEY TABLE 4.

PIECE NUMBER	MERCERISING DETAILS: SIZE CIGAR 1	MERCERISING DETAILS: SIZE CIGAR 2	MERCERISING DETAILS: COMMENTS	FINISHING DETAILS: TRI-PAD STRETCHER WIDTH	FINISHING DETAILS: WIDTH AFTER TRI-PAD	FINISHING DETAILS: COURSES/3CM AFTER TRI-PAD	FINISHING DETAILS: WIDTH AFTER DRYER	FINISHING DETAILS: COURSES/3CM. AFTER DRYER	FINISHING DETAILS: WIDTH AFTER CALENDER	FINISHING DETAILS: COURSES/3CM. AFTER CALENDER
									79	
30/3	148	120	OK	101.6	76½					
30/2	148		OK				65	43	79	
30/1	148		OK						79	46½
29/3	140		STOPPED THRO' MACHINE		76½				79	
29/2	140		OK		76½		64½	43	79	
29/1	140		OK						79	46
28/3	140		OK		76½				79	
28/2	140		OK				64	43½	79	
28/1	140		OK						79	46
27/3	132		STOPPED THRO' MACHINE		77				79	
27/2	132		OK 28½% LENGTH EXTENSION				63	44½	79	
27/1	132		OK		77		64½	45	79	46
26/3	132		OK		76½				79	
26/2	132		OK						79	
26/1	132		OK				65	46	79	46½
25/3	124		STOPPED THRO' MACHINE		76			45		
25/2	124		OK							
25/1	124		OK		73		64	45	79	46½
24/3	124		OK		73				79	
24/2	124		OK						79	
24/1	124		OK		70½		64	44½	79	
23/3	116		STOPPED THRO' MACHINE OK						79½	50
23/2	116		21% LENGTH EXTENSION						79½	
23/1	116		OK				64½	46	79½	45
22/3	116		OK							
22/2	116		OK							
22/1	116		LONG STOPPAGE				64	45½	79	46
	UNMERCERISED		CONTROL							
21				111.7			80½	53½	89	50½

IIC 1x1 RIB TABLE 5.

	MERCERISING DETAILS			FINISHING DETAILS							
PIECE NUMBER	SIZE CIGAR 1	SIZE CIGAR 2	COMMENTS	TRI-PAD STRETCHER WIDTH	WIDTH AFTER TRI-PAD	COURSES/3CM AFTER TRI-PAD	WIDTH AFTER DRYER	COURSES/3CM AFTER DRYER	WIDTH AFTER CALENDER	COURSES/3CM AFTER CALENDER
20/3	116	120 FIXED	OK	63.5						
20/2			OK				44	38	51	
20/1			OK		54		43			
19/3			OK 37½% LENGTH EXTENSION				42	39	51	40½
19/2			OK							
19/1			LONG STOPPAGE VARIABLE TENSION		55		42	38		
18/3										
18/2			OK				42	39	51	40
18/1			VERY LONG STOPPAGE VARIABLE TENSION		52					
17/3									51	38
	UNMERCERISED		CONTROLS							
17/2				60.9	59	47½	48	46½	57	45½
17/1				60.9						
16/3	WET STRETCHING			63.5						
16/2				63.5	59	47½	48½	46½	57	45
16/1	TRIALS			63.5						
15				66	61	48	49½	50	57	46
14				68.5	64	49	50	49	57	47
13				71.1	64	51	50	50	57	48½
12				76.2	64	50	50½	50	57	48
11				78.7	63	46	50½	49	56½	46½

Table 6



DATA	REF	COR	MAT	PROC	MAQ	QUILOS	LITROS
		B151	MERC	RF	5	198.6	896

FABRIC WEIGHT — LIQUOR VOLUME — LIQUOR RATIO 4.5 TO 1

CORANTES		DYESTUFFS
LEVAFIX VERMELHO BRIL. E4BA	973.14 G	0.5% owf LEVAFIX BRILLIANT RED E4BA
REMAZOL PRETO GF	2383.2 G	1.2% owf REMAZOL BLACK GF.
PRODUTOS		CHEMICALS
PERSOFTAL FA	896 G	
CALGON T	896 G	
HUMECTOL C	1344 G	WETTING AGENT
SODA SOLVAY	2688 G	SODA ASH
SAL VATEL	44800 G	SALT
SODA CAUSTICA	806 G	CAUSTIC SODA
COTOBLANC RS	896 G	AFTER TREATMENT (SOAPING AGENT)
REWIN SRF	5958 G	CATIONIC SOFTENER 3% owf
DESENCOLAGEM		SCOURING
TOXAL K	896 G	Detergent
SODA SOLVAY	1792 G	Soda ash.

Research Record No: 173 Supplementary

The Processing Of Knitted Fabrics On A Dornier Mercerising Machine
Analysis Of The Fabrics Processed At
Empresa Textil De Barcelos Sarl (Tebe)
Barcelos, Portugal
11-15th July 1983

1. Introduction

Research Record No.173 outlines the objectives of the work being carried out at Tebe and describes the first stage of the exercise which was the evaluation of the merceriser itself. In particular we were interested to determine just how critical the machine settings are and what the effect of changing settings will be on the *Reference State* of single jersey and 1x1 rib qualities.

We need this information to enable optimum machine settings to be determined so that the thirty single jersey qualities in *Stage 2* of the project can be processed under realistic conditions.

This report describes the analysis of the results obtained and draws certain conclusions which will be used when establishing a processing plan for *Stage 2* of the project.

2. Background

The previous report (No.173) describes how an IIC single jersey quality and a Tebe 1x1 rib quality were mercerised on a Dornier machine with a range of settings of the cigar in the first wash tower (cigar circumferences of 148, 140, 132, 124, and 116 cm).

The cigar in the second wash tower was damaged and was jammed at a size of 120 cm circumference at its widest point. This was therefore unalterable and remained fixed at this size for all the treatments whilst the size of cigar 1 was altered.

After mercerising, the fabrics were dyed in a Barriquand "Gyrostock" machine and finished to the same targets using the following equipment.

Wet stretch	Tubetex Tripad
Dry	Tubetex Super-relax Jet
Calendar	Tubetex

These finished targets were established entirely from an evaluation of Tebe fabrics which had been previously analysed in Manchester and also using the experience of Tebe personnel. As well as the mercerised fabrics, unmercerised controls were also dyed and finished so that any changes to the reference state due to the dyeing route can be identified.

3. Evaluation

3.1. Tebe 1x1 Rib

Table 3 in Research Record No.173 details the precise processing conditions which were applied to the 40 pieces of Tebe 1x1 rib fabric and, where in-process measurements were obtained these have been presented.

Where fabric was stopped at various stages in the merceriser, for a cigar size change or an unavoidable machine stoppage, then the affected fabric has been identified. An examination of this table will also reveal that for each setting of the cigar on the merceriser there were several pieces of fabric processed. The test results from all the processed fabrics including the ones which were stopped on the merceriser are given in *Table 1* of this supplementary report.

We are particularly interested in the *Reference* courses and wales since these two properties reflect any permanent alteration to the fabric structure which is brought about by mercerising.

Since a number of pieces of fabric were processed under a given set of conditions, an average of the courses and wales has been calculated together with the standard deviations. These have been plotted and are shown in *Figure 1*.

The *Reference* courses and wales of the unmercerised control fabrics have also been plotted so that the overall changes in the *Reference State* due to mercerising can be determined.

Altering the size of the cigar in the first wash tower from 148 cm down to 116 cm has had very little effect on the *Reference* wales and hence width of the fabric. In fact the overall spread is of the order of half a wale in 42.5 which is under 1%.

The permanent effect of mercerising on fabric width can be obtained by comparing the *Reference* wales of the mercerised and control fabrics. The percentage width change is given by the relationship:

100 (Ref Wales, control – Ref Wales, mercerised) / Ref Wales, mercerised

which gives:

100 (37.2 – 42.5) / 42.5 = -12.5 %

Although altering the size of the cigar within the range studied appears to have very little effect on fabric width, it does have an effect on fabric length which is indicated in a change in the *Reference* course density. This remains fairly constant in the range 148-132 cm cigar circumference but at lower settings the linear density increases indicating length shrinkage. At the lower stretch levels the linear density of the courses approximates to that of the unmercerised control fabric.

In the stretch range 132 to 148 cm the permanent extension in fabric length is given by the relationship:

100 (Ref Courses, control – Ref Courses, mercerised) / Ref Courses, mercerised

which gives:

100 (57.5 – 56.2) / 56.2 = +2.3 %

In *Figure 2* the *Reference* courses and wales of the fabrics which were stopped on the merceriser have been included and a certain amount of variability is apparent particularly in the linear density of the courses.

3.2. IIC Single Jersey.

Table 4 in Research Record No.173 details the processing conditions which applied to the IIC single jersey fabrics.

The test figures of all these fabrics, including the ones which were stopped on the machine, are given in *Table 2* of this supplementary report.

As with the 1x1 rib construction, average *Reference* courses and wales of the several fabric pieces treated at each machine setting have been calculated together with the standard deviations. These have been plotted in *Figure 3*.

Again it can be seen that altering the size of the cigar in the first wash tower has very little effect on the reference wales and therefore fabric width. Over the full range of cigar sizes used (116-148 cm) the overall effect on wales is less than 1%.

The permanent change in *Reference* wales and therefore fabric width brought about by mercerising is calculated as for the rib construction and found to be:

100 (44.75- 51.5) / 51.5 = -13.1 %

As for the 1x1 rib construction the effect of changing cigar size on the *Reference* courses is far more apparent but in the size range 148 to 132 cm this is more or less a constant change. Below this size, length shrinkage becomes apparent.

The permanent change in length brought about by mercerising is calculated as previously and found to be:

$$100\ (58.4 - 55.4) / 55.4 \quad = \quad +5.4\%$$

In *Figure 4*, the *Reference* courses and wales of the fabrics which were stopped in the machine have been included. Unlike the rib construction it was not possible to indicate which precise section of the machine the test samples represent. Although the number of suspect samples is lower than with the rib fabric 66% of these are within one standard deviation of the average of the "good" samples.

4. Observations And Conclusions

The main observation which has come from analysing the results of this preliminary trial is that altering the size of the cigar in the first wash tower seems to have virtually no effect on the *Reference* wales and therefore width of the mercerised fabric. A width reduction of 12.5% in the case of 1x1 rib and 13.1% in the case of single jersey would appear to be typical of this merceriser when compared with unmercerised fabric. Altering cigar size within the range studied appears to give little or no control over this.

Altering cigar size does however seem to have an effect on the *Reference* course density particularly at lower cigar diameters.

In order to maintain consistency, it would therefore seem logical to ensure that a certain degree of width stretch is applied to ensure that the conditions will give a result which falls on the flat part of the curve which represents the *Reference* course linear density.

The fabrics to be used in *Stage 2* of this project have a range of target finished widths. Therefore it is necessary to have some factor which can be used to determine the optimum size of the cigar during the mercerising stage. In the case of the fabrics which were treated in this particular exercise: if it is assumed that the 140 cm cigar size is sufficiently far away from the danger area then the cigar size can be related to the target finished widths of these fabrics.

With the mercerised 1x1 rib construction a realistic target finished width to give approximately 8% width shrinkage can be shown to be around 65 cm.

The factor is therefore:

$$140 / 65 \quad = \quad 2.15$$

With the mercerised single jersey fabric the target finished width to give a residual shrinkage of 10% is approximately 75 cm.

The factor is therefore:

$$140 / 75 \quad = \quad 1.87$$

For *Stage 2* processing therefore, the target finished widths for the unmercerised control can be obtained using STARFISH, with a width shrinkage of 10% built in. This can then be reduced by 13% to allow for mercerising and the suggested cigar size calculated by multiplying the target finished width by a factor of 1.87.

It will no doubt be necessary to group the fabrics into several width brackets for mercerising

since the cigar size cannot be altered for each fabric variant.

The question arises as to whether end-cloths should be placed between the various groups to ensure that fabric is not stopped on the machine during changes to the cigar size. Provided that the fabrics are mercerised in the order of wide to narrow, the change of cigar size should be effected in a very short period of time (less than 1 minute). It is the author's view therefore that, since the differences observed in the *Reference* courses and wales of the single jersey fabric stopped on the machine were within one standard deviation of the average, that it is not necessary to use end-cloths and this will greatly simplify the exercise.

Table 1

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA 1-4-84

Sample no.	1	2	3	4	5
Length shrinkage, 1x	10.53	13.27	13.62	13.79	13.71
Width shrinkage, 1x	2.86	7.82	8.88	8.80	9.47
Length shrinkage, 5x	13.14	17.67	17.77	18.00	18.09
Width shrinkage, 5x	3.72	8.14	8.90	9.45	9.72
Weight (gsm)BW - square	198.07	207.32	204.54	202.98	207.17
Weight (gsm)AW - square	239.78	265.94	263.65	263.88	263.49
Weight (gsm)BW - circular	199.94	207.19	202.97	200.60	205.83
Weight (gsm)AW - circular	236.61	264.79	262.00	262.19	262.18
Courses per 3cm BW	51.30	46.10	46.70	46.60	46.80
Courses per 3cm AW	58.40	55.90	56.40	56.30	56.90
Wales per 3cm BW	35.70	38.70	39.30	38.60	38.20
Wales per 3cm AW	37.10	42.60	42.90	42.20	41.60
Stitch length (mm) BW	2.58	2.48	2.50	2.48	2.47
Stitch length (mm) AW	2.57	2.48	2.48	2.47	2.46
Burst strength, BW	687.40	783.70	787.40	780.70	801.00
Burst strength, AW	647.50	773.70	756.60	765.40	780.00
Distension at burst, BW	18.57	14.88	16.44	16.58	13.83
Distension at burst, AW	22.96	21.17	20.67	20.94	20.59
Angle of spirality, BW	0.23	-0.80	1.49	1.36	-1.97
Angle of spirality, AW	0.24	-1.88	0.66	-0.61	0.02
Width, BW	70.77	64.47	64.57	65.57	66.13
Yarn strength, BW	201.71	229.25	222.33	228.56	229.41
Yarn strength, AW	188.85	225.65	219.35	215.94	230.52
Yarn extension at break, BW	6.93	6.20	6.04	6.61	6.85
Yarn extension at break, AW	6.54	6.39	6.39	6.32	6.66
Yarn count (tex), BW	19.74	20.76	20.40	20.94	21.03
Yarn count (tex), AW	19.80	20.70	20.47	20.76	20.68
Thickness, BW	775.30	685.40	685.70	674.80	670.40
Thickness, AW	1029.40	998.70	1004.40	1004.70	1000.70

CIGAR SIZE

1	WHEEL	148	148	148	STOP
2	CONTROL	120	120	120	

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	6	7	8	9	10
Length shrinkage, 1x	12.47	13.66	13.30	12.28	12.97
Width shrinkage, 1x	11.30	9.09	7.85	8.76	8.66
Length shrinkage, 5x	16.48	17.74	17.22	16.26	17.11
Width shrinkage, 5x	11.52	9.56	7.94	9.09	8.86
Weight (gsm)BW - square	200.37	214.64	211.29	210.76	207.61
Weight (gsm)AW - square	264.96	268.20	267.13	265.40	260.00
Weight (gsm)BW - circular	196.87	214.87	210.92	210.38	208.70
Weight (gsm)AW - circular	264.39	266.53	267.16	264.48	265.99
Courses per 3cm BW	47.60	47.50	47.00	47.80	47.60
Courses per 3cm AW	55.70	56.70	56.40	56.00	55.90
Wales per 3cm BW	38.10	38.50	38.90	38.90	39.20
Wales per 3cm AW	42.50	42.80	42.70	42.50	42.70
Stitch length (mm) BW	2.47	2.48	2.48	2.47	2.48
Stitch length (mm) AW	2.46	2.46	2.46	2.47	2.46
Burst strength, BW	813.80	807.50	790.20	766.70	802.50
Burst strength, AW	798.50	758.10	764.00	791.20	782.70
Distension at burst, BW	15.02	16.88	15.98	15.64	15.57
Distension at burst, AW	20.56	20.93	20.97	20.51	21.10
Angle of spirality, BW	1.04	0.95	-1.73	2.40	0.15
Angle of spirality, AW	1.46	3.07	-1.04	2.38	0.06
Width, BW	66.40	64.37	64.62	65.13	64.70
Yarn strength, BW	233.33	231.28	222.25	231.17	220.71
Yarn strength, AW	229.43	222.57	222.20	227.59	219.17
Yarn extension at break, BW	6.29	6.28	6.07	5.96	5.81
Yarn extension at break, AW	6.64	6.55	6.61	6.67	6.62
Yarn count (tex), BW	20.86	20.65	20.73	20.79	20.68
Yarn count (tex), AW	20.83	20.66	20.74	20.57	20.76
Thickness, BW	681.20	696.60	691.70	697.10	702.30
Thickness, AW	998.30	1003.30	1012.40	1010.60	1008.70

CIGAR SIZE

1	STOP	STOP	140	140	140
2			120	120	120

Table 1 (cont.)

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	11	12	13	14	15
Length shrinkage, 1x	13.29	13.13	13.95	13.35	13.45
Width shrinkage, 1x	9.05	7.62	7.82	9.28	7.89
Length shrinkage, 5x	16.55	16.16	17.31	16.54	16.35
Width shrinkage, 5x	8.84	7.55	7.23	9.04	7.84
Weight (gsm)BW - square	213.79	209.45	201.99	209.41	205.21
Weight (gsm)AW - square	278.10	276.23	271.02	271.24	271.58
Weight (gsm)BW - circular	212.56	211.92	206.63	214.30	206.49
Weight (gsm)AW - circular	267.05	273.84	268.60	271.47	270.62
Courses per 3cm BW	46.20	45.60	45.90	45.70	46.20
Courses per 3cm AW	54.20	55.60	55.00	56.30	55.10
Wales per 3cm BW	38.80	37.90	37.40	38.00	38.40
Wales per 3cm AW	42.00	41.90	42.30	41.90	42.20
Stitch length (mm) BW	2.47	2.48	2.48	2.48	2.47
Stitch length (mm) AW	2.47	2.46	2.47	2.47	2.47
Burst strength, BW	736.40	753.10	701.00	765.10	761.10
Burst strength, AW	744.10	778.70	777.00	805.10	759.30
Distension at burst, BW	18.10	17.98	17.93	17.56	18.75
Distension at burst, AW	21.27	21.45	21.14	21.56	20.96
Angle of spirality, BW	-4.47	-1.58	1.33	-2.11	2.06
Angle of spirality, AW	-2.24	-3.80	-1.36	-1.00	-1.46
Width, BW	65.07	63.50	64.37	64.83	64.80
Yarn strength, BW	226.25	242.04	235.46	231.27	235.93
Yarn strength, AW	225.48	224.88	225.52	228.53	223.39
Yarn extension at break, BW	6.62	6.89	6.91	6.69	7.28
Yarn extension at break, AW	6.85	6.98	6.87	6.92	7.02
Yarn count (tex), BW	20.87	21.23	20.88	21.43	21.09
Yarn count (tex), AW	20.92	21.01	20.55	20.98	20.84
Thickness, BW	711.20	733.50	722.50	727.50	722.20
Thickness, AW	1076.20	1071.20	1084.50	1091.90	1082.40
CIGAR SIZE					
1	STOP	STOP	STOP	132	STOP
2				120	

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	16	17	18	19	20
Length shrinkage, 1x	13.87	13.38	14.29	13.89	14.65
Width shrinkage, 1x	8.55	9.68	7.83	9.18	9.08
Length shrinkage, 5x	16.56	16.06	17.24	16.64	17.50
Width shrinkage, 5x	8.45	10.01	7.68	9.48	9.21
Weight (gsm)BW - square	210.62	220.31	201.17	217.22	210.44
Weight (gsm)AW - square	274.43	274.37	265.67	273.19	265.61
Weight (gsm)BW - circular	213.43	222.02	204.02	216.26	208.10
Weight (gsm)AW - circular	270.71	272.13	263.49	272.26	263.51
Courses per 3cm BW	45.70	47.00	46.80	47.70	47.20
Courses per 3cm AW	56.50	55.90	56.10	56.30	55.70
Wales per 3cm BW	38.50	37.50	37.90	39.30	38.80
Wales per 3cm AW	42.70	41.70	43.20	42.20	42.60
Stitch length (mm) BW	2.47	2.47	2.46	2.47	2.46
Stitch length (mm) AW	2.47	2.46	2.45	2.46	2.47
Burst strength, BW	771.50	731.00	745.40	787.90	762.70
Burst strength, AW	784.00	781.30	747.10	785.00	756.00
Distension at burst, BW	17.80	18.06	17.44	19.32	17.87
Distension at burst, AW	20.89	21.63	21.16	21.55	21.94
Angle of spirality, BW	-1.69	-0.92	1.66	-3.71	0.24
Angle of spirality, AW	-3.45	-1.90	-1.51	-4.23	-0.17
Width, BW	64.63	65.20	64.33	64.33	63.83
Yarn strength, BW	235.85	239.53	219.35	254.23	233.52
Yarn strength, AW	234.82	238.43	224.41	245.63	227.48
Yarn extension at break, BW	7.24	7.02	6.89	7.63	6.96
Yarn extension at break, AW	6.93	7.18	6.89	7.63	7.19
Yarn count (tex), BW	21.34	20.94	21.15	21.34	21.35
Yarn count (tex), AW	21.04	20.97	20.84	21.16	20.82
Thickness, BW	710.40	727.10	720.20	742.30	743.30
Thickness, AW	1056.70	1088.30	1074.40	1066.90	1055.70
CIGAR SIZE					
1.	STOP	STOP	STOP	132	132
2.				120	120

Table 1 (cont.)

FIRST TEBE TRIAL — TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	21	22	23	24	25
Length shrinkage, 1x	14.58	12.37	11.91	12.26	14.12
Width shrinkage, 1x	7.48	7.45	8.51	7.98	7.27
Length shrinkage, 5x	17.78	15.27	14.95	15.43	16.86
Width shrinkage, 5x	7.68	7.68	8.82	7.99	7.27
Weight (gsm)BW - square	219.69	217.66	217.47	217.72	218.82
Weight (gsm)AW - square	270.43	269.98	265.16	266.10	276.39
Weight (gsm)BW - circular	219.90	217.65	217.30	217.36	215.58
Weight (gsm)AW - circular	271.50	265.53	264.35	267.25	276.36
Courses per 3cm BW	47.60	48.30	48.30	47.80	49.00
Courses per 3cm AW	56.20	56.40	56.00	56.30	57.90
Wales per 3cm BW	39.00	39.40	38.70	40.20	39.10
Wales per 3cm AW	42.00	43.40	43.00	43.00	42.10
Stitch length (mm) BW	2.43	2.43	2.44	2.44	2.43
Stitch length (mm) AW	2.43	2.40	2.40	2.42	2.43
Burst strength, BW	789.70	786.10	815.20	807.30	845.80
Burst strength, AW	802.60	826.40	800.20	767.10	787.70
Distension at burst, BW	16.13	16.59	16.75	16.07	15.84
Distension at burst, AW	19.27	20.26	19.32	19.75	20.00
Angle of spirality, BW	-3.38	-0.41	-0.76	-2.78	-5.04
Angle of spirality, AW	0.70	2.76	3.16	1.70	0.50
Width, BW	64.67	64.43	64.27	64.17	64.40
Yarn strength, BW	246.17	233.33	233.27	230.75	234.69
Yarn strength, AW	235.24	214.19	218.39	223.72	246.17
Yarn extension at break, BW	8.40	7.93	8.35	7.71	7.70
Yarn extension at break, AW	7.71	7.36	7.35	7.75	9.49
Yarn count (tex), BW	21.46	20.93	21.14	20.82	21.04
Yarn count (tex), AW	21.00	21.12	21.09	20.91	21.26
Thickness, BW	688.20	735.80	722.80	705.80	715.40
Thickness, AW	994.80	972.00	969.60	973.20	1032.60
CIGAR SIZE					
1	STOP	STOP	STOP	124	124
2				120	120

FIRST TEBE TRIAL — TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	26	27	28	29	30
Length shrinkage, 1x	15.71	18.80	12.60	14.57	14.64
Width shrinkage, 1x	10.09	7.10	9.41	6.93	5.55
Length shrinkage, 5x	18.19	20.82	15.14	17.54	17.17
Width shrinkage, 5x	10.12	7.41	10.34	6.92	5.77
Weight (gsm)BW - square	205.95	209.52	222.46	209.25	215.55
Weight (gsm)AW - square	268.18	266.37	270.92	272.91	275.25
Weight (gsm)BW - circular	203.95	207.73	216.95	209.66	220.42
Weight (gsm)AW - circular	266.28	266.20	271.29	273.50	274.79
Courses per 3cm BW	47.30	45.40	49.10	48.60	48.80
Courses per 3cm AW	56.60	57.40	57.40	57.50	58.20
Wales per 3cm BW	38.00	39.40	38.50	38.70	39.30
Wales per 3cm AW	42.40	42.30	42.30	42.00	42.20
Stitch length (mm) BW	2.44	2.43	2.44	2.46	2.43
Stitch length (mm) AW	2.42	2.43	2.43	2.43	2.48
Burst strength, BW	814.30	819.00	836.70	800.10	821.70
Burst strength, AW	771.70	818.00	792.20	797.00	809.10
Distension at burst, BW	15.68	15.17	16.98	16.80	15.70
Distension at burst, AW	19.21	20.02	19.40	20.04	20.51
Angle of spirality, BW	-2.10	-2.90	-3.77	0.26	-3.63
Angle of spirality, AW	0.66	-0.30	0.24	1.86	0.74
Width, BW	65.47	64.10	66.67	65.13	64.50
Yarn strength, BW	226.30	236.19	233.76	242.57	222.03
Yarn strength, AW	240.40	224.23	236.04	218.15	230.37
Yarn extension at break, BW	7.46	8.13	8.03	7.81	7.31
Yarn extension at break, AW	9.94	9.23	9.23	8.91	8.82
Yarn count (tex), BW	20.89	21.05	21.20	21.17	21.13
Yarn count (tex), AW	21.14	21.04	21.15	20.98	21.04
Thickness, BW	687.20	666.20	725.80	692.80	720.40
Thickness, AW	1009.80	991.83	1025.30	1027.50	1058.70
CIGAR SIZE					
1.	124	STOP	STOP	STOP	116
2.	120				120

Table 1 (cont.)

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	31	32	33	34	35
Length shrinkage, 1x	14.57	15.13	13.48	12.72	12.90
Width shrinkage, 1x	7.29	7.44	5.87	7.38	7.31
Length shrinkage, 5x	17.21	17.38	15.73	14.94	15.66
Width shrinkage, 5x	7.10	7.46	5.59	7.33	7.11
Weight (gsm)BW - square	211.39	214.00	210.44	214.70	210.10
Weight (gsm)AW - square	268.16	269.55	266.97	268.25	263.45
Weight (gsm)BW - circular	212.95	215.60	214.72	215.40	211.40
Weight (gsm)AW - circular	264.84	269.40	264.46	266.87	263.77
Courses per 3cm BW	47.80	48.20	48.20	48.10	47.60
Courses per 3cm AW	57.40	57.70	57.10	57.10	56.90
Wales per 3cm BW	39.80	39.50	40.10	39.30	39.30
Wales per 3cm AW	42.00	42.20	42.30	42.40	42.20
Stitch length (mm) BW	2.45	2.46	2.45	2.44	2.44
Stitch length (mm) AW	2.44	2.46	2.45	2.44	2.45
Burst strength, BW	768.40	826.30	797.00	802.10	766.60
Burst strength, AW	764.70	806.90	765.70	773.70	782.30
Distension at burst, BW	16.20	16.75	16.88	17.19	16.21
Distension at burst, AW	20.15	19.82	20.53	19.43	19.45
Angle of spirality, BW	0.74	-1.26	0.87	3.36	-0.41
Angle of spirality, AW	0.86	-1.12	1.45	4.67	-1.18
Width, BW	63.45	63.73	63.60	63.97	63.70
Yarn strength, BW	240.73	230.03	226.85	231.45	224.24
Yarn strength, AW	225.11	236.84	230.60	230.60	222.08
Yarn extension at break, BW	7.67	7.56	7.00	6.96	7.06
Yarn extension at break, AW	7.41	7.72	7.38	7.25	6.92
Yarn count (tex), BW	21.02	20.91	21.07	20.80	21.02
Yarn count (tex), AW	20.89	20.54	20.92	20.95	20.99
Thickness, BW	700.50	691.10	690.20	695.50	700.20
Thickness, AW	1019.50	1032.10	1008.20	1008.30	1013.50

CIGAR SIZE

1	116	116	STOP	STOP	STOP
2	120	120			

FIRST TEBE TRIAL TEBE 1x1 RIB, FINISHED - TEST DATA

Sample no.	36	37	38	39	40
Length shrinkage, 1x	11.01	11.62	10.13	10.52	10.26
Width shrinkage, 1x	5.15	5.56	6.30	5.89	5.95
Length shrinkage, 5x	12.83	13.08	11.41	12.05	11.84
Width shrinkage, 5x	5.12	6.20	6.70	5.94	6.44
Weight (gsm)BW - square	197.65	197.37	201.26	201.41	200.29
Weight (gsm)AW - square	234.74	236.52	233.85	238.37	237.59
Weight (gsm)BW - circular	197.43	199.22	201.68	201.94	199.00
Weight (gsm)AW - circular	233.56	236.83	232.97	236.77	238.14
Courses per 3cm BW	50.20	49.90	51.20	50.70	50.80
Courses per 3cm AW	56.80	57.40	57.50	57.40	57.20
Wales per 3cm BW	35.30	35.10	35.10	35.10	35.20
Wales per 3cm AW	37.20	37.50	37.50	37.00	36.90
Stitch length (mm) BW	2.58	2.59	2.58	2.57	2.59
Stitch length (mm) AW	2.57	2.56	2.57	2.57	2.57
Burst strength, BW	677.10	702.70	657.20	667.60	673.00
Burst strength, AW	643.20	643.90	638.90	629.60	666.60
Distension at burst, BW	19.58	19.17	20.00	19.32	19.76
Distension at burst, AW	20.57	20.24	20.40	20.47	20.82
Angle of spirality, BW	1.42	0.32	2.72	0.84	2.49
Angle of spirality, AW	0.03	-1.12	1.16	0.78	2.28
Width, BW	70.47	70.87	72.10	71.33	71.57
Yarn strength, BW	179.79	174.48	182.23	181.12	185.63
Yarn strength, AW	181.44	183.83	181.99	175.24	190.47
Yarn extension at break, BW	6.14	5.93	6.45	6.15	6.46
Yarn extension at break, AW	6.77	6.50	6.58	6.58	6.67
Yarn count (tex), BW	19.79	19.93	19.73	19.86	19.86
Yarn count (tex), AW	19.53	19.97	19.72	19.87	19.97
Thickness, BW	752.10	745.80	740.80	760.70	747.10
Thickness, AW	1016.40	1013.70	1013.90	1020.10	1008.90

← UNMERCERISED CONTROLS →

Table 2

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA
REF 1006

Sample no.	1 21/1	2 25/1	3 22/1	4 27/1	5 29/1
Length shrinkage (1x)	11.66	14.38	15.41	16.59	15.74
Width shrinkage (1x)	8.98	11.50	14.28	11.90	12.16
Length shrinkage (5x)	13.36	17.33	18.50	19.27	19.27
Width shrinkage (5x)	9.64	10.21	12.55	10.99	10.75
Weight (gsm)BW	120.54	130.64	126.07	127.64	124.15
Weight (gsm)AW	153.87	172.45	172.15	169.66	167.96
Courses per 3cm BW	52.10	47.70	47.60	46.20	46.00
Courses per 3cm AW	58.80	57.20	56.70	56.40	55.80
Wales per 3cm BW	40.60	46.90	45.70	45.80	47.20
Wales per 3cm AW	45.00	51.80	51.50	51.60	52.00
Stitch length (mm) BW	2.84	2.70	2.70	2.71	2.72
Stitch length (mm) AW	2.82	2.70	2.70	2.71	2.71
Burst strength BW	498.60	584.50	579.20	593.10	596.20
Burst strength AW	481.60	611.00	616.20	585.40	596.60
Distension at burst, mm. BW	16.47	14.25	14.57	14.65	14.65
Distension at burst, mm. AW	20.25	20.60	20.64	20.15	20.25
Angle of Spirality, BW	5.95	1.05	2.15	2.47	1.67
Angle of Spirality, AW	9.73	5.92	5.84	5.04	4.98
Width BW (tubular)	86.93	74.37	76.73	75.40	75.30
Yarn strength, BW	211.80	296.45	283.35	296.64	276.73
Yarn strength, AW	228.59	271.19	271.52	269.32	259.41
Yarn extension at break, BW	7.64	9.09	8.43	9.64	7.76
Yarn extension at break, AW	7.74	9.31	9.15	8.56	7.94
Yarn count (tex), BW	18.70	19.76	19.89	20.14	19.72
Yarn count (tex), AW	19.26	20.26	20.06	20.18	20.15
Thickness, BW	510.70	488.10	468.90	469.20	475.00
Thickness, AW	804.00	807.10	805.50	805.60	810.60
CIGAR SIZE					
1	UNHERC CONTROL	124	STOP	132	140
2		120		120	120

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA
REF 1006

Sample no.	6 23/1	7 28/1	8 24/1	9 30/1	10 26/1
Length shrinkage (1x)	15.54	15.41	14.80	16.21	16.30
Width shrinkage (1x)	13.55	12.72	13.80	12.67	12.84
Length shrinkage (5x)	18.39	19.33	18.39	19.78	19.31
Width shrinkage (5x)	12.48	11.00	12.35	11.29	11.57
Weight (gsm)BW	125.04	122.71	128.52	123.64	121.65
Weight (gsm)AW	173.05	169.81	173.38	168.63	168.89
Courses per 3cm BW	47.30	46.40	47.10	44.90	46.00
Courses per 3cm AW	57.30	56.90	56.70	55.20	55.40
Wales per 3cm BW	45.00	45.90	46.00	46.50	46.20
Wales per 3cm AW	51.70	51.60	52.00	51.90	52.10
Stitch length (mm) BW	2.69	2.72	2.69	2.73	2.73
Stitch length (mm) AW	2.69	2.73	2.69	2.73	2.72
Burst strength BW	601.00	578.10	608.50	609.30	577.30
Burst strength AW	631.80	611.90	637.10	630.70	642.40
Distension at burst, mm. BW	14.46	14.22	14.97	14.79	14.22
Distension at burst, mm. AW	20.55	20.58	20.15	20.08	20.11
Angle of Spirality, BW	1.80	2.42	2.62	1.57	2.55
Angle of Spirality, AW	5.29	5.48	5.00	4.79	6.16
Width BW (tubular)	76.80	75.07	76.27	75.40	76.10
Yarn strength, BW	281.75	293.96	294.99	280.89	284.89
Yarn strength, AW	263.91	266.92	274.12	261.89	261.81
Yarn extension at break, BW	8.92	7.96	8.99	8.12	8.49
Yarn extension at break, AW	8.47	8.26	8.46	7.90	7.89
Yarn count (tex), BW	19.98	19.77	19.94	19.90	19.71
Yarn count (tex), AW	20.10	19.88	20.40	19.83	19.75
Thickness, BW	473.60	471.40	489.10	478.10	462.20
Thickness, AW	813.40	815.00	809.20	802.10	806.70
CIGAR SIZE					
1	116	140	124	148	132
2	120	120	120	120	120

Table 2 (cont.)

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA
REF 1007

Sample no.	11 23/2	12 25/2	13 21/2	14 30/2	15 28/2
Length shrinkage (1x)	13.17	13.32	10.24	14.12	13.93
Width shrinkage (1x)	11.94	10.76	9.06	12.39	10.82
Length shrinkage (5x)	17.00	17.04	11.52	18.26	18.39
Width shrinkage (5x)	11.76	10.56	9.87	12.61	10.66
Weight (gsm)BW	128.03	129.04	123.02	122.51	124.29
Weight (gsm)AW	174.21	172.61	153.37	167.61	169.70
Courses per 3cm BW	47.10	47.40	52.10	44.40	45.90
Courses per 3cm AW	52.90	54.80	57.50	54.60	55.90
Wales per 3cm BW	44.40	44.90	40.20	45.00	46.20
Wales per 3cm AW	50.50	50.60	44.40	51.50	51.60
Stitch length (mm) BW	2.72	2.75	2.84	2.75	2.75
Stitch length (mm) AW	2.72	2.71	2.87	2.77	2.76
Burst strength BW	623.90	616.10	476.40	617.20	621.70
Burst strength AW	591.60	591.60	473.30	563.20	625.10
Distension at burst, mm. BW	15.08	15.61	17.35	14.60	14.69
Distension at burst, mm. AW	21.04	21.71	20.88	22.30	21.91
Angle of Spirality, BW	3.03	3.93	7.51	2.51	3.49
Angle of Spirality, AW	5.00	7.09	10.17	6.73	4.93
Width BW (tubular)	76.10	75.27	86.90	75.67	75.23
Yarn strength, BW	287.21	268.65	210.00	269.95	300.73
Yarn strength, AW	269.04	271.63	220.28	258.57	261.63
Yarn extension at break, BW	8.17	7.18	6.19	7.33	7.51
Yarn extension at break, AW	7.57	7.55	6.41	6.60	6.93
Yarn count (tex), BW	19.71	19.72	18.65	19.40	19.36
Yarn count (tex), AW	19.94	19.96	19.07	19.60	19.61
Thickness, BW	492.20	470.90	511.50	463.40	455.10
Thickness, AW	793.30	775.90	799.20	803.00	789.20
CIGAR SIZE					
1	116	124	CONTROL	148	140
2	120	120		120	120

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA
REF. 1007

Sample no.	16 22/2	17 29/2	18 26/2	19 24/2	20 27/2
Length shrinkage (1x)	13.38	14.58	14.46	13.09	14.05
Width shrinkage (1x)	12.27	11.01	11.87	12.55	11.43
Length shrinkage (5x)	17.20	18.70	17.65	15.45	17.86
Width shrinkage (5x)	12.12	10.68	11.61	12.30	11.00
Weight (gsm)BW	128.10	122.32	125.49	126.38	126.49
Weight (gsm)AW	172.87	170.00	169.05	172.78	170.87
Courses per 3cm BW	47.50	45.50	45.20	46.60	45.30
Courses per 3cm AW	57.70	54.70	54.80	56.10	55.30
Wales per 3cm BW	44.90	46.90	45.00	44.00	44.90
Wales per 3cm AW	51.60	51.80	50.70	51.20	51.60
Stitch length (mm) BW	2.71	2.75	2.73	2.71	2.73
Stitch length (mm) AW	2.72	2.73	2.75	2.72	2.73
Burst strength BW	563.60	592.60	571.10	600.30	614.50
Burst strength AW	632.20	615.20	586.60	609.30	602.80
Distension at burst, mm. BW	15.62	15.25	15.56	14.88	16.24
Distension at burst, mm. AW	21.40	21.19	21.04	21.81	21.34
Angle of Spirality, BW	2.68	3.70	2.76	3.10	2.78
Angle of Spirality, AW	3.98	4.80	4.22	5.24	7.10
Width BW (tubular)	76.23	74.60	75.60	76.60	75.53
Yarn strength, BW	269.68	282.39	280.61	280.60	274.12
Yarn strength, AW	261.83	261.25	258.41	274.64	262.93
Yarn extension at break, BW	7.69	7.05	6.78	7.57	6.98
Yarn extension at break, AW	7.62	6.95	7.06	7.48	7.39
Yarn count (tex), BW	19.83	19.20	19.75	19.87	19.77
Yarn count (tex), AW	19.77	19.85	20.20	19.81	19.89
Thickness, BW	467.80	449.60	453.80	458.30	471.70
Thickness, AW	802.00	778.10	787.50	784.80	801.10
CIGAR SIZE					
1.	116	140	132	124	132
2.	120	120	120	120	120

Table 2 (cont.)

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA

REF 1008

Sample no.	21 24/3	22 27/3	23 30/3	24 21/3	25 26/3
Length shrinkage (1x)	13.65	14.02	14.60	12.00	14.63
Width shrinkage (1x)	11.16	10.23	10.85	9.16	10.38
Length shrinkage (5x)	17.49	18.15	18.68	13.82	18.45
Width shrinkage (5x)	10.97	10.29	10.80	10.26	10.84
Weight (gsm)BW	124.70	127.78	122.53	121.73	126.00
Weight (gsm)AW	173.49	171.62	168.55	154.32	170.17
Courses per 3cm BW	47.20	46.50	45.50	51.10	46.90
Courses per 3cm AW	56.40	56.70	54.80	58.90	56.00
Wales per 3cm BW	46.00	46.60	46.30	39.80	46.10
Wales per 3cm AW	51.90	51.20	52.00	44.60	51.55
Stitch length (mm) BW	2.72	2.63	2.74	2.72	2.69
Stitch length (mm) AW	2.63	2.69	2.69	2.83	2.65
Burst strength BW	657.30	622.60	594.40	475.00	623.70
Burst strength AW	617.20	635.70	622.00	472.80	633.70
Distension at burst, mm. BW	15.65	15.03	14.54	16.32	14.74
Distension at burst, mm. AW	20.33	20.20	20.48	20.50	20.82
Angle of Spirality, BW	5.40	4.92	6.82	9.18	5.70
Angle of Spirality, AW	7.68	7.70	8.50	11.76	8.88
Width BW (tubular)	76.67	75.97	76.18	88.50	76.67
Yarn strength, BW	300.16	288.19	278.17	215.21	281.40
Yarn strength, AW	262.23	266.24	273.08	211.81	264.92
Yarn extension at break, BW	8.86	8.64	8.09	7.53	8.80
Yarn extension at break, AW	8.09	7.64	7.36	6.84	7.66
Yarn count (tex), BW	20.22	19.70	19.75	18.57	19.66
Yarn count (tex), AW	20.49	20.31	19.77	19.09	20.08
Thickness, BW	448.80	448.60	440.40	465.40	442.00
Thickness, AW	779.36	776.90	763.90	771.30	775.60
CIGAR SIZE					
1	124	STOP	148	CONTROL	132
2	120	120	120	120	120

TEBE TRIAL FINISHED SINGLE JERSEY - TEST DATA

REF 1008

Sample no.	26 28/3	27 22/3	28 29/3	29 25/3	30 23/3
Length shrinkage (1x)	14.29	13.31	14.61	14.51	14.07
Width shrinkage (1x)	10.57	13.68	12.17	11.06	12.15
Length shrinkage (5x)	17.93	17.21	18.92	18.02	18.01
Width shrinkage (5x)	10.44	13.83	11.93	11.23	12.30
Weight (gsm)BW	124.77	127.45	126.08	126.75	126.99
Weight (gsm)AW	168.64	172.18	169.03	170.53	172.83
Courses per 3cm BW	46.00	48.20	45.90	46.60	47.80
Courses per 3cm AW	55.50	57.50	55.70	55.90	56.90
Wales per 3cm BW	45.60	44.80	46.30	45.20	45.70
Wales per 3cm AW	51.30	51.70	51.90	50.50	51.80
Stitch length (mm) BW	2.62	2.61	2.64	2.59	2.68
Stitch length (mm) AW	2.70	2.62	2.67	2.70	2.63
Burst strength BW	606.70	631.20	608.00	611.10	601.90
Burst strength AW	620.30	626.20	643.60	634.00	637.10
Distension at burst, mm. BW	16.89	16.19	15.35	14.80	15.34
Distension at burst, mm. AW	20.12	20.25	20.37	20.70	21.45
Angle of Spirality, BW	4.04	3.96	4.04	4.96	4.10
Angle of Spirality, AW	7.30	6.66	7.20	8.00	7.80
Width BW (tubular)	75.70	77.37	75.53	76.50	77.00
Yarn strength, BW	281.83	271.47	267.17	269.49	285.55
Yarn strength, AW	272.57	272.37	257.91	268.03	249.32
Yarn extension at break, BW	8.25	8.34	7.69	7.94	8.44
Yarn extension at break, AW	7.83	8.17	7.40	8.07	7.78
Yarn count (tex), BW	20.25	20.17	20.00	19.99	20.14
Yarn count (tex), AW	20.26	20.08	20.01	20.09	19.98
Thickness, BW	434.60	452.40	441.00	426.00	439.30
Thickness, AW	793.50	791.50	799.20	794.60	813.80
CIGAR SIZE					
1	140	116	STOP	STOP	STOP
2.	120	120			

Figure 1

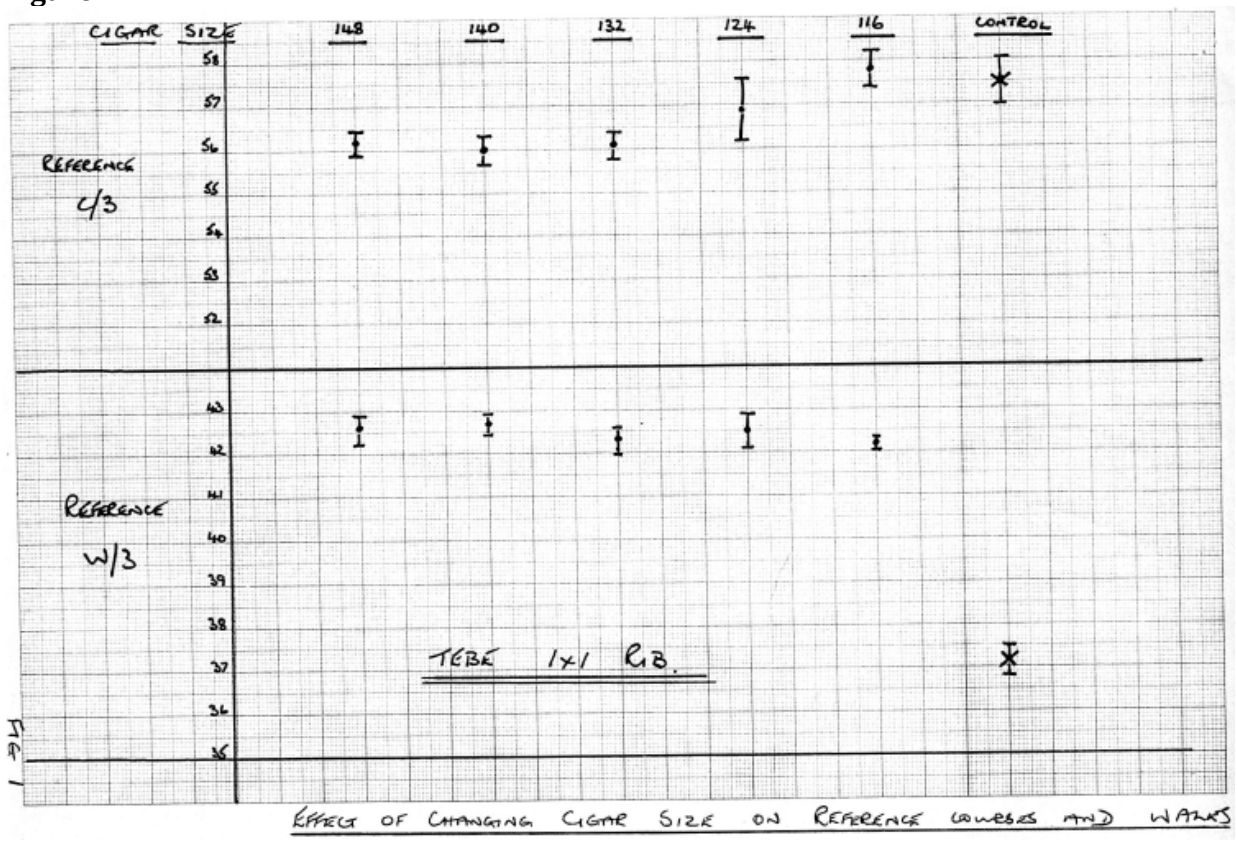


Figure 2

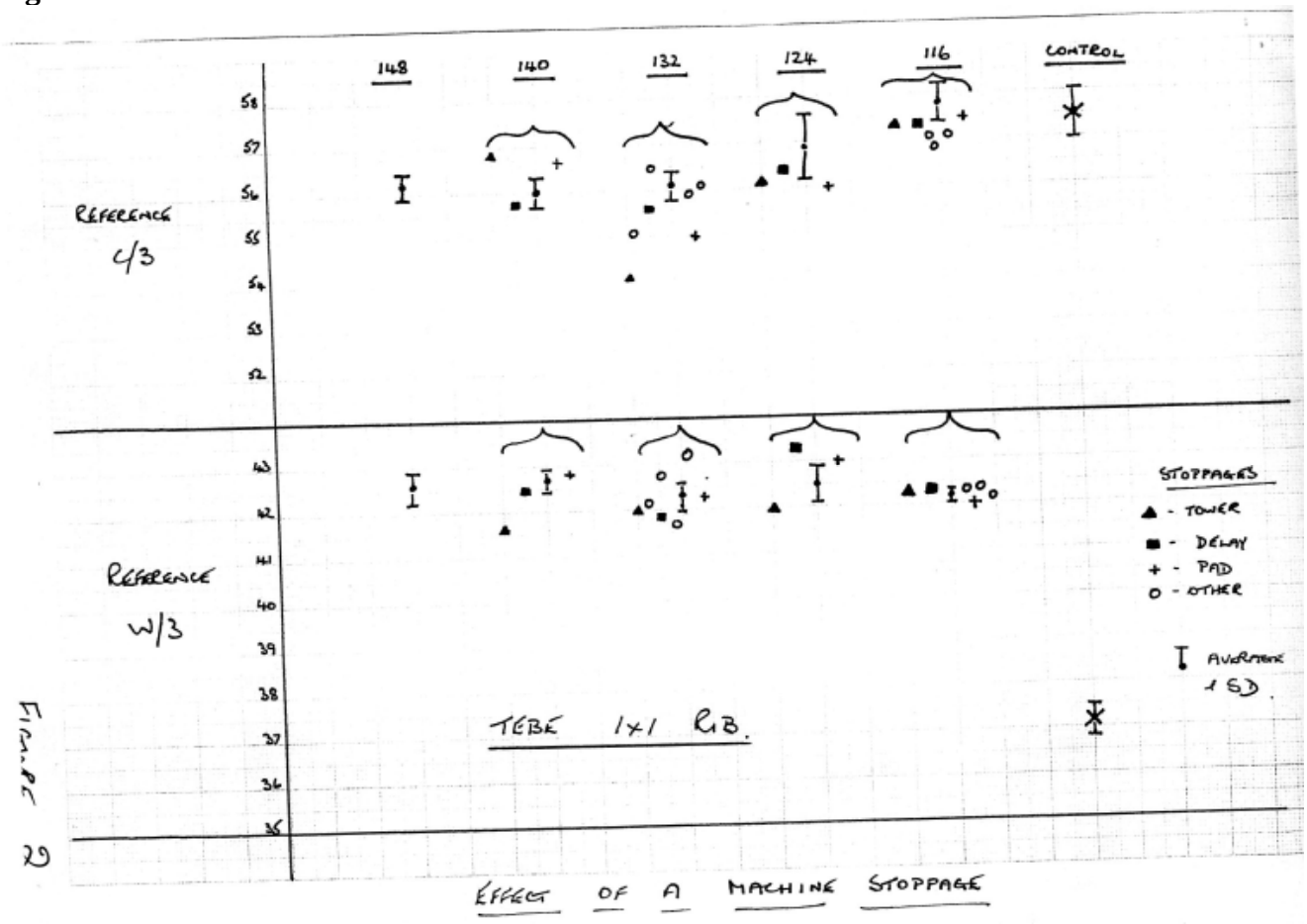


Figure 3

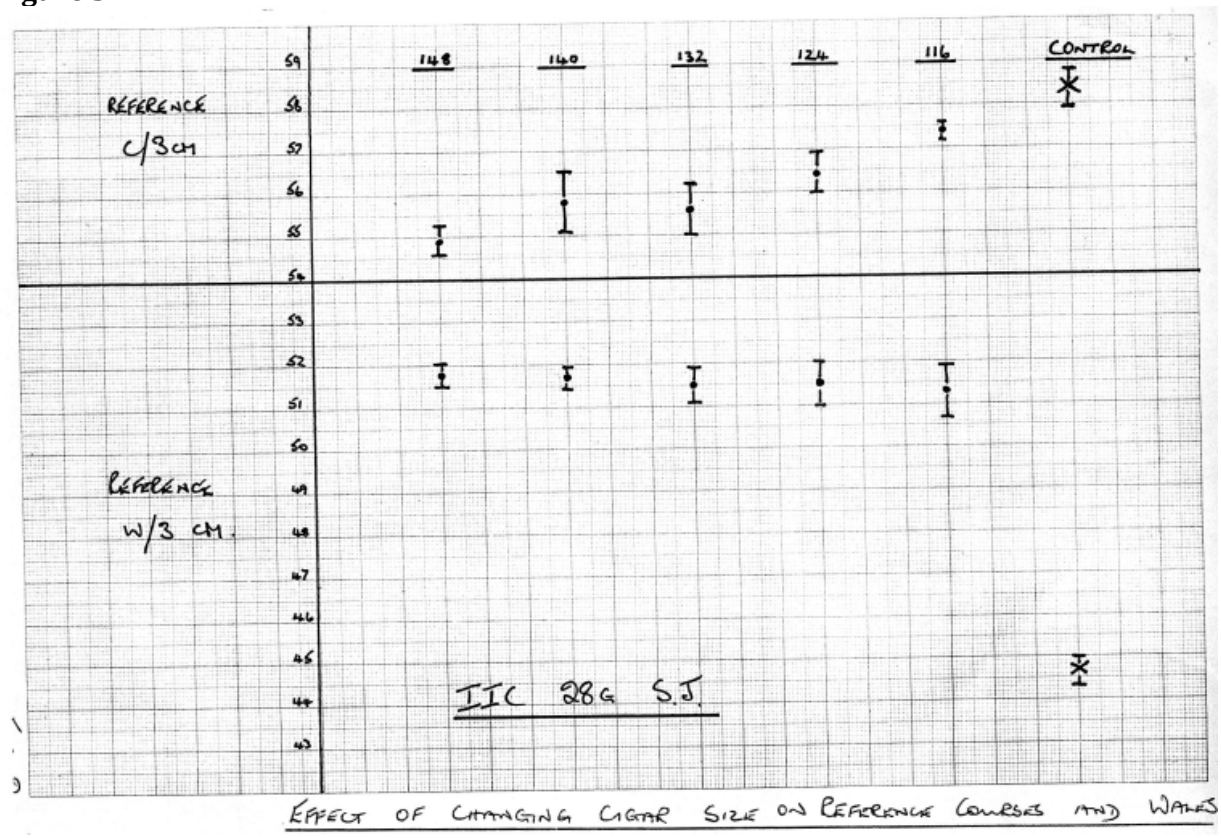
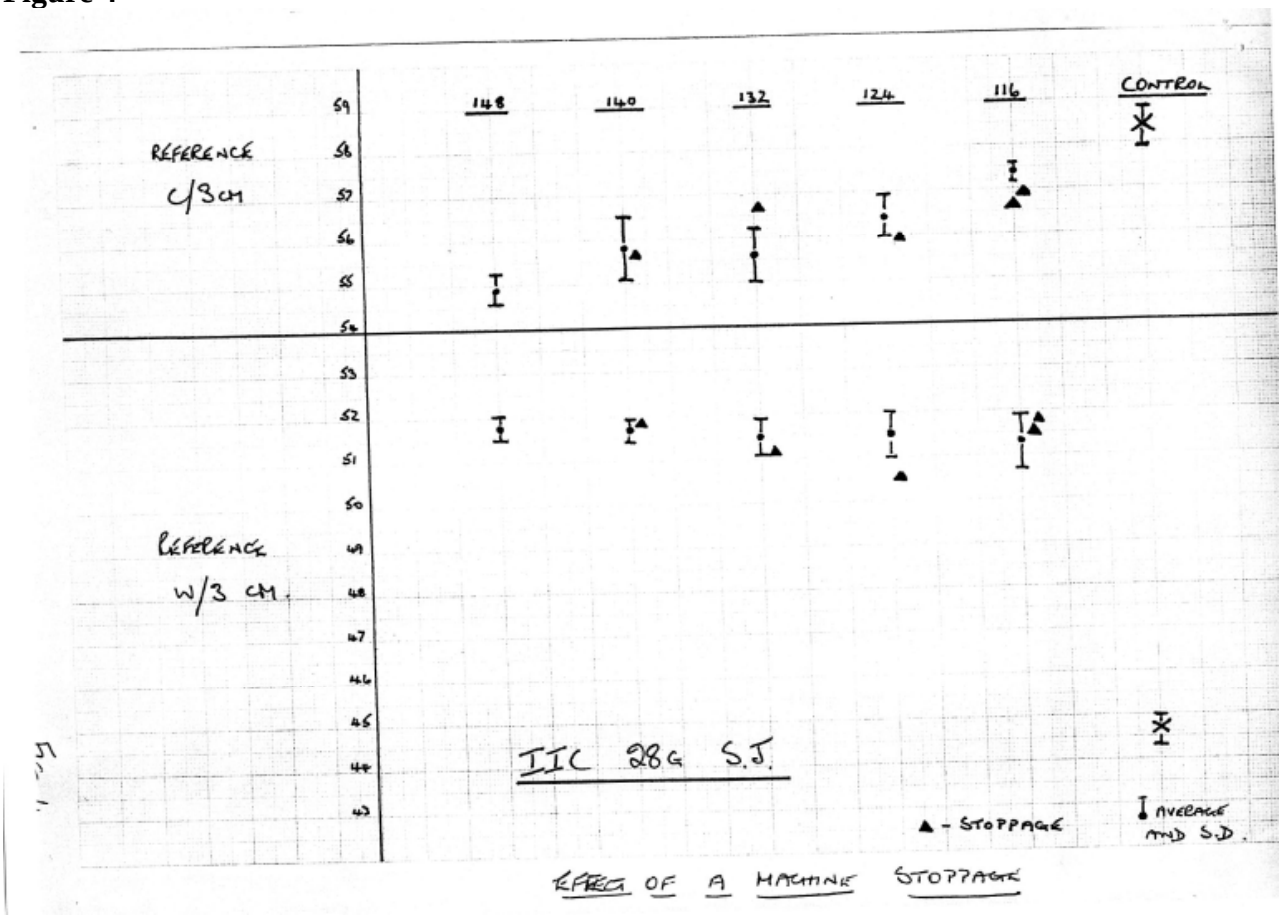


Figure 4



Research Record No: 173 (Second Supplementary)

The Processing Of Knitted Fabrics On A Dornier Mercerising Machine
Analysis Of The Fabrics Processed At Empresa Textil De Barcelos Sarl (Tebe)
Parcelos, Portugal
11 - 15th July 1983

1. Introduction

Research Record No.173 and its supplementary report describes the processing and the analysis of the single jersey and 1x1 rib fabrics which were treated during the preliminary visit to Tebe to evaluate the Dornier merceriser.

In these reports the point was made that the IIC 14 gauge 1x1 rib fabrics which had been shipped to Portugal from the UK were rather too narrow for the cigars which are used at Tebe. Nevertheless an attempt was made to mercerise five of the pieces even though the fabric was subjected to excessive levels of tension. These high levels of tension eventually created mechanical problems on the machine, with the drive chain at the base of No.1 wash tower repeatedly jumping off the sprocket. Some of the fabric therefore was subjected to long delay times on the merceriser itself and the intermittent operation made the treatment somewhat suspect and unrepresentative.

These fabrics were not immediately tested and the results not used when evaluating the effect of the merceriser on fabric structure.

In recent months and when testing capacity existed, these fabrics have been evaluated and this brief supplementary report attempts to try to determine whether any useful information can be derived from the treatment even though it was very irregular.

2. Coding

The main report describes how the fabrics were marked into thirds so that the part of the fabric piece stopped on a particular part of the machine can be easily identified.

Out of the planned five pieces for mercerising, only $3^{1}/_{3}$ pieces were eventually treated and these are coded as follows:

17/3 18/1 18/2 18/3 19/1 19/2 19/3 20/1 20/2 20/3

The remaining $1^{2}/_{3}$ pieces were added to the five control pieces which were dyed and used in an evaluation of wet spreading which is also described in the main report. The evaluation of the wet spread fabrics established that there was no change in the fabric *Reference State* which could be attributed to the wet spreading operation and therefore the results from these fabrics can be used as a basis for evaluating the IIC rib fabrics which did in fact get mercerised.

3. Evaluation

To determine the permanent change in fabric dimensions brought about by mercerising it is necessary to compare the courses /3cm and wales /3cm of the mercerized and control fabrics in the after-wash (AW) or relaxed state (*Reference State*). The full test figures of the mercerised and unmercerised controls are given in the Appendix. From these, the average courses /3cm and wales /3cm of the control fabrics and the standard deviations were determined.

The fabric which passed through the merceriser without stoppage has been designated by the letters "OK".

Figure 1 shows the relaxed courses /3cm of all the mercerised fabrics including those which were stopped for varying periods. The average and standard deviation of the "OK" samples were determined and these as well as those for the control fabrics are also indicated. *Figure 2* treats the wales /3cm similarly.

4. Observations

Courses /3cm

The mean courses /3cm of the "OK" samples is 48.3 with a standard deviation of only 0.22.

The mean courses /3cm of the unmercerised fabrics is 54.2 with a standard deviation of 0.75.

From these, the permanent change in fabric length is given by:

$$100\ (54.2 - 48.3) / 48.3 \quad = \quad +12.2\%\ \text{(extension)}$$

The fabric which was stopped on the merceriser during the mechanical troubles exhibits a higher variability in terms of the *Reference* courses /3cm.

Wales /3cm

The mean wales /3cm of the "OK" samples is 38.8 with a standard deviation of 0.33.

The mean wales /3cm of the control samples is 33.1 with a standard deviation of only 0.40.

From these the permanent change in fabric width is given by:

$$100\ (33.1 - 38.8) / 38.8 \quad = \quad -14.7\%\ \text{(reduction)}$$

The samples which were stopped on the merceriser during the mechanical troubles do not appear to exhibit higher variability in terms of *Reference* wales /3cm than the mercerised "OK" samples.

5. Conclusions

If the permanent changes in fabric structure brought about by mercerising of the IIC 1x1 rib fabric are compared with those found on the Tebe 1x1 rib and IIC single jersey fabrics, the picture is as follows.

	Length, %	**Width, %**
IIC single jersey	+ 5.4	- 13.1
Tebe 1x1 rib	+ 2.3	- 12.5
IIC 1x1 rib	+ 12.2	- 14.7

It is clear that the very high tensions conferred on the IIC rib fabric has resulted in greater changes to the fabric structure. These changes are more apparent in the fabric length. This confirms the conclusions already established, that on the Dornier merceriser changing the size of the cigars has only a slight effect on the fabric width but can have a pronounced effect on fabric length.

Figure 1

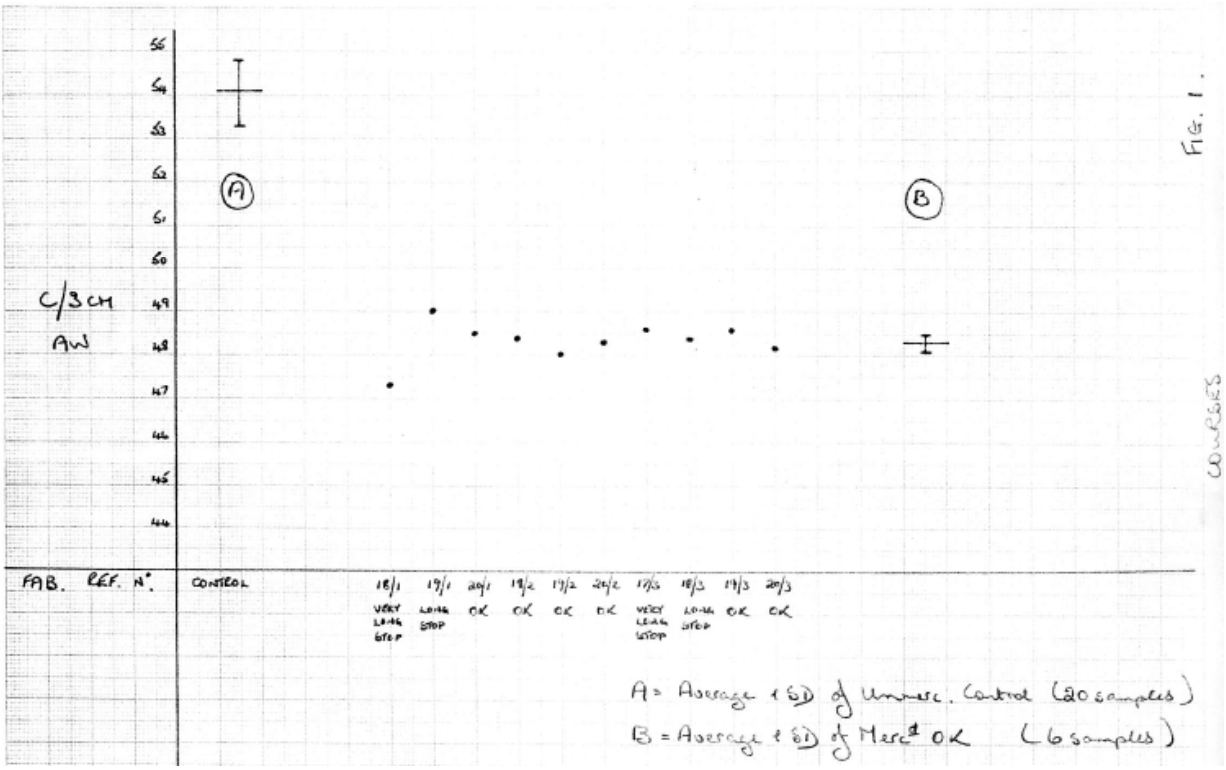
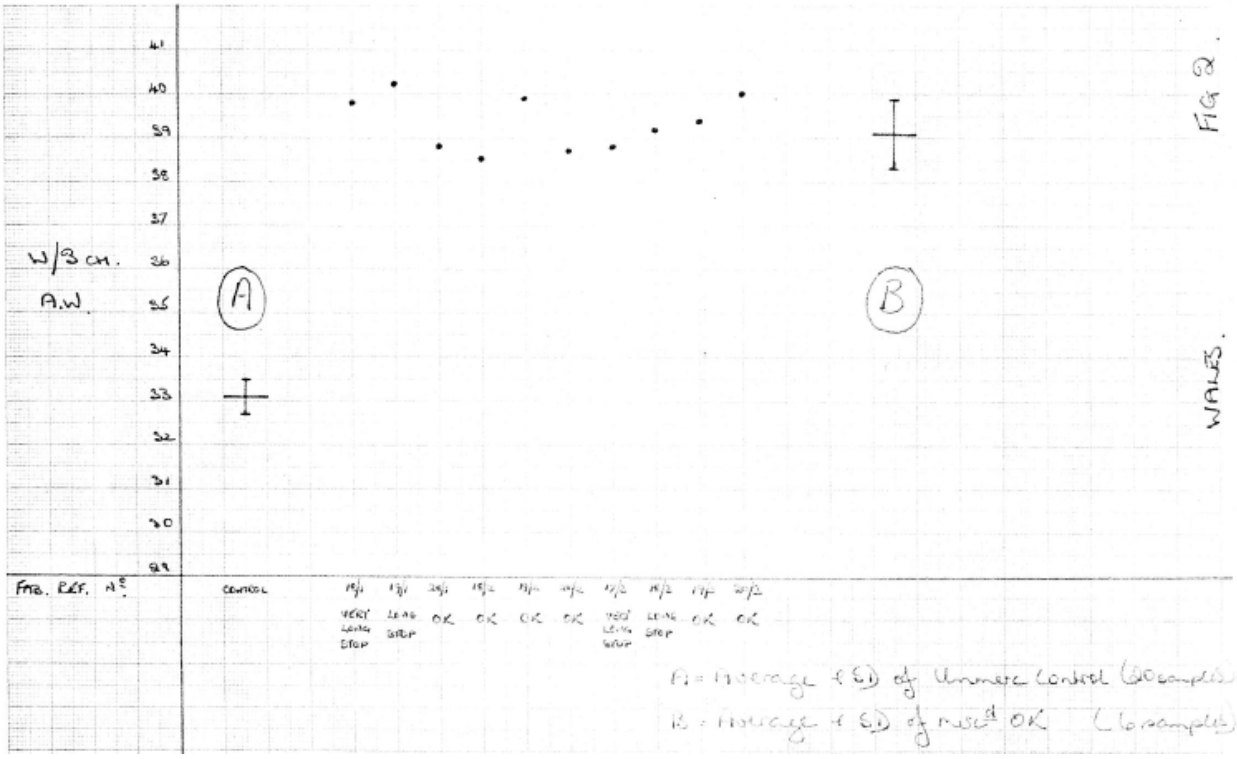


Figure 2



TEBE TRIAL
FINISHED 1x1 RIB

UNMERCERISED CONTROLS | MERCERISED 18/1 19/1 20/1

Sample no.	31	32	33	34	35	36	37	38	39	40
Length shrinkage (1x)	12.27	12.79	12.45	10.60	11.51	12.12	12.74	15.22	15.73	16.20
Width shrinkage (1x)	10.74	9.62	8.71	8.50	9.04	8.47	8.52	7.07	17.47	16.03
Length shrinkage (5x)	13.98	14.74	14.83	12.55	13.42	13.78	14.77	18.81	20.16	19.13
Width shrinkage (5x)	11.70	11.17	9.75	9.20	10.47	10.83	10.28	16.68	17.18	15.70
Weight (gsm)BW	177.25	167.93	172.14	180.66	172.77	177.59	170.85	66.61	160.63	165.93
Weight (gsm)AW	228.81	215.01	215.51	216.70	218.52	226.53	222.78	239.15	241.10	237.55
Courses per 3cm BW	47.50	45.20	46.30	47.40	46.00	47.30	46.50	38.60	39.00	39.70
Courses per 3cm AW	54.70	53.70	54.10	53.90	53.80	54.40	54.00	47.40	49.00	48.50
Wales per 3cm BW	28.40	29.50	29.60	28.90	29.40	29.90	29.70	33.90	33.30	32.90
Wales per 3cm AW	32.70	32.80	33.30	33.00	33.40	33.20	33.80	39.80	40.20	38.80
Stitch length (mm) BW	2.85	2.88	2.88	2.87	2.88	2.83	2.82	2.81	2.77	2.79
Stitch length (mm) AW	2.83	2.86	2.87	2.87	2.87	2.83	2.82	2.80	2.77	2.79
Burst strength BW	513.80	536.50	505.00	514.10	561.50	521.90	518.20	637.90	633.50	646.70
Burst strength AW	501.00	507.60	442.40	454.30	503.10	471.50	485.60	674.80	638.50	636.00
Distension at burst, mm. BW	20.31	19.62	19.35	20.02	20.00	19.21	19.03	13.72	13.45	14.40
Distension at burst, mm. AW	22.42	22.18	22.22	22.46	22.86	22.59	22.01	20.46	20.59	20.78
Angle of Spirality, BW	3.51	1.56	3.69	3.36	4.19	1.81	-2.68	-4.87	-2.84	-2.80
Angle of Spirality, AW	-0.33	-0.16	-0.32	0.64	0.45	-0.28	-0.06	-1.74	-1.91	0.25
Width BW (tubular)	54.70	54.80	54.27	53.83	54.90	54.90	53.20	47.87	48.17	48.73
Yarn strength, BW	199.73	202.40	179.92	178.60	223.64	193.69	178.15	232.44	237.71	255.59
Yarn strength, AW	210.83	199.48	176.61	189.51	206.60	176.27	174.27	237.49	230.91	247.12
Yarn extension at break, BW	6.66	7.15	6.20	5.99	7.46	6.53	6.08	7.45	6.05	6.19
Yarn extension at break, AW	7.47	7.25	6.57	6.81	7.28	6.50	6.26	6.40	6.28	7.06
Yarn count (tex), BW	19.96	19.63	19.57	19.62	19.34	19.82	19.44	20.80	20.23	20.82
Yarn count (tex), AW	20.46	21.00	19.98	20.24	20.07	20.66	19.85	21.05	20.49	21.17
Thickness, BW	749.80	717.50	784.40	785.30	742.30	754.80	786.10	632.00	641.00	648.40
Thickness, AW	1109.90	1117.10	1129.50	1125.70	1110.50	1109.20	1125.00	007.90	1011.70	1000.80

DATA CHECKS

Calc/Obs Wt BW	0.96	1.00	1.00	0.95	0.97	0.99	0.98	1.02	1.01	1.02
Calc/Obs Wt AW	1.00	1.09	1.07	1.06	1.05	1.04	1.02	1.03	1.03	1.04
Calc/Obs Courses/3cm AW	1.01	0.99	1.00	1.01	0.99	1.01	1.01	1.00	1.00	1.01
Calc/Obs Wales/3cm AW	0.98	1.01	0.98	0.96	0.98	1.01	0.98	1.02	1.00	1.01

TEBE TRIAL
FINISHED 1x1 RIB

UNMERCERISED CONTROLS | MERCERISED 18/2 19/2 20/2

Sample no.	41	42	43	44	45	46	47	48	49	50
Length shrinkage (1x)	12.48	11.25	13.47	12.35	14.35	11.77	11.91	15.79	15.85	15.98
Width shrinkage (1x)	10.69	10.72	10.02	11.99	9.30	9.14	11.25	15.94	17.58	14.63
Length shrinkage (5x)	14.02	12.66	15.09	13.83	16.05	13.29	13.11	19.82	19.89	18.95
Width shrinkage (5x)	10.49	10.79	10.18	13.45	9.54	10.04	11.76	15.02	17.45	14.08
Weight (gsm)BW	172.92	174.35	173.69	179.90	178.26	177.82	177.52	160.11	160.17	165.48
Weight (gsm)AW	218.15	218.93	217.51	226.53	220.87	222.09	228.78	241.68	237.54	241.10
Courses per 3cm BW	47.00	47.90	46.00	48.40	45.20	48.70	47.90	38.80	38.90	38.80
Courses per 3cm AW	53.80	54.20	53.70	55.00	53.60	55.60	54.90	48.40	48.00	48.30
Wales per 3cm BW	28.70	28.80	28.70	28.80	30.00	29.30	29.20	32.60	32.80	33.70
Wales per 3cm AW	32.80	32.60	32.80	33.40	33.50	33.40	33.50	38.50	39.90	38.70
Stitch length (mm) BW	2.87	2.87	2.87	2.83	2.87	2.81	2.83	2.80	2.78	2.81
Stitch length (mm) AW	2.86	2.86	2.85	2.82	2.86	2.80	2.81	2.79	2.76	2.79
Burst strength BW	458.50	470.30	509.90	484.50	531.60	490.00	473.80	619.00	632.30	661.50
Burst strength AW	463.30	462.40	498.10	465.20	501.10	498.30	469.30	635.40	642.20	633.20
Distension at burst, mm. BW	19.16	19.67	18.99	19.60	19.46	18.89	19.33	14.18	13.94	14.84
Distension at burst, mm. AW	22.36	21.93	22.32	22.05	22.32	22.54	22.08	20.57	20.57	20.73
Angle of Spirality, BW	3.25	1.96	1.79	3.13	4.05	1.96	-2.00	-1.97	-3.23	-3.25
Angle of Spirality, AW	1.95	0.71	1.36	0.82	1.19	1.24	1.60	-0.04	0.85	-1.59
Width BW (tubular)	55.60	54.20	54.33	54.67	53.33	53.50	54.63	48.53	48.00	48.10
Yarn strength, BW	201.85	198.87	214.81	194.57	205.60	187.89	185.64	250.41	251.81	272.32
Yarn strength, AW	188.56	196.37	212.95	199.03	210.87	195.07	201.75	250.12	233.75	249.87
Yarn extension at break, BW	7.37	7.61	7.73	6.99	7.26	6.53	6.32	6.02	6.28	6.73
Yarn extension at break, AW	6.59	6.72	7.04	6.55	7.00	6.59	6.56	7.10	6.24	6.76
Yarn count (tex), BW	19.75	20.03	19.84	20.34	20.19	19.87	20.21	20.92	20.19	20.71
Yarn count (tex), AW	19.88	19.89	19.90	20.50	20.02	20.00	20.34	20.94	20.38	20.82
Thickness, BW	741.30	763.90	722.20	744.20	719.30	745.60	737.40	654.80	632.30	670.30
Thickness, AW	1063.60	1066.70	1052.60	1072.60	1059.70	1058.20	1053.80	1028.90	1029.60	1029.30

DATA CHECKS

Calc/Obs Wt BW	0.98	1.01	0.96	0.99	1.03	1.00	1.00	1.03	0.99	1.02
Calc/Obs Wt AW	1.02	1.02	1.02	1.04	1.03	1.04	1.02	1.00	1.01	1.00
Calc/Obs Courses/3cm AW	1.02	1.01	1.01	1.02	1.00	1.01	1.00	1.00	1.01	0.99
Calc/Obs Wales/3cm AW	0.98	0.99	0.97	1.00	0.99	0.98	0.99	1.00	1.00	1.01

TEBE TRIAL
FINISHED 1x1 RIB

UNMERCERISED CONTROLS | MERCERISED 17/3 18/3 19/3 20/3

Sample no.	51	52	53	54	55	56	57	58	59	60
Length shrinkage (1x)	12.15	11.54	9.51	9.53	10.86	10.71	16.74	16.16	17.29	15.73
Width shrinkage (1x)	9.28	9.83	10.08	9.74	11.76	11.05	14.12	17.52	15.46	17.60
Length shrinkage (5x)	15.07	13.91	11.79	11.49	12.95	12.88	19.99	20.29	20.75	19.42
Width shrinkage (5x)	9.57	11.28	11.77	10.86	13.04	12.21	13.76	17.22	14.93	17.71
Weight (gsm)BW	172.55	170.69	177.80	184.19	179.81	177.87	65.69	161.10	159.94	157.97
Weight (gsm)AW	218.56	218.99	221.06	219.21	228.16	226.89	239.68	239.28	239.38	238.55
Courses per 3cm BW	45.30	48.10	50.20	49.30	49.60	49.70	38.90	37.90	38.40	39.40
Courses per 3cm AW	53.60	52.80	55.00	52.60	54.10	55.00	48.60	48.40	48.60	48.20
Wales per 3cm BW	30.93	30.40	29.70	29.50	29.60	29.90	33.50	32.70	33.00	32.70
Wales per 3cm AW	33.30	33.70	32.50	32.80	32.50	33.40	38.80	39.20	39.40	40.00
Stitch length (mm) BW	2.85	2.86	2.80	2.85	2.82	2.80	2.79	2.80	2.81	2.77
Stitch length (mm) AW	2.88	2.83	2.76	2.79	2.75	2.74	2.78	2.78	2.81	2.76
Burst strength BW	495.30	476.50	478.10	476.60	477.30	489.70	666.40	620.40	655.30	639.20
Burst strength AW	544.40	481.80	468.40	460.50	479.80	498.30	623.60	651.70	632.90	627.20
Distension at burst, mm. BW	18.57	19.42	19.63	18.73	19.89	18.78	14.26	13.19	12.82	13.72
Distension at burst, mm. AW	22.07	21.67	22.05	20.94	21.51	21.63	20.11	20.26	20.44	20.21
Angle of Spirality, BW	0.18	-0.68	1.68	1.54	-0.46	-0.48	-6.48	1.30	-2.98	-2.68
Angle of Spirality, AW	0.42	0.42	0.16	-0.06	0.20	0.18	-1.81	1.56	0.13	-1.10
Width BW (tubular)	53.53	55.63	54.20	54.53	55.67	55.20	47.33	48.23	48.55	48.17
Yarn strength, BW	223.13	201.01	189.59	197.24	200.96	201.80	264.85	277.95	259.29	253.77
Yarn strength, AW	212.16	195.27	185.92	200.01	202.69	201.56	245.84	243.84	252.55	242.21
Yarn extension at break, BW	8.03	7.68	7.05	7.50	7.40	7.64	6.55	7.43	5.77	6.94
Yarn extension at break, AW	7.21	6.90	6.32	6.72	6.51	6.49	6.54	6.72	7.30	6.48
Yarn count (tex), BW	20.02	20.48	20.12	20.12	20.73	20.38	20.90	20.75	20.79	20.61
Yarn count (tex), AW	19.95	19.84	20.29	19.88	20.75	20.52	20.79	20.87	20.59	20.35
Thickness, BW	736.40	760.50	772.00	805.70	737.40	755.40	663.30	632.70	634.40	623.50
Thickness, AW	1102.40	1114.80	1144.00	1133.20	1135.60	1137.60	1014.70	1008.90	1013.30	995.40
DATA CHECKS										
Calc/Obs Wt BW	1.03	1.12	1.05	1.01	1.06	1.06	1.02	0.99	1.03	1.04
Calc/Obs Wt AW	1.04	1.01	1.01	0.97	0.98	1.01	1.01	1.02	1.03	1.01
Calc/Obs Courses/3cm AW	1.00	1.06	1.03	1.06	1.05	1.04	1.00	0.98	1.00	1.01
Calc/Obs Wales/3cm AW	1.03	1.02	1.04	1.01	1.05	1.02	1.00	1.01	0.98	0.99