



**International Institute For Cotton**  
**Technical Research Division**

**Research Record No. 128**

**Project CP78**  
**Piece Mercerisation Of Interlock And Rib Fabrics**  
**On The Omez "Mercelux" Machine**

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## 1. Introduction

As part of a joint project with Meridian Limited, Nottingham, to investigate methods for controlling stability in knitted fabrics, a series of interlock and rib fabrics has been processed on an Omez "Mercelux" Mark II tubular knitgoods mercerising range.

Details of the production of these fabrics, their constructions and physical properties, in the grey state and after relaxation, are given in *Research Record No. 83*. Briefly, the series includes a total of fifteen 20 gauge interlock constructions from three counts of singles yarns in five stitch lengths, and an similar range of 14 gauge 1 x 1 rib fabrics.

The finishing programme for these fabrics has included studies of continuous, winch and jet preparation, bleaching and dyeing. Piece mercerisation was also included in the programme, so that the influence of this treatment on fabric structure, stability, dyeing properties and subsequent response to crosslinking could be examined.

This report describes the machine used for the mercerisation treatment in Italy, fabric processing on this machine and subsequent washing and drying and the evaluation of the fabric at that stage.

After mercerisation and drying the fabrics were returned to the Meridian works for dyeing and finishing. These operations have already been described in *Research Record No. 94*. Further fabric evaluations were carried out after dyeing and after tubular finishing through a mechanical compacting machine.

In this report the effects of mercerisation are examined at three stages in the processing route, as follows.

1. After mercerising (compared to grey fabric).
2. After bleaching or dyeing.
3. After finishing.

A later report will describe the results of crosslinking treatments.

## 2. The Omez Mercelux Mark II Knitgoods Merceriser

Trials on the Mercelux Mark I machine were carried out in June 1977 and are described in *Research Record No. 86*.

Since then some modifications were carried out and the machine then corresponded to the Mark II design shown in *Figure 1*. Although at the time of these trials it was still installed at Tintoria Giuseppe Tosi, Busto Arsizio, it had been relocated in another finishing unit to be closer to the washing range.

The main modification has concerned the fabric passage through the wash tower which has been reversed in direction. The upwards movement of the fabric thus results in a counter-flow washing action, which has improved removal of caustic from the cloth.

The vertical two-bowl impregnation mangle has been replaced by a horizontal nip with slightly higher expression, and the final water spray and mangle have been removed. The delay section has also been slightly redesigned. A useful improvement has been to replace the manual adjustment of the stretcher frames in the impregnation and tower units by push-button electrical drives.

### 3. Fabric Constructions And Coding

Details of the fabric constructions and method of coding have been given in *Research Record No. 83*. In the mercerising trials, two 50-metre pieces of each of the interlock constructions (piece Nos. 5 and 6) and one 100-metre length of each rib (piece No. 3) were included. The rib pieces were later divided into two 50-metre lengths which were re-coded 31 and 32.

### 4. Preparation Of Fabrics For Processing

Before processing, samples of each of the fabric constructions were subjected to a laboratory relaxation treatment, described in *Figure 1a*. The results of fabric shrinkage measurements obtained by this treatment are described in *Research Record No. 102*. Measurements of wale spacings were also carried out on these relaxed fabrics and from a knowledge of the number of needles used in knitting the fabrics (1500 x 2 for the interlock, 1056 x 2 for the rib), the relaxed tubular fabric widths were calculated. The data for relaxed wales/3cm and calculated tubular width (in cm.) are given in *Table I*.

These data were used to arrange each series of fabrics in ascending order of width for processing.

Based on our earlier experience with the Omez mercerising range (*Research Record No. 86*), it was suggested that the main stretcher frame, in the wash tower, should be set to about 80% of grey relaxed width.

### 5. Processing On The Machine At Tosi

The fabric was processed at Tosi on June 14th, 1978. Peter Greenwood of IIC Manchester was present to observe the trials.

The rib constructions were processed first, followed by the interlock, each series arranged in the order recommended. This meant that the first fabric through was the tightest rib (stitch length 2.48 mm.). Some problems had been experienced in the knitting of this fabric and several holes were present in the piece, which led to difficulty with break-outs. It was a matter of some relief to the observer when this turned out to be the only problem fabric.

The following observations were made.

Caustic concentration	28° Bé
Caustic temperature	25° C
Swelling time (impregnation + delay)	45 seconds
Wash water temperature	75° C
Fabric speed - entry	40 m/min
- exit	44 m/min

The stretcher frame in the wash tower was not, on the whole, maintained very closely to IIC recommendations. As in the earlier trial on this machine, the operator had his own ideas. *Table I* gives the actual stretcher width setting for each fabric, and the percentage of fully-relaxed grey width that this represents. It will be seen that, although the average setting was about 80% of relaxed, as recommended, stretcher widths for individual constructions varied between 65 and 92% of the fully relaxed grey width.

Following mercerising and partial washing-off, the fabrics were neutralised with acetic acid in the Omez tensionless washer, rinsed, dried on an Alea continuous drier and returned to Manchester for testing and further processing. Perhaps unfortunately, no observer was present during the washing and drying stages and details of the processing conditions are not known. However it should be pointed out here that intermediate drying between mercerisation and dyeing represents an unusual and probably uncommercial situation in any case.

## 6. Mercerising Charges

The total quantity of fabric processed was 586.5 kg. The charge for processing was £408.00 - 70 pence per kilo.

## 7. Subsequent Processing

On return to Manchester, a sample of each construction was removed for testing. The remainder of each fabric was jet dyed and finished in the same manner as the corresponding unmercerised material with the exception that six pieces of rib in lot 31 were winch bleached instead of being jet dyed. The grey constructions of these six pieces were similar to those which had been selected for the minor trials (continuous bleach, winch bleach and winch dye) of the unmercerised fabrics.

Details of the jet dyeing, winch bleaching and final finishing treatments are described in *Research Record No. 94*. The interlock was dyed to a red shade, and the rib fabrics to a navy blue. The latter recipe was identical for both the unmercerised and mercerised fabrics but, unfortunately, the red was slightly changed. Details of the dyeing recipes, and samples of the dyed fabrics, appear as an *Appendix* to this report.

*Note for the digital version:* Some additional examples of dyed mercerised fabrics have also been included.

## 8. Test Results And Discussion

The full test data for this project are already available in *Research Record No. 121* and will not therefore be reproduced here.

What follows is a straightforward account of the differences in properties which have been observed between mercerised and unmercerised fabrics. Only a very superficial examination has been made to attempt to identify some of the trends in fabric properties produced by mercerisation. A detailed elucidation of the inter-relationships between structural parameters, process selection and physical properties will be reported at a later date as part of Project K3 (knitgoods model).

*Tables II and III* give a general indication of the sizes and directions of the trends produced by mercerisation. Simple average values over the two fabric structure ranges, at each stage of processing, have been calculated for a number of fabric properties. These have then been reported in comparative terms, taking the corresponding figure for the grey, fully relaxed series as 100, so that the direction and size of the trends at each processing stage can be seen.

This simple analysis does not, of course, indicate differences in behaviour resulting from variations in the original fabric structures; yarn count, for instance, or stitch length. A number of graphs have therefore also been produced to discover whether these factors may

have significant influences. Definitive conclusions, however, must await the completion of the knitgoods model.

Fabric shrinkage has been excluded from this analysis. The influence of mercerisation on fabric stability is discussed separately (*Section 9*).

## **8.1 Interlock Results**

Trends in the main interlock fabric properties, at various processing stages, are shown in *Table II*. The average behaviour is indicated, over the range of fabrics produced, in comparison with the corresponding grey, fully relaxed fabric. The data used to calculate these figures have all been from fully relaxed fabrics.

Data on the unrelaxed fabrics are probably irrelevant, with the exception of stitch length and yarn count on the fabrics as knitted. The corresponding figures for stitch length and yarn count on the unrelaxed grey fabrics are 102.2 and 100.6 respectively, indicating that during relaxation of the grey fabrics the stitch length shrunk by 2.2% and the yarn count (in tex) was also reduced by 0.6% indicating a loss of mass (solubles, loose fibres etc.) of about 2.8% during grey fabric relaxation.

It is convenient to consider the observed trends for each parameter separately.

### **8.1.1 Stitch Length, Yarn Count and Tightness Factor**

(Measured) Stitch length was reduced by about 6% as a result of mercerisation, i.e. this was the extent of yarn shrinkage in the caustic treatment; it then remained constant during dyeing and finishing. The (measured) yarn count increased (using the tex system) by about the same amount.

These effects together produced an increase in tightness factor, attributable to mercerisation, of about 10%.

### **8.1.2 Course and Wale Spacings and Fabric Weight**

Jet dyeing, with the Thies R-Jet 95 machine, has been shown to result in a reduction in both course and wale spacings in interlock constructions. Over the range of fabrics examined, course spacing decreased by about 7% and wale spacing by 3-4%, following the jet dyeing treatment.

Mercerisation also resulted in a reduction in course spacing of about 7%; subsequent jet dyeing produced a further decrease in course spacing to give an overall reduction of about 12%. Another way of looking at this effect, of course, is to regard it as an increase in fabric length.

The effect of mercerisation on wale spacing, however was very different. This increased by about 15% on mercerising and remained unchanged through dyeing and finishing. This may be regarded as a reduction in the relaxed fabric width, on the average, of about 13%.

These effects combined produced an increase in the relaxed fabric weight of about 11% following mercerisation. After dyeing, there was no further change, in spite of the observed reduction in course spacing.

Apparently the added weight of the dye was sufficient to maintain the fabric weight constant.

Graphs showing the effects of mercerisation on the relaxed course and wale counts and on weight are given in *Figures 2 - 7*. It may be noted here that the stretcher widths, reported in *Table I* appeared to have no influence on the relaxed fabric structure as shown in these

graphs.

### **8.1.3 Thickness**

With each stage of the finishing process, the thickness of the fabric appeared to be reduced, so that the mercerised fabrics after dyeing and finishing were reduced in thickness, compared to the corresponding grey fabrics, by about 25%. As the unmercerised fabrics also showed this trend, albeit to a lesser degree, the size of the effect may depend on the amount of mechanical treatment, and the direct influence of mercerisation on fabric thickness is difficult to isolate.

### **8.1.4 Burst Strength and Distension, and Yarn Strength and Extension**

The burst strength data produced a curious result. Mercerisation produced an increase in strength of about 7% so that the ratio of strength to weight was in fact almost unchanged at that stage. The effect of jet dyeing on the unmercerised fabrics was to reduce the burst strength by about 6 - 7% but, on dyeing the mercerised fabric, the burst strength increased to give an improvement over the mercerised-only fabric of about 23%, and over the original grey fabric of more than 30%. The improvement in strength-to-weight ratio at the finished stage, attributable to mercerising, was over 20%.

The strength of yarn taken from the fabric showed similar trends, though rather less marked.

Measurements of distension and yarn extension at break showed fluctuations which are difficult to understand, unless the test methods themselves are perhaps unreliable. Graphs showing the effects of mercerisation on bursting strength and distension at burst are given in *Figures 8 - 11*.

### **8.1.5 Spirality**

Spirality is not normally very apparent in interlock constructions, because of the balanced nature of this type of structure and, in fact, all the results in this study were very small - under 5°. Trend analysis is therefore probably of little importance.

## **8.2 Rib Results**

*Table III* shows the trends, during processing, in the main physical properties of the 1x1 rib fabrics. As with the interlock, the figures represent average values over the range of fabrics, fully relaxed, with the grey relaxed fabric values taken as 100.

Compared to the grey relaxed fabrics, stitch length and yarn count (tex) of the fabrics as knitted were respectively 1.6% and 1.6% greater, indicating a loss in mass of about 3.2% in the relaxation treatment.

### **8.2.1 Stitch Length, Yarn Count and Tightness Factor**

As with interlock, stitch length was reduced by about 6% as a result of mercerisation. Yarn count (tex) increased by a similar amount in the case of dyed fabric; less in the case of bleached fabrics. Again, tightness factor increased as a result of mercerisation, by about 10%.

### **8.2.2 Course and Wale Spacings and Fabric Weight**

Jet dyeing, as with interlock, produces reductions in both course and wale spacings in relaxed rib fabrics, amounting to about 7% in the courses and 4% in the wales. Winch bleaching was here found to give similar results.

Mercerisation resulted in a reduction in course spacing of about 4%: rather less than for



interlock. After dyeing the overall reduction rose to about 7%, not significantly different from the unmercerised, dyed fabric. Winch bleaching, however, resulted in a course spacing reduction, or length increase, of over 10%.

The effect of mercerising on wale spacing was similar to that produced on interlock: an increase of about 15%.

The increase in weight corresponded to a combination of the length-wise and width-wise effects, amounting to about 7% in the case of the dyed fabrics and rather less for the bleached fabrics, in direct consequence of the mercerising treatment.

Graphs showing the effects of mercerisation on relaxed course and wale counts and on weight are given in *Figures 12-17*. As with interlock, stretcher width appeared to have no influence in determining the final fabric structure.

### **8.2.3 Thickness**

Trends in thickness results were very similar to those noted for interlock and the conclusions must be the same.

### **8.2.4 Burst Strength, Distension, Yarn Strength and Extension**

As with interlock, jet dyeing after mercerisation produced an unexpected bursting strength increase. Winch bleaching after mercerising also gave this result; a phenomenon which at the moment is difficult to explain.

Yarn strength on the mercerised and winch bleached fabric showed a similar trend, but the jet dyed results did not (unlike interlock).

Graphs showing the effects of mercerisation on bursting strength and distension at burst are given in *Figures 18-21*.

### **8.2.5 Spirality**

Although, like interlock, rib structures are balanced and would be expected to exhibit negligible spirality, nevertheless some of the spirality results on the mercerised fabrics were significantly higher than for the corresponding unmercerised fabrics; another result which is difficult to understand without further investigation.

## **9. Dimensional Stability**

One of the main advantages claimed by many proponents of the knitgoods mercerising process is the so-called "stabilisation" effect. It is difficult to see the justification for any statement along such lines as, of course, the mercerisation treatment is not carried out in isolation, but in combination with other operations such as washing, dyeing and drying, all of which will also have an influence on fabric stabilisation.

*Figures 22 - 29* show the shrinkage behaviour of the fabrics in the study, at various stages of processing. After mercerisation, length shrinkages were higher than those on the original grey fabrics; width shrinkages, however, were so much lower that they extended, a result which, presumably, merely indicates that all the fabrics were dried too narrow.

After drying, an attempt was made to control the drying conditions so that the finished fabrics came within predetermined stability limits. These limits are given in the table below, where shrinkage is according to the results obtained from the five-cycle IIC method (*Figure 1a*).

<b>Interlock</b>	<b>1x1 Rib</b>
Length: 5% maximum	Length: 5% maximum
Width: 10% maximum	Width: 8% maximum

It can be seen from the graphs that, in general, the width shrinkage targets were achieved, but length targets were not. Subsequent passage through a Hunt & Moscrop "Bestan" compressive shrinkage machine resulted in very little improvement, although later it was found that the machine was not operating correctly. The winch bleached rib fabrics were finished through a Tubetex Compactor, and the targets were achieved without difficulty on both unmercerised and mercerised fabrics.

## 10. Conclusions

It has already been pointed out that firm quantitative conclusions from this work must wait until the knitgoods model has been completed. Nevertheless some preliminary observations can be set down at this stage.

- a) There was no evidence from this study that knitgoods mercerisation is a stabilising process.
- b) There was also no evidence to suggest that the amount of width-way stretch during washing-off had any effect on the final relaxed dimensions, within the range of conditions studied.
- c) For both interlock and rib, mercerisation resulted in the following changes in the properties of the fully relaxed fabrics.
  - increase in length;
  - decrease in width;
  - increase in weight;
  - increase in strength;
  - increase in strength to weight ratio;
  - decrease in thickness.
- d) A curious effect was the apparently incomplete development of the full improvement in bursting strength until after the dyeing stage, suggesting almost that after mercerisation the fabric was in some kind of metastable state.

IIC/MERIDIAN JOINT PROJECT 1978 Table No. I

INTERLOCK FABRICS

RIB FABRICS

SAMPLE	F.R.W. G	R.S.W.	A.S.W.	%offRW		SAMPLE	F.R.W. G	R.S.W.	A.S.W.	%offRW
I34/377	55.8	44.6	46	86	23.4	R26/350	55.1	44.1	49	89
I34/359	54	43.2	46	85	35	R26/326	52.1	41.7	47	90
I34/340	52.4	41.9	44.6	85	25	R26/306	49	39.2	45.1	92
I34/324	51.4	41.1	42	82	21.7	R26/285	47	37.6	42	89
I34/307	50.2	40.2	42	84	23.3	R26/267	45.5	36.4	37.5	82
I38/377	53.2	42.6	46	86	26.5	R30/350	56.3	45	46	82
I38/359	52.1	41.7	43.1	83	20.7	R30/326	52.7	42.2	42.1	80
I38/340	51.4	41.1	42	82	21.7	R30/306	50	40	41.1	82
I38/324	49.8	39.8	40.1	80	20.5	R30/285	46.3	37	39.5	85
I38/307	48.9	39.1	32	65	15.1	R30/267	44.7	35.8	41.2	92
I42/377	51.2	41	42	82	22	R34/350	58.6	46.9	44.5	76
I42/359	50.4	40.3	40.1	79	24.4	R34/326	54	43.2	43.2	80
I42/340	49.5	39.6	38.5	78	23.8	R34/306	49.9	39.9	38.2	77
I42/324	48.9	39.1	32	65	15.4	R34/285	45.9	36.7	37.5	82
I42/307	47.6	38.1	35.5	75	24.6	R34/267	44.8	35.8	35.9	80
					26.4	R34/248	42.8	34.2	35.9	81

Fabric widths in Onez washing tower, related to fully relaxed grey widths.

F.R.W. = fully relaxed width  
 R.S.W. = recommended stretcher width  
 A.S.W. = actual stretcher width  
 (all in cm.)

TABLE NO. II

## AVERAGE PROPERTIES OF FINISHED INTERLOCK FABRICS

(Grey, relaxed = 100)

	Jet Dyed	Jet Dyed + finished	Mercerised	Mercerised + Jet Dyed	Mercerised, Jet Dyed + Finished
Stitch length	101.0	101.0	93.9	94.1	93.8
Yarn count (tex)	99.1	98.7	104.9	108.4	107.6
Weight	95.4	94.1	111.5	111.3	110.1
Courses/3cm.	92.7	92.8	93.4	88.4	87.9
Wales/3cm.	95.5	97.2	114.7	113.8	114.3
Purst strength	92.0	94.2	107.2	132.4	134.5
Pistension	85.7	102.4	89.1	98.6	92.5
Pirality	90.3	109.0	99.3	125.1	99.7
Thickness	93.0	84.6	87.3	81.5	75.8
arn strength	98.9	97.6	122.8	128.1	125.5
arn extension	86.7	91.8	102.7	89.8	89.4

TABLE NO. III

## AVERAGE PROPERTIES OF FINISHED 1 x 1 RIB FABRICS

(Grey, relaxed = 100)

	Jet Dyed	Jet D. + Fin.	Winch Bleached	Winch Bleached + Fin.	Merc.	Merc. + Jet Dyed	Merc. Jet Dyed + Fin.	Merc. + Winch Bleached	Merc. + Winch Bl. + Fin.
Stitch length	100.7	100.2	99.2	99.2	94.5	94.7	94.3	94.5	94.1
Yarn count (Tex)	101.3	101.3	97.9	99.1	105.2	107.6	107.7	103.6	104.1
Weight	95.9	95.0	91.9	89.9	114.6	112.1	112.7	103.8	100.7
Courses/3cm	93.4	94.2	94.6	93.1	95.7	91.3	93.4	89.1	89.3
Wales/3cm	95.7	96.5	96.0	95.8	116.2	115.6	116.6	115.4	114.8
Burst strength	89.9	89.4	94.0	97.8	108.8	123.8	123.9	131.9	132.6
Distension	108.2	103.4	85.6	100.5	90.7	102.9	99.3	93.4	88.5
Spirality	113.8	105.2	119.0	128.6	177.9	203.7	161.2	192.7	227.7
Thickness	91.8	86.5	92.7	84.9	94.1	88.1	82.6	83.1	76.1
Yarn strength	98.0	92.6	127.6	116.4	124.4	119.0	112.6	135.0	136.6
Yarn extension	75.0	79.2	70.9	82.2	101.0	88.8	90.1	80.0	88.4

Figure 1

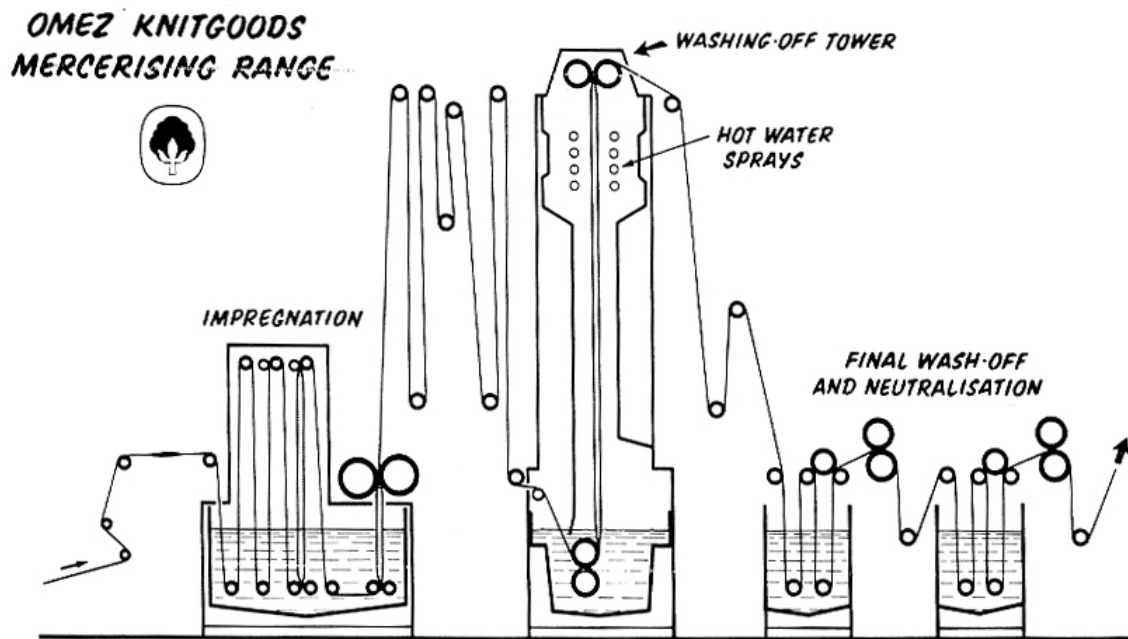


Figure 1a

**'FULLY RELAXED STRUCTURE' – IIC LABORATORY METHOD**

1. **CONDITION**
2. **MARK** fabric sample (50cm length and width)
3. **WASH** in automatic domestic washing machine at 60°C
4. **TUMBLE DRY** until dry
5. **WET OUT** in washing machine (Rinse cycle)
6. **TUMBLE DRY** until dry
7. **REPEAT** steps 5 and 6 three more times
8. **RE-CONDITION**
9. **MEASURE** marked distances
10. **CALCULATE** shrinkages (length and width)



*Note for the digital version:* This method was later renamed “Starfish Reference Relaxation Procedure” and the relaxation produced by this method was termed the “Starfish Reference State”.

Figure 2

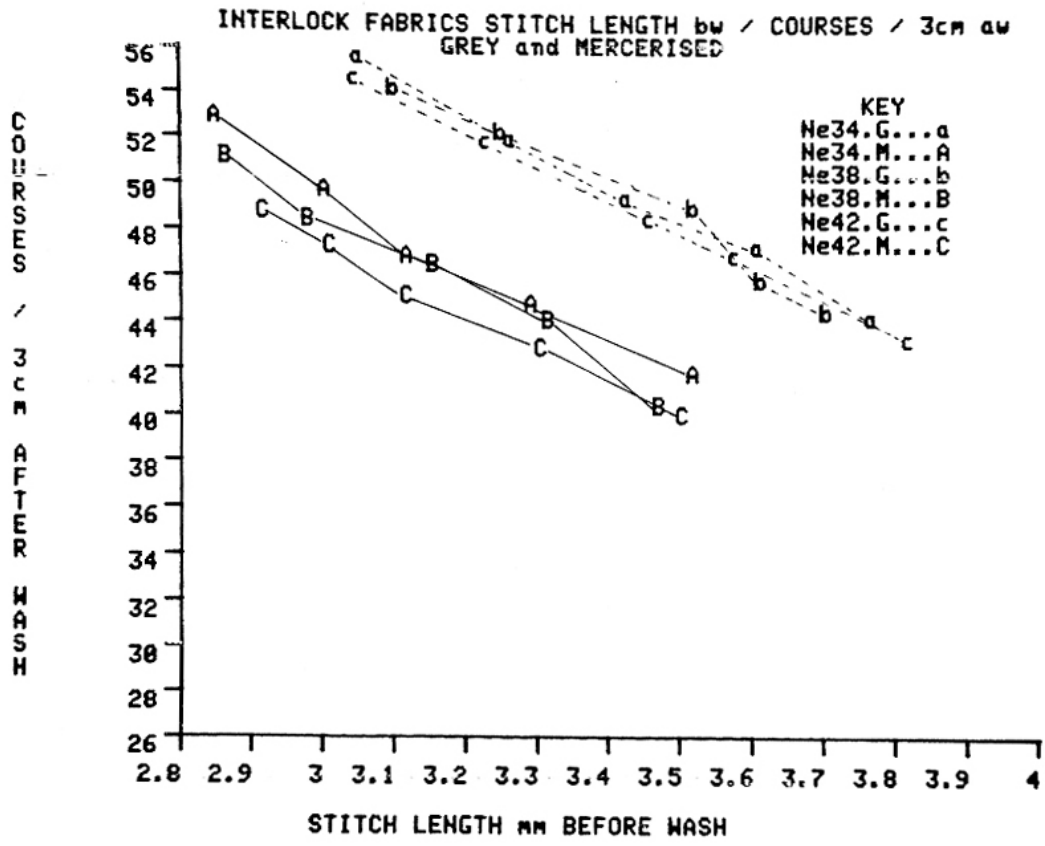


Figure 3

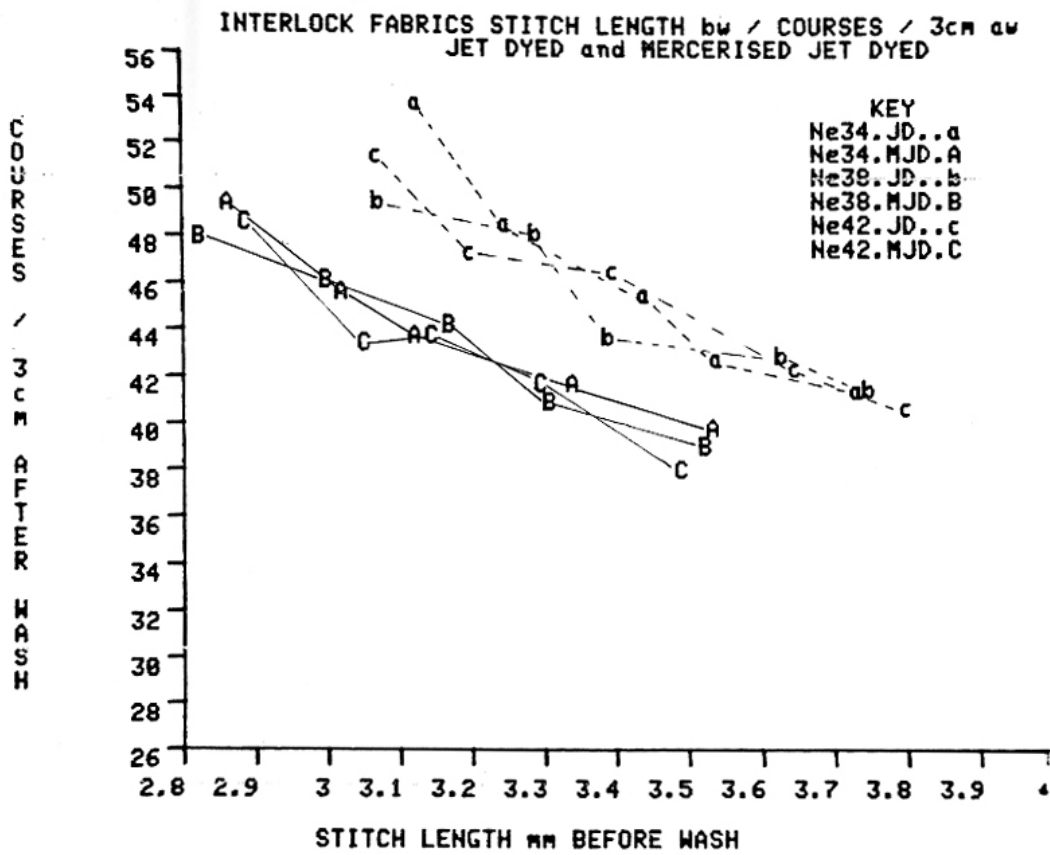


Figure 4

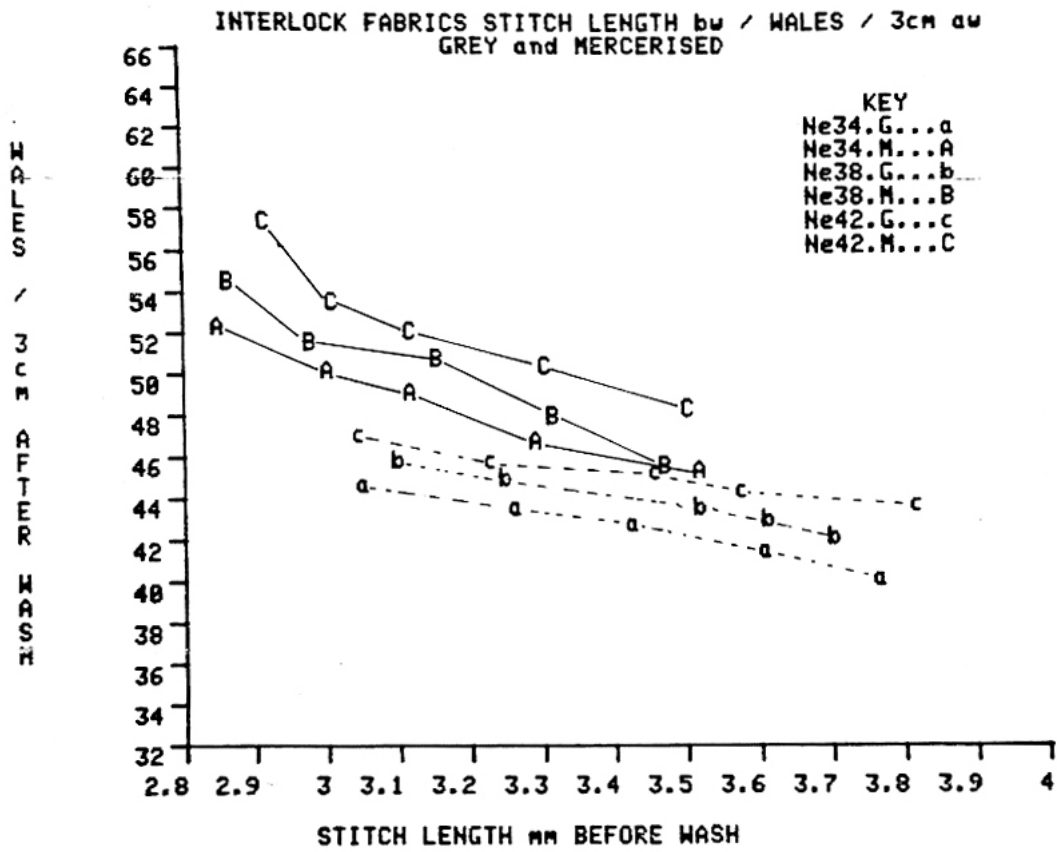


Figure 5

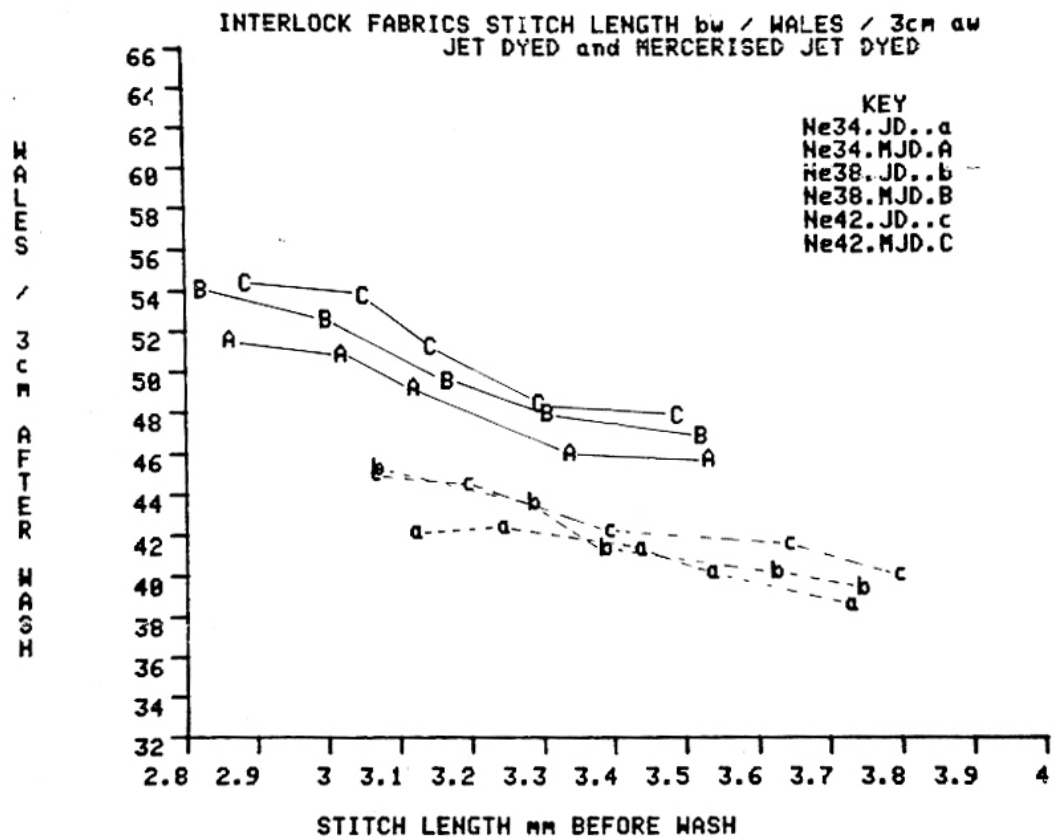




Figure 6

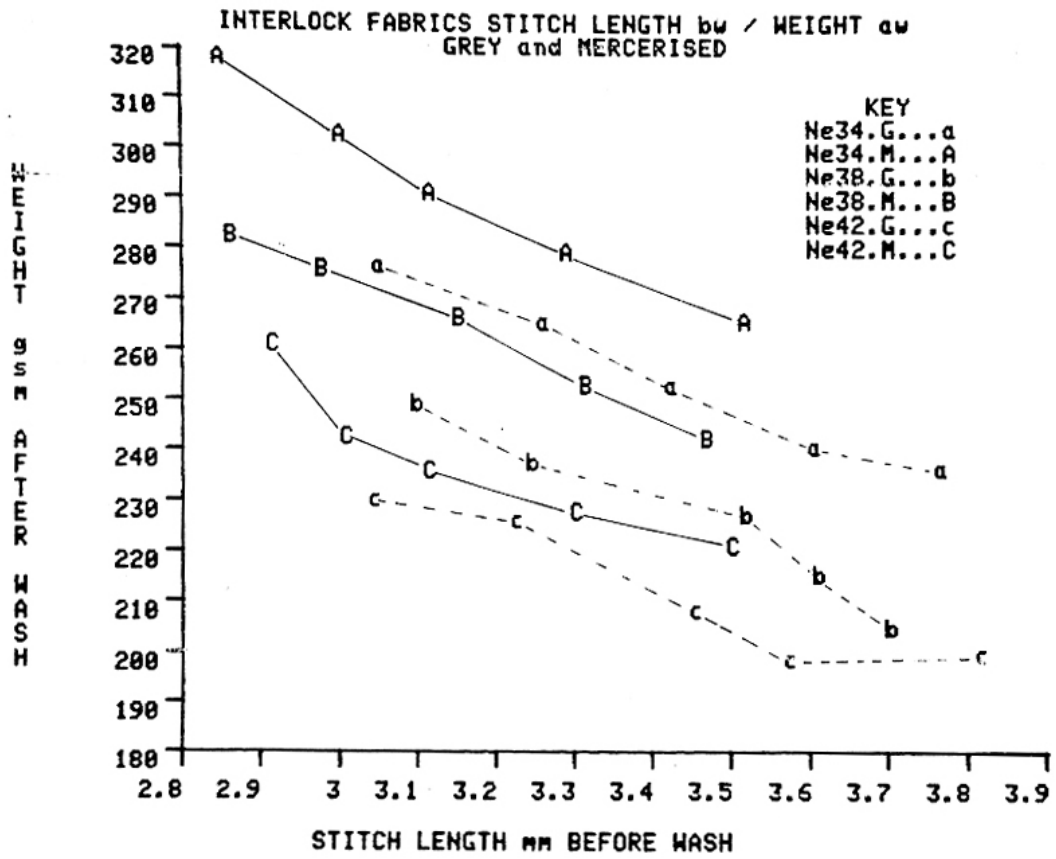


Figure 7

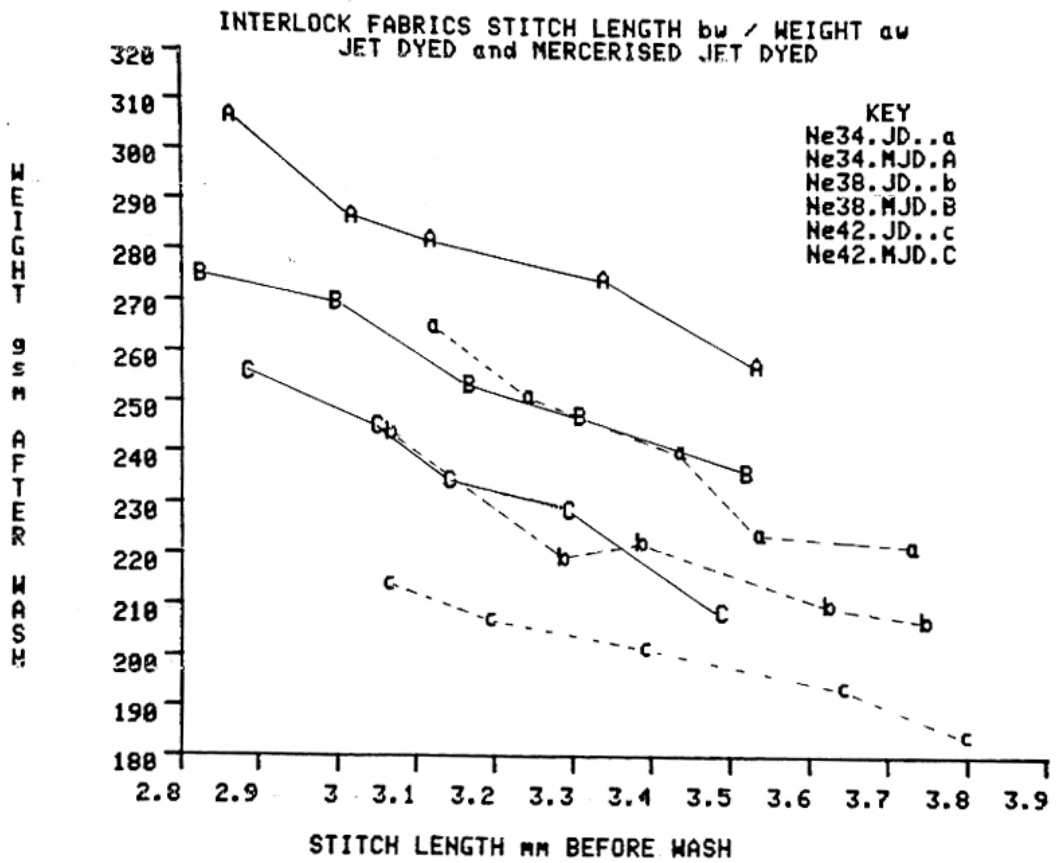


Figure 8

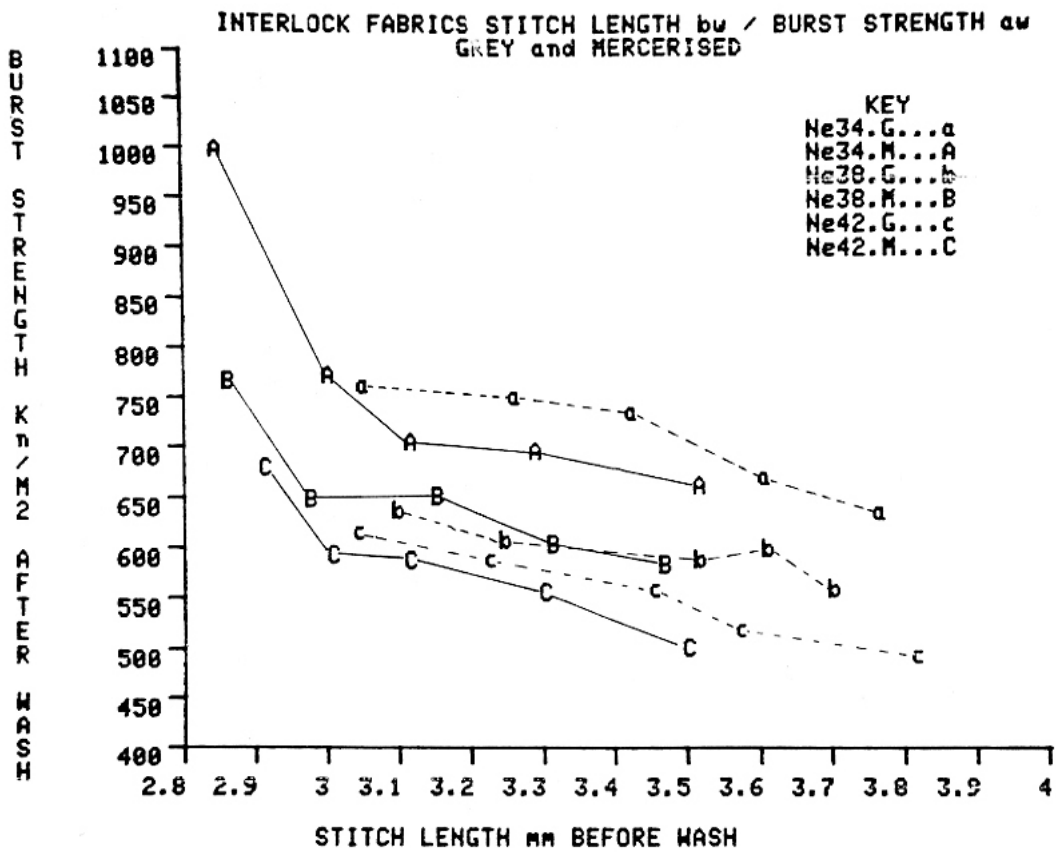


Figure 9

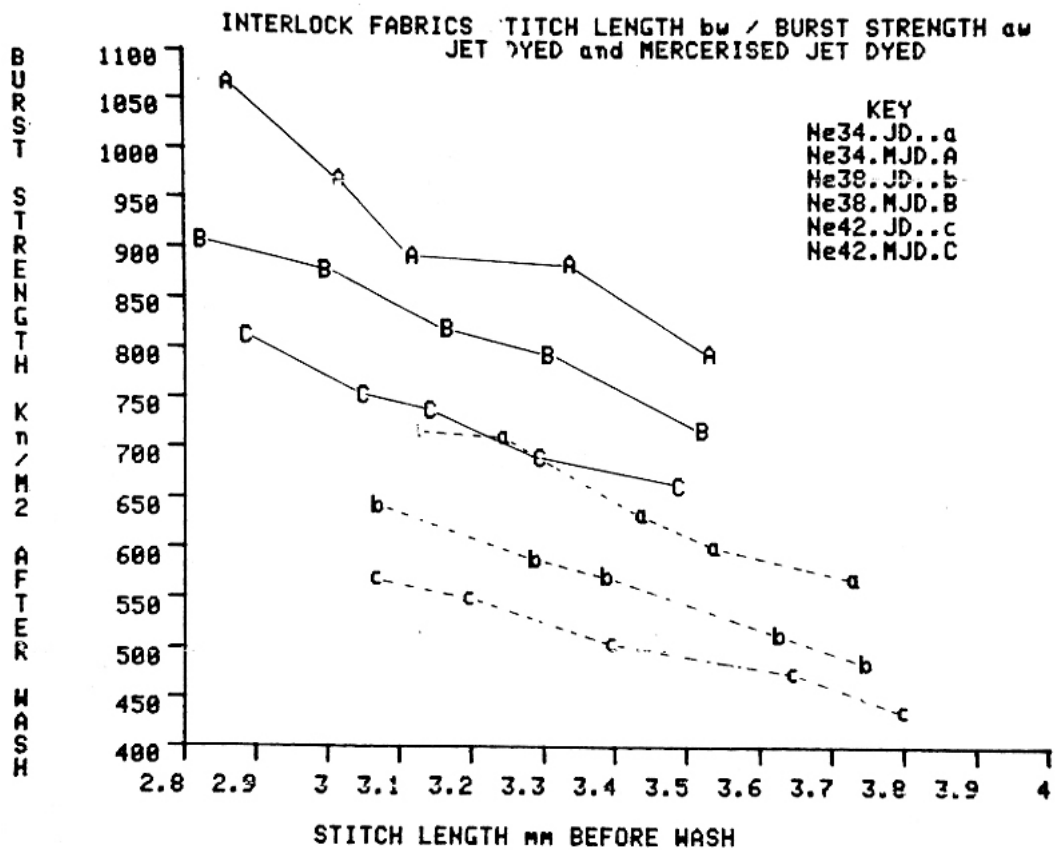


Figure 10

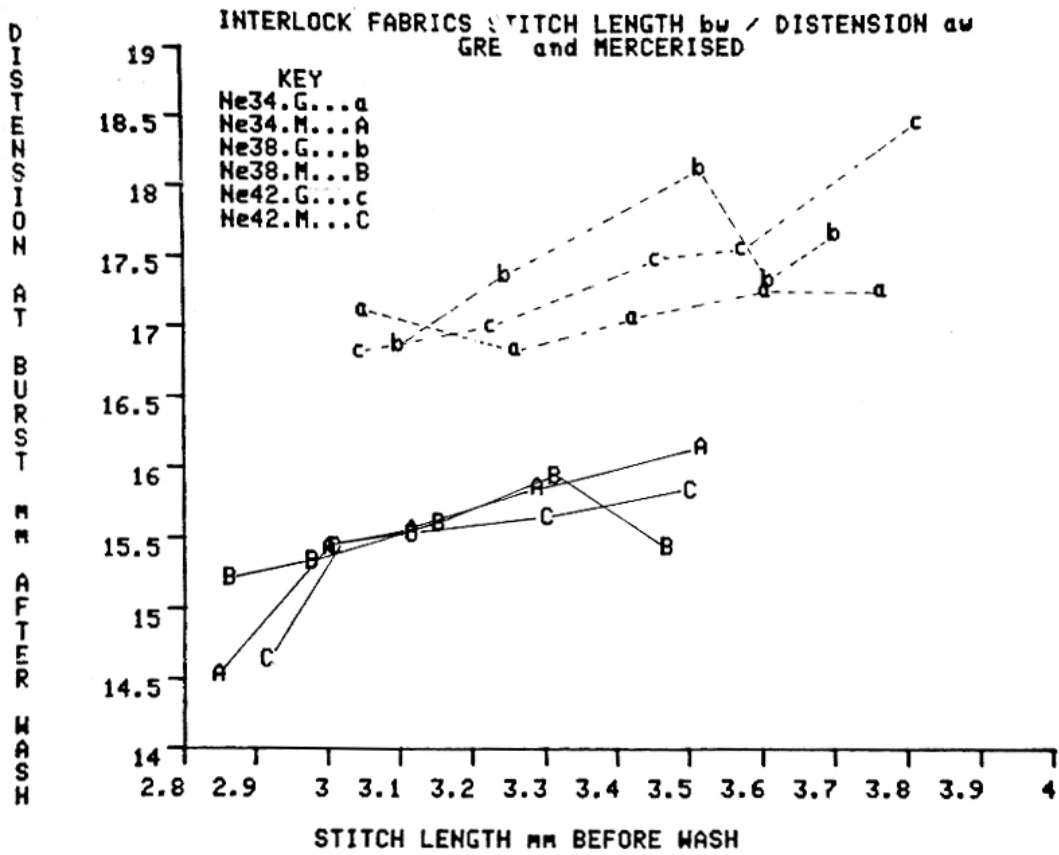


Figure 11

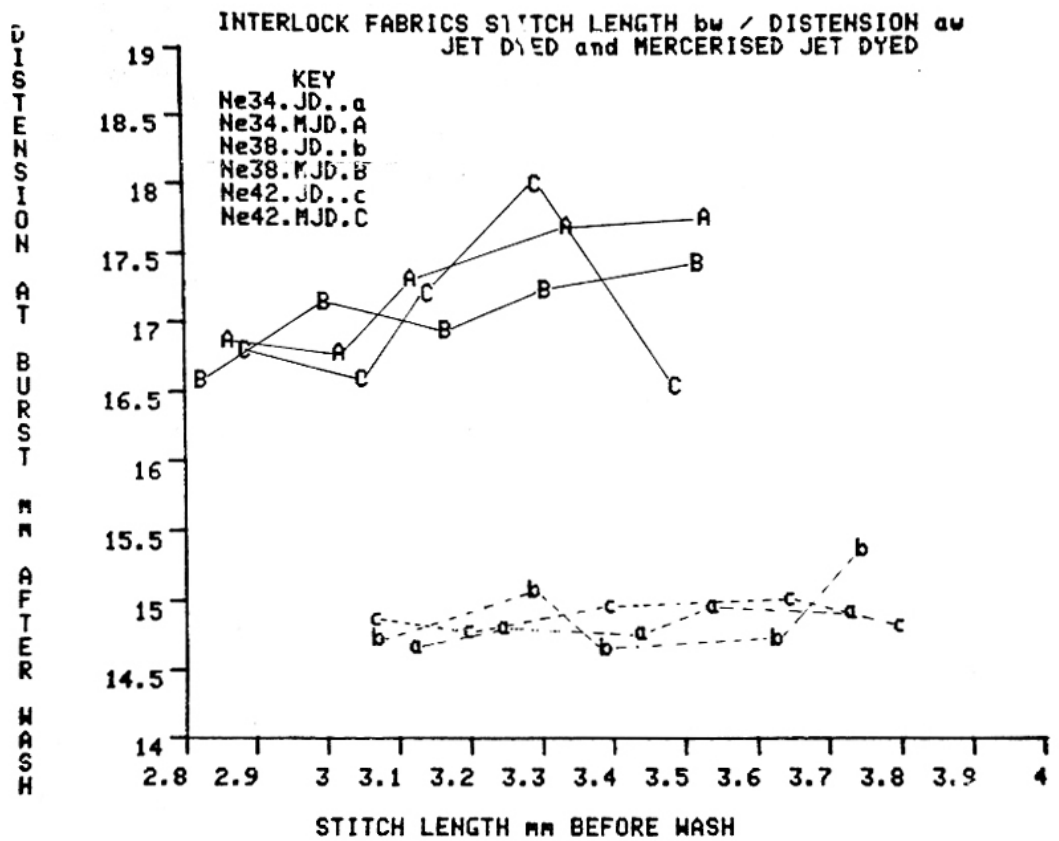


Figure 12

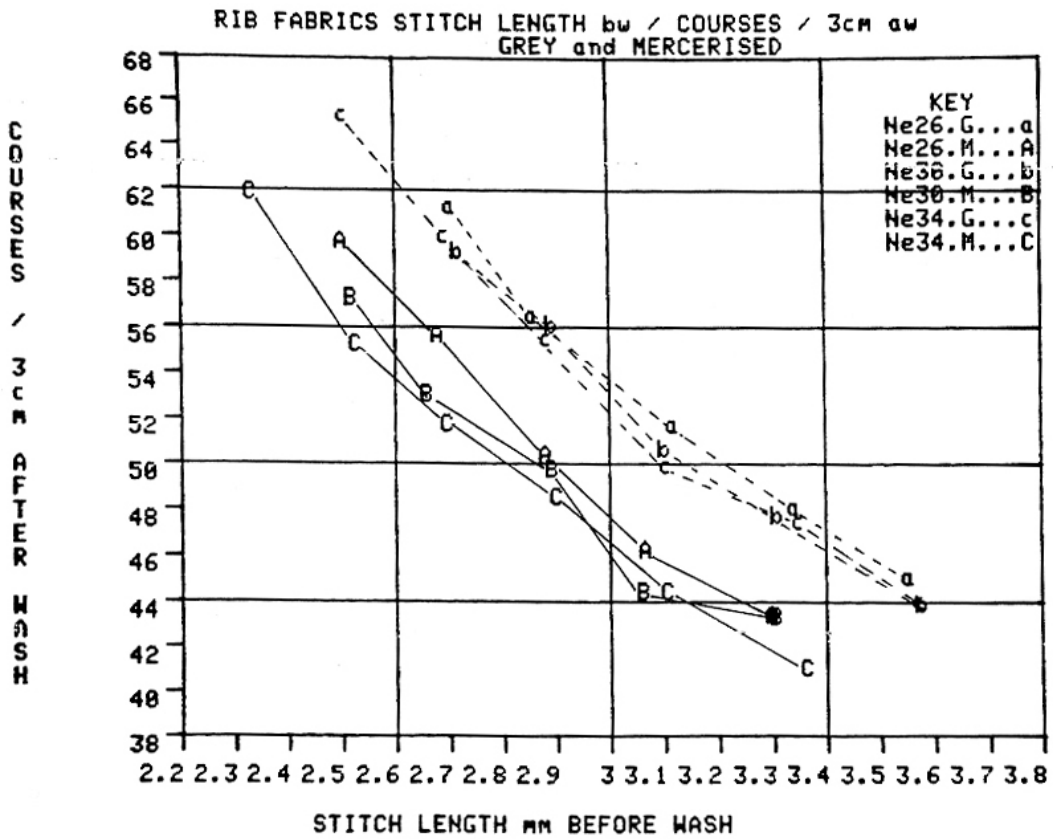


Figure 13

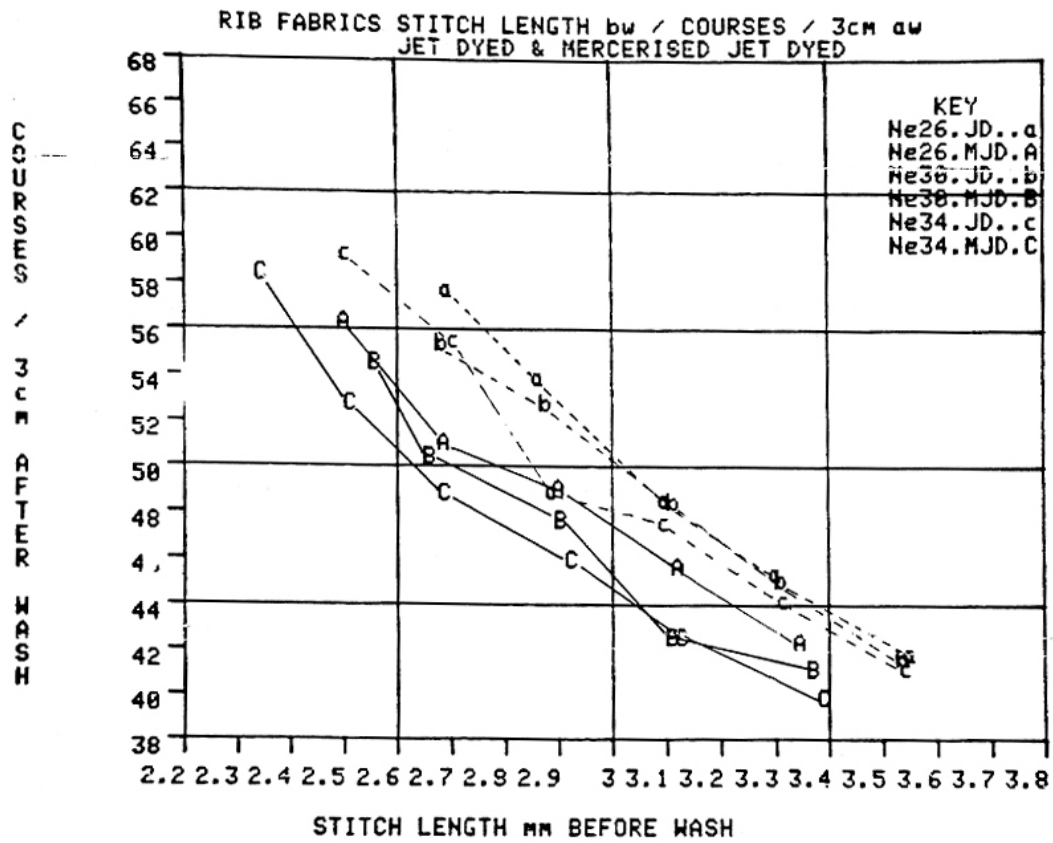


Figure 14

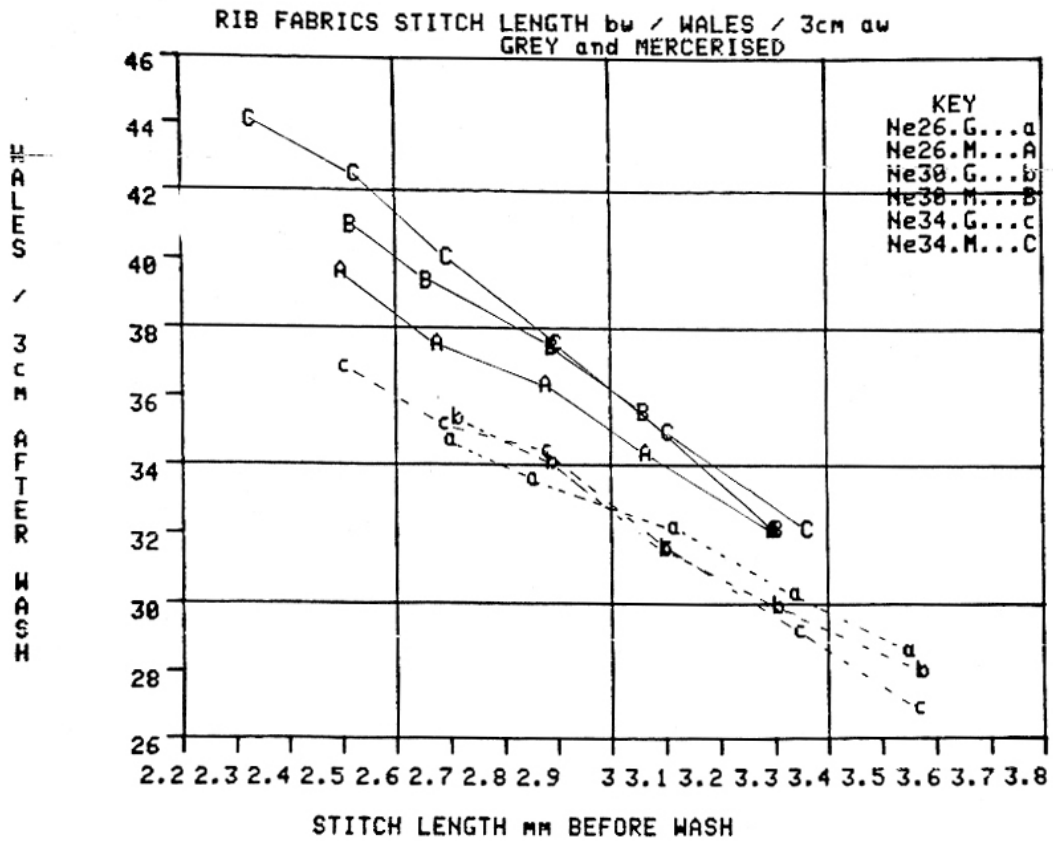


Figure 15

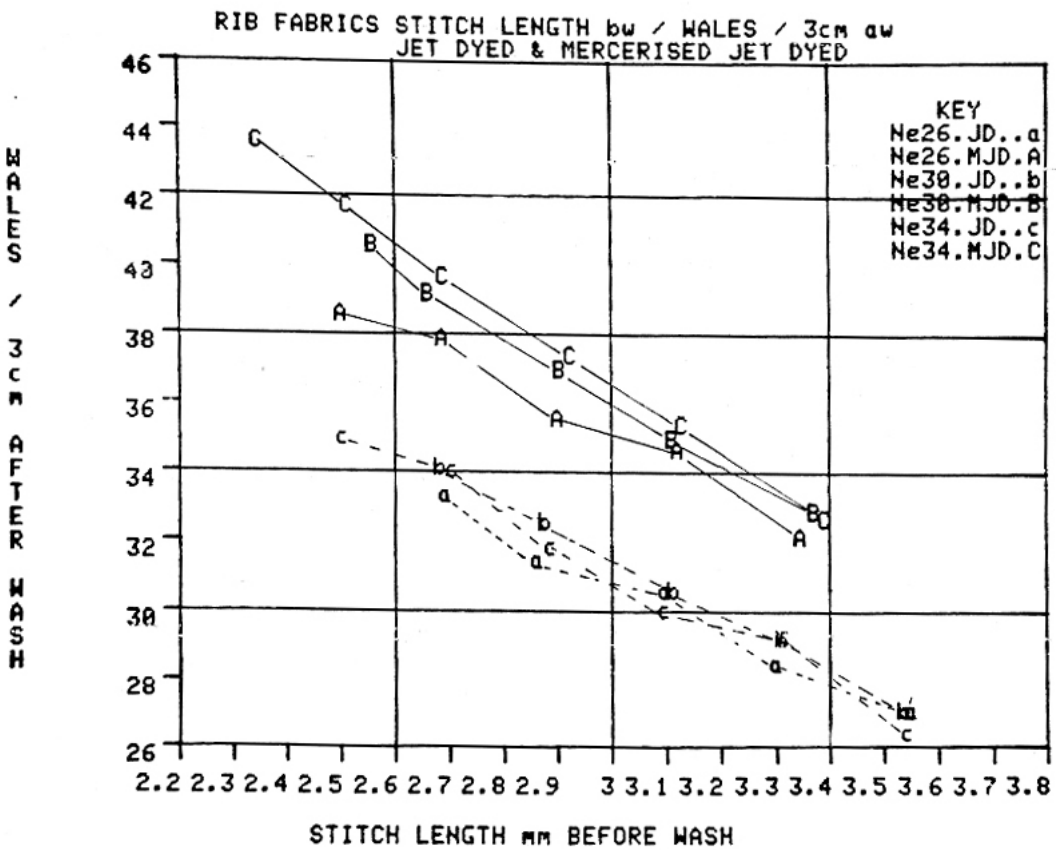


Figure 16

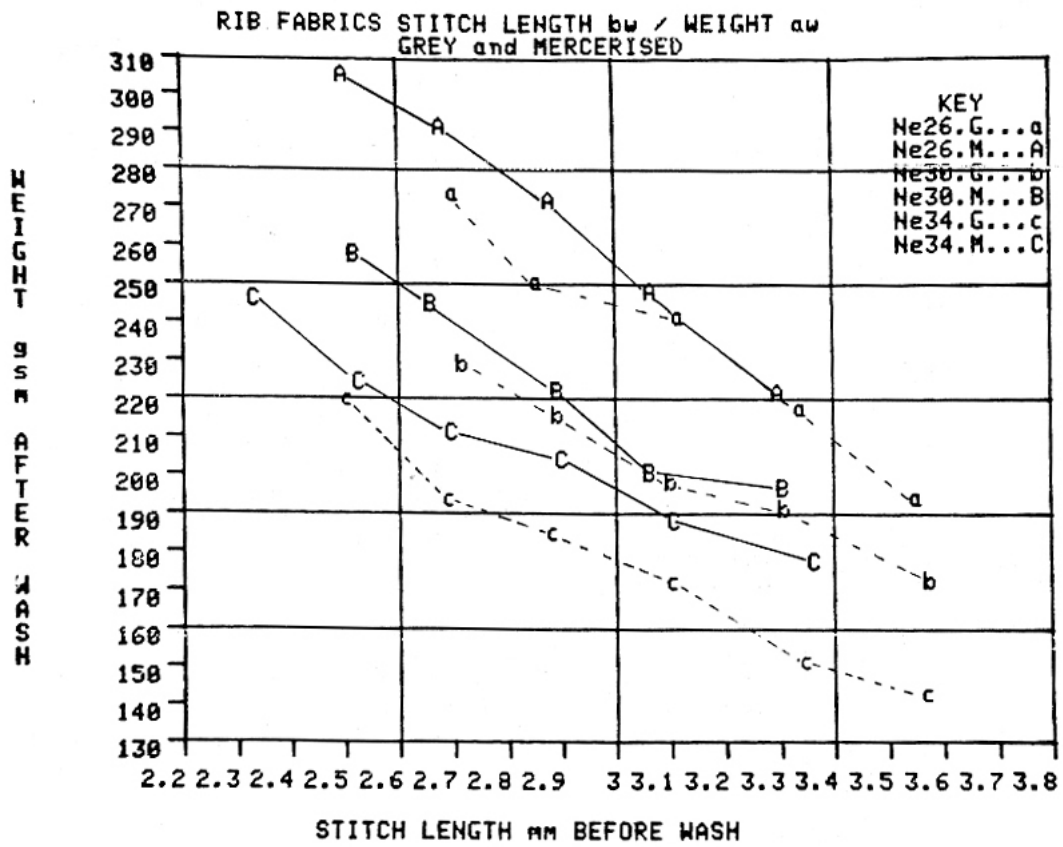
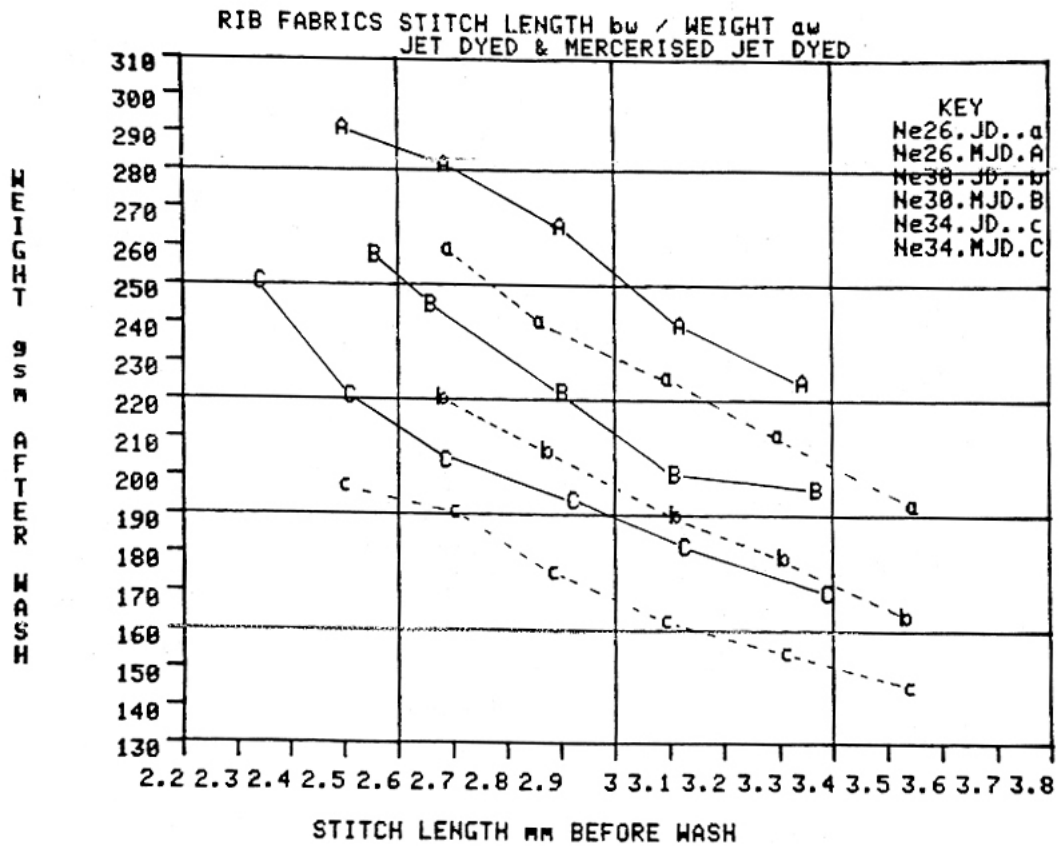


Figure 17



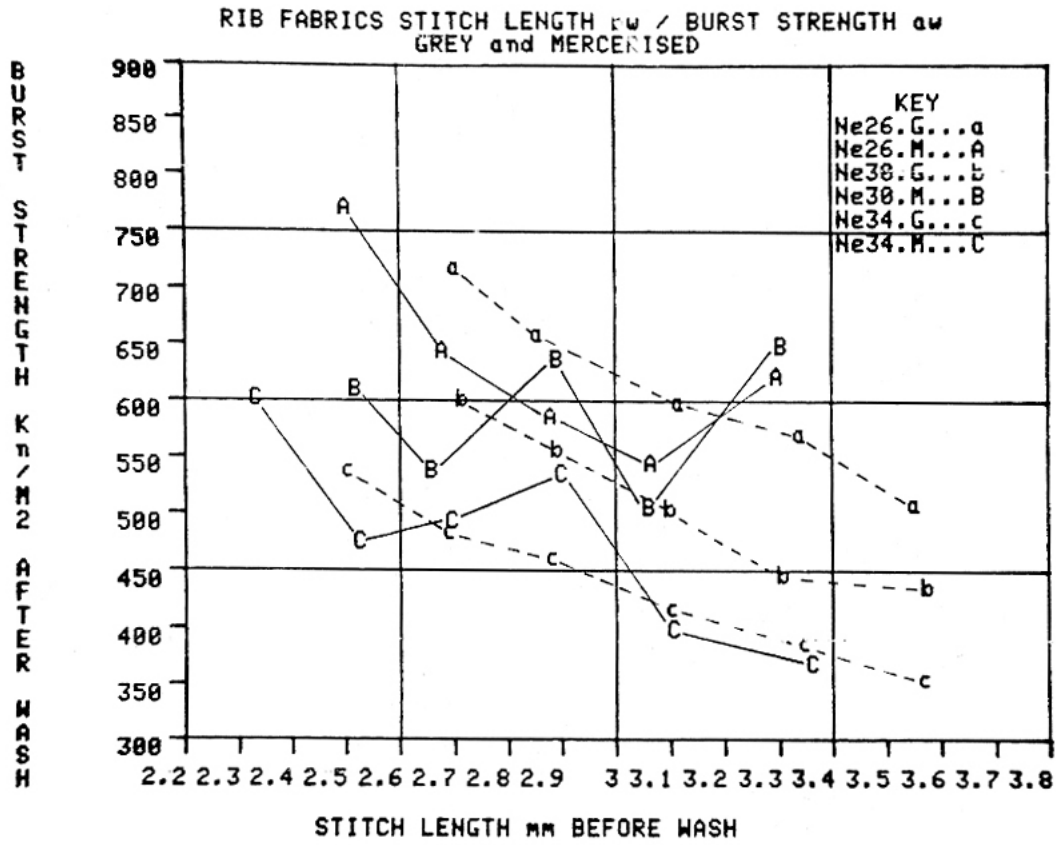


Figure 19

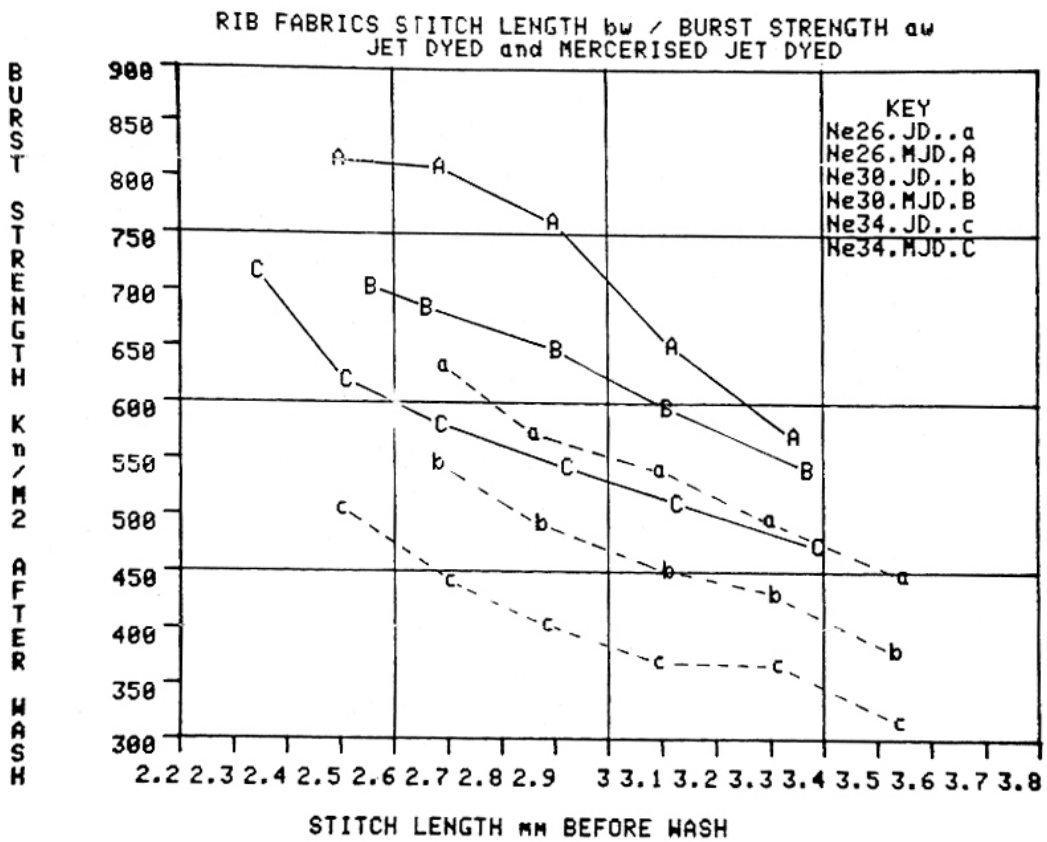


Figure 20

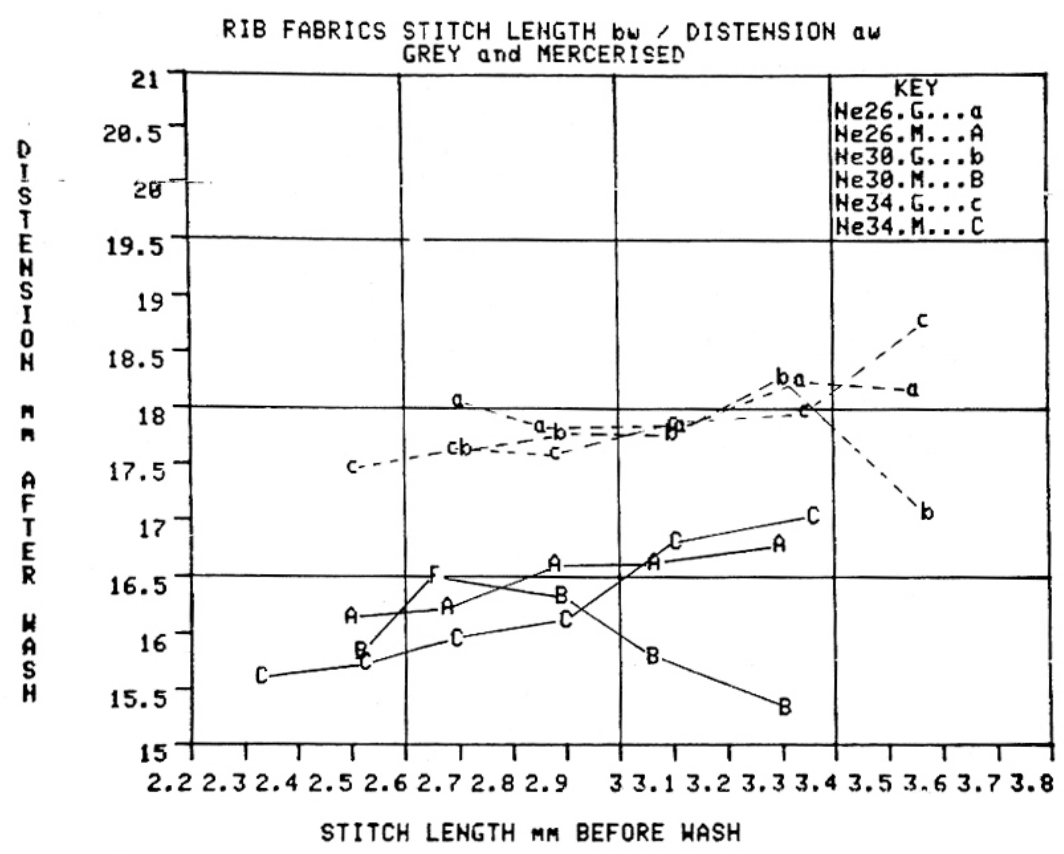


Figure 21

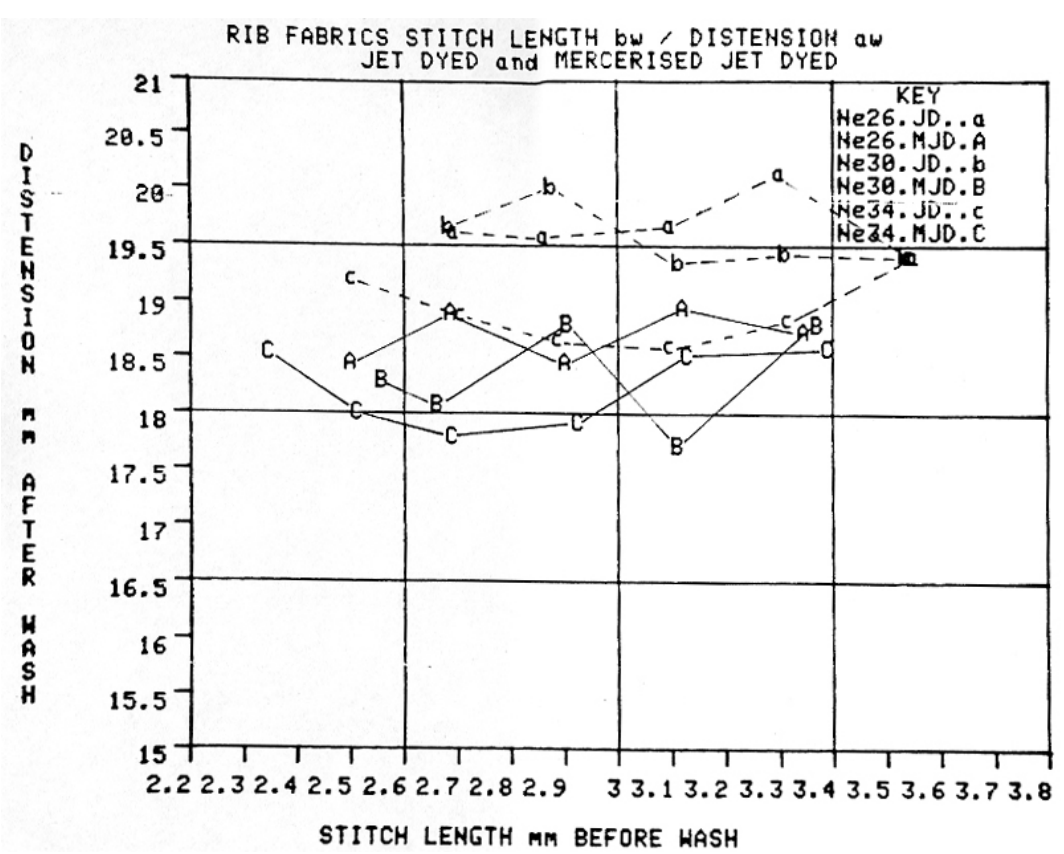




Figure 22

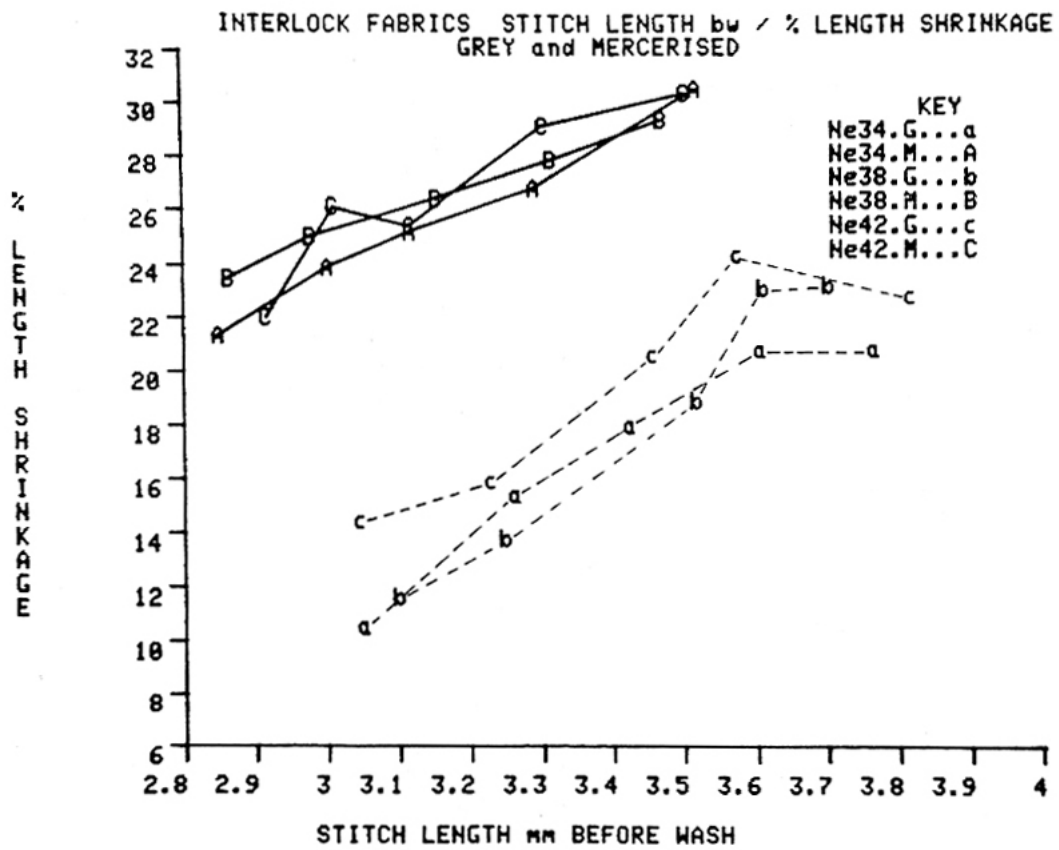


Figure 23

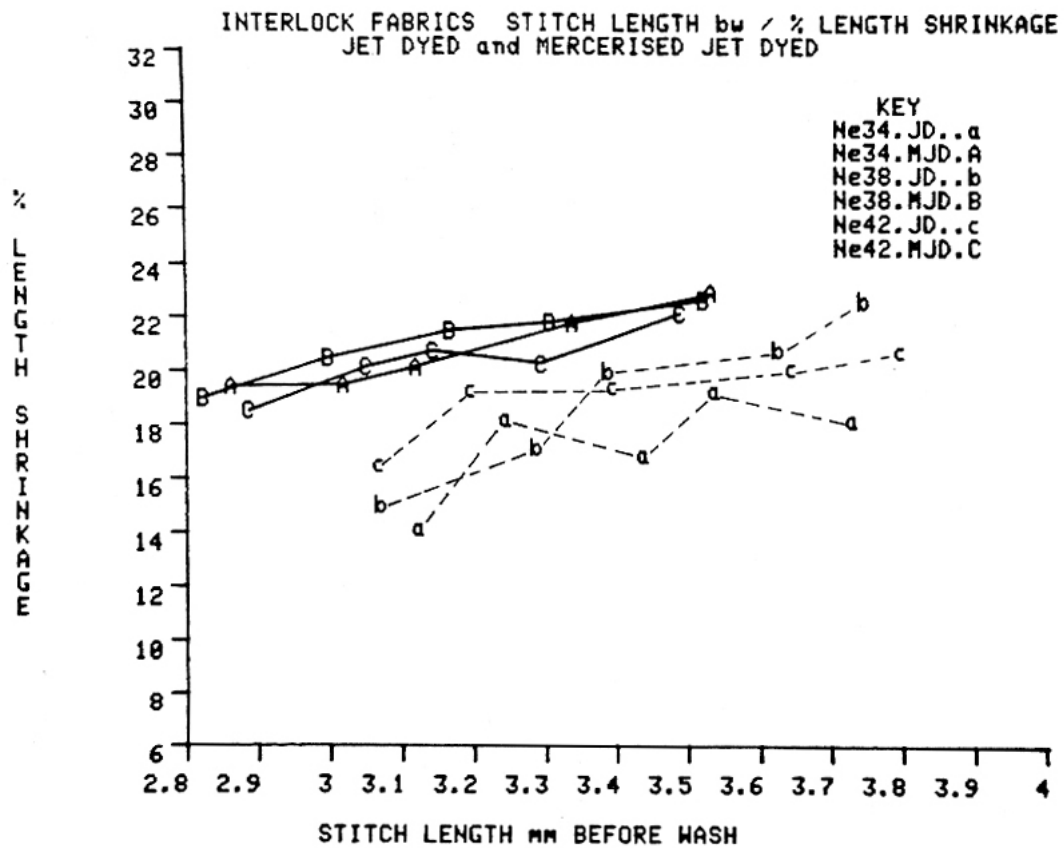


Figure 24

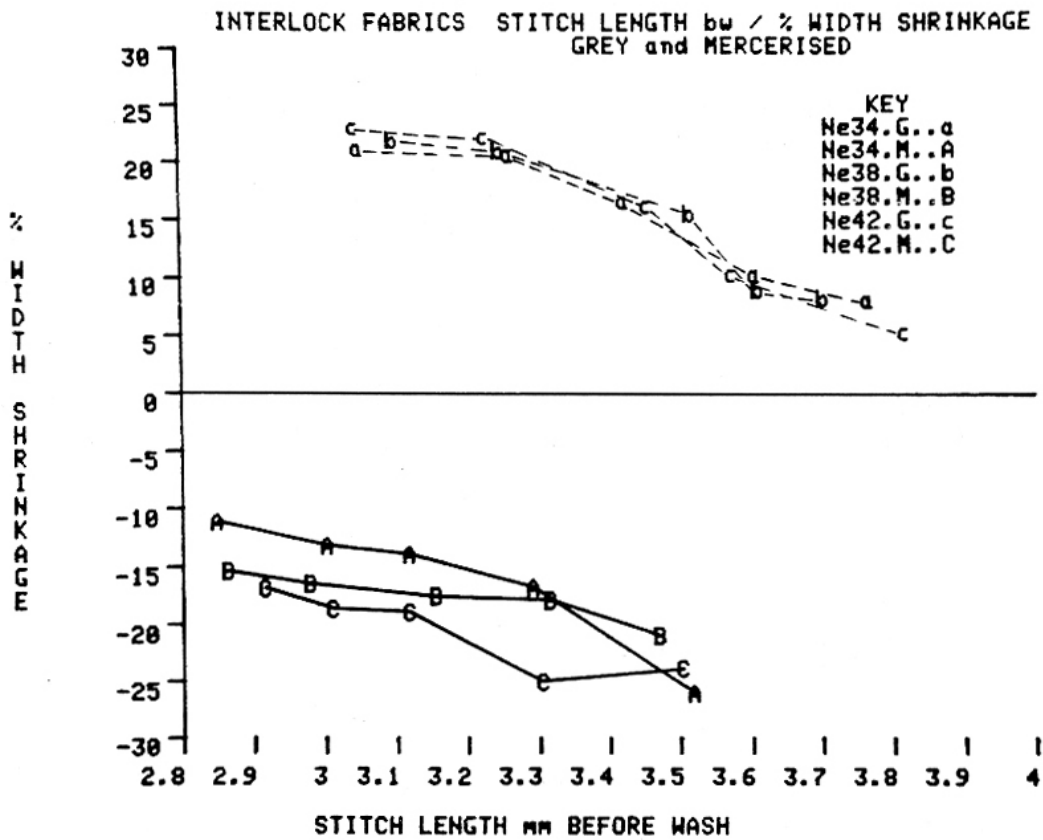


Figure 25

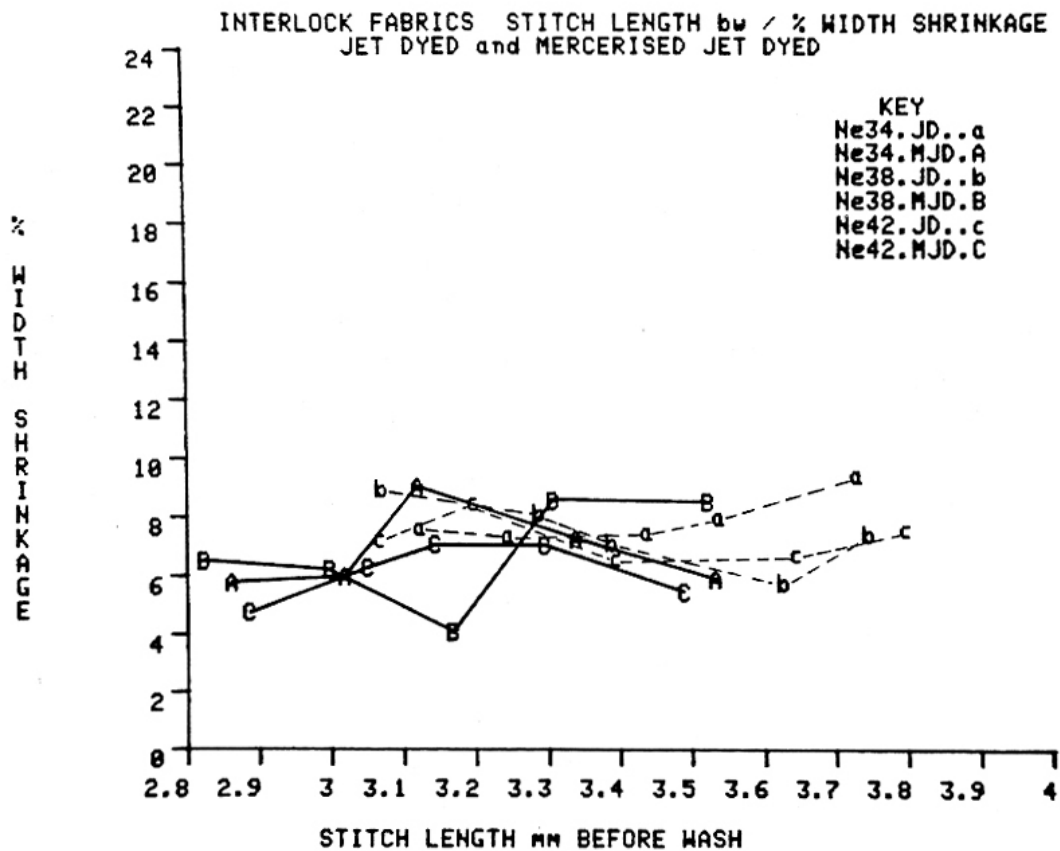


Figure 26

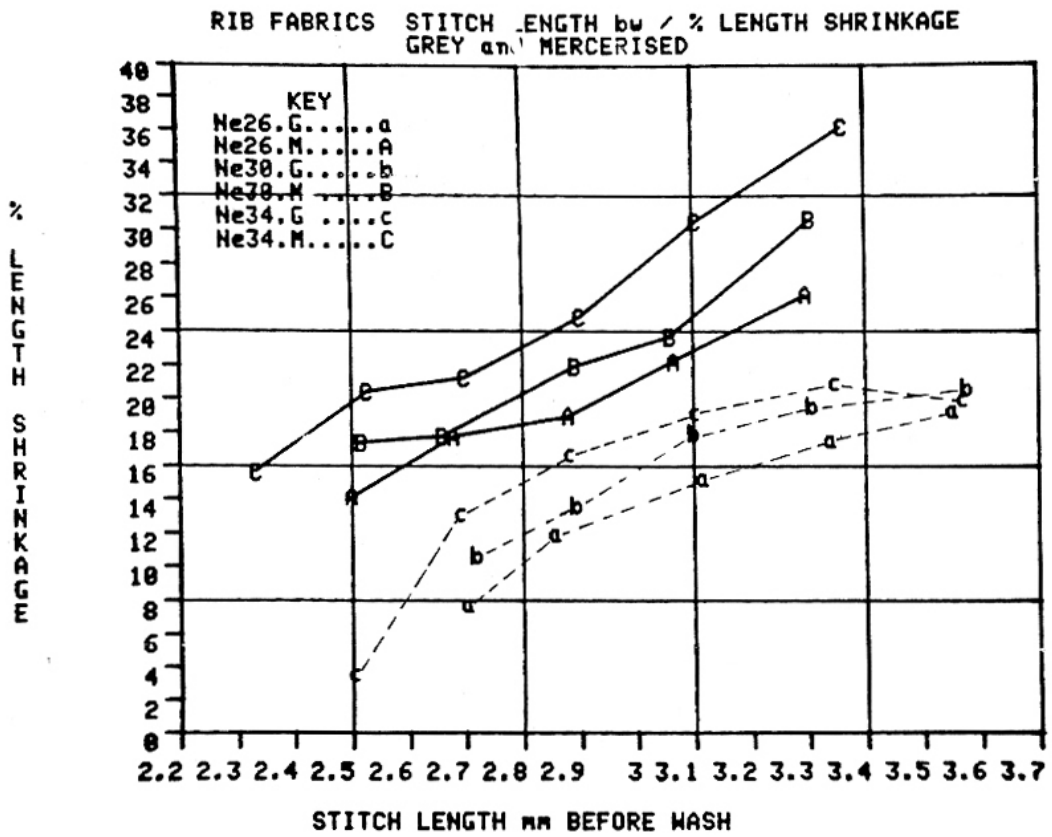


Figure 27

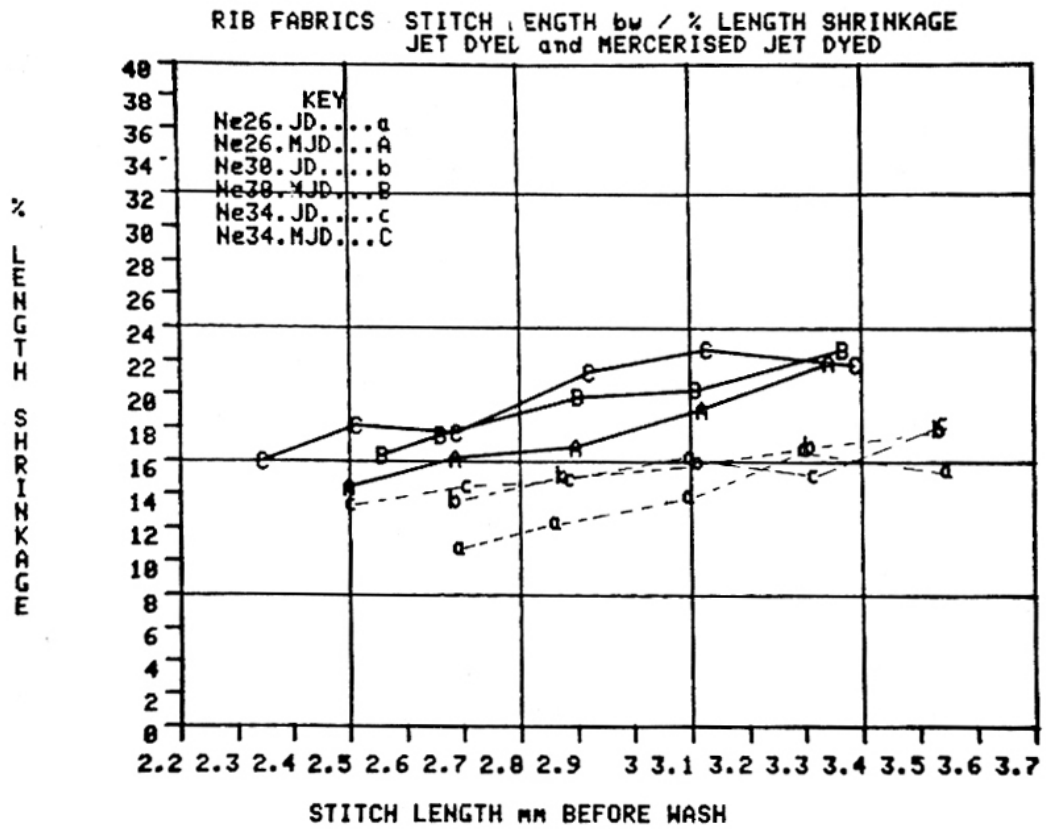


Figure 28

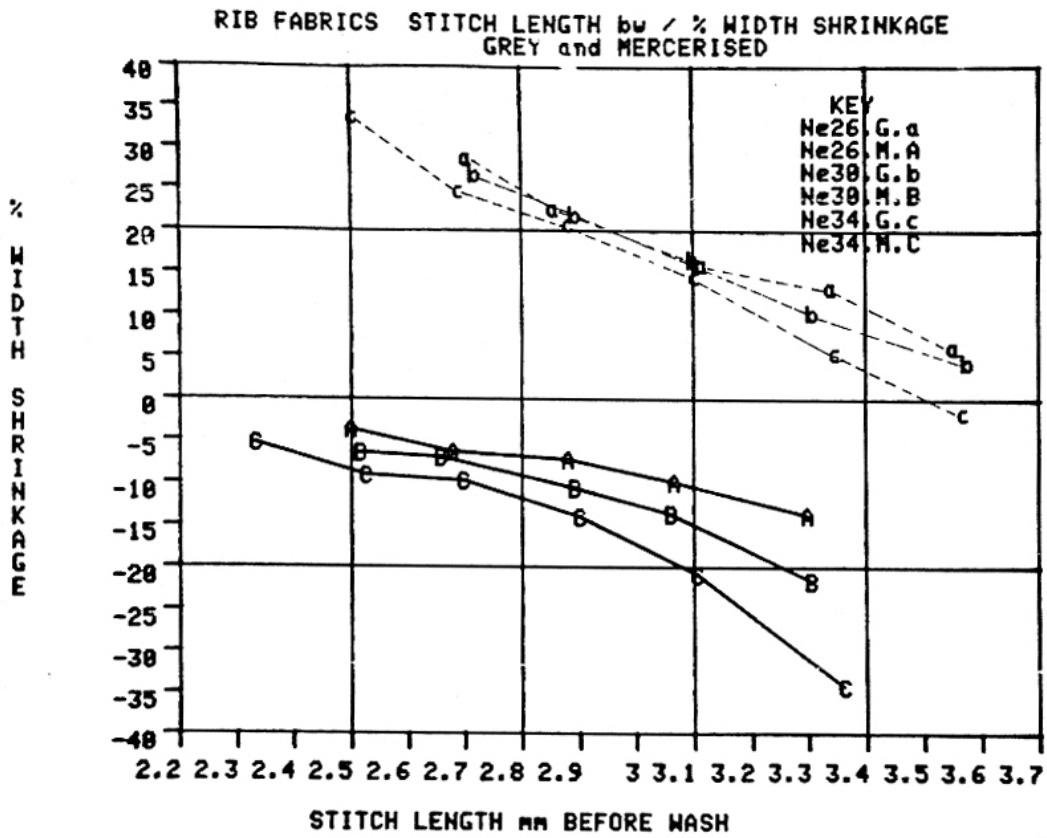
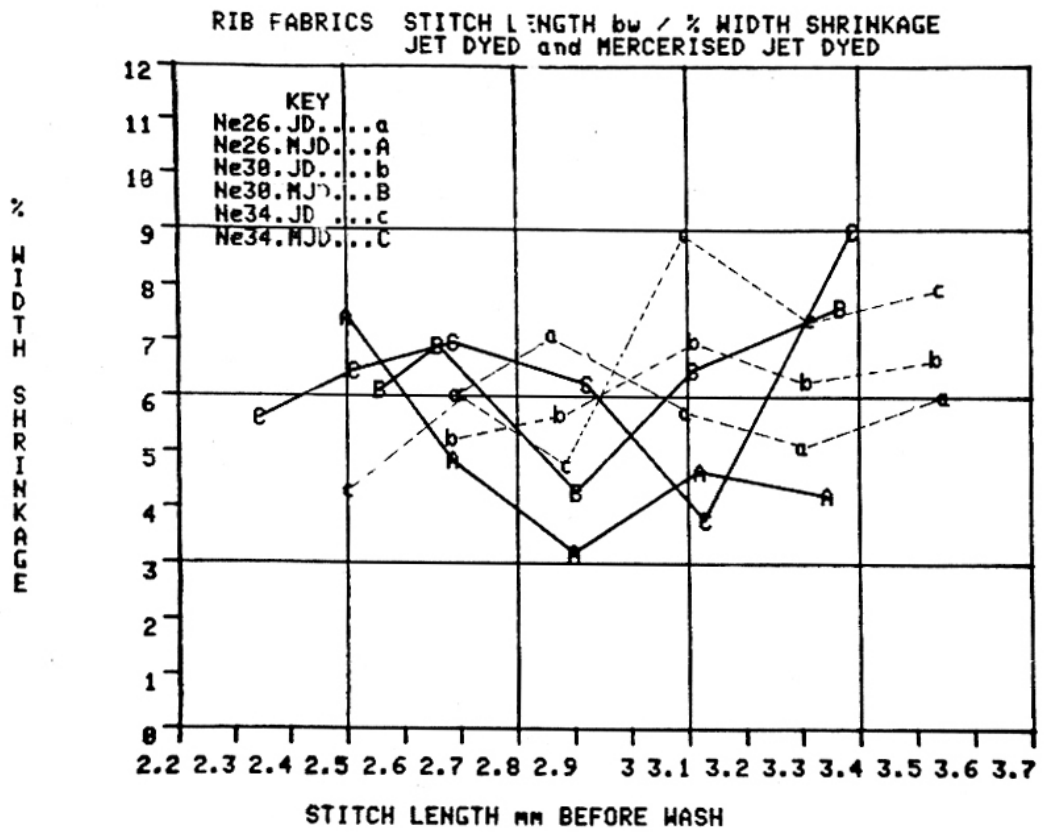


Figure 29



A P P E N D I X

Dye Recipes

1. Unmercerised interlock:-

Procion Red H-E3B	3.13%
Procion Yellow H-E4R	1.67%
Liquor ratio	6.38

2. Mercerised interlock:-

Procion Red H-E3B	3.4%
Procion Yellow H-E4R	1.8%
Liquor ratio	6.31

3. Unmercerised 1 x 1 rib:-

Levafix Navy Blue E4RA	1.42%
Remazol Black B	2.78%
Levafix Brilliant Blue EBRA	0.27%
Liquor ratio	6.20

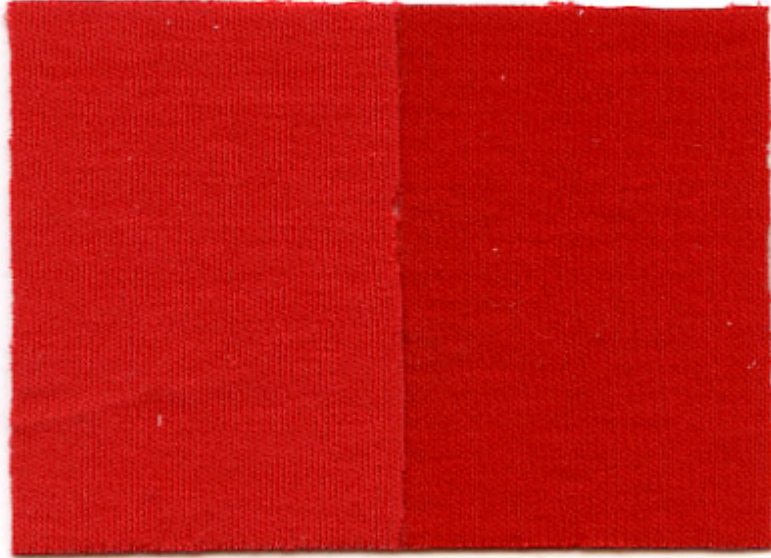
4. Mercerised 1 x 1 rib:-

Levafix Navy Blue E4RA	1.42%
Primazin Black BN	2.78%
Levafix Brilliant Blue EBRA	0.27%
Liquor ratio	7.70

INTERLOCK

Not mercerised

Mercedised



1 x 1 RIB

Not mercerised

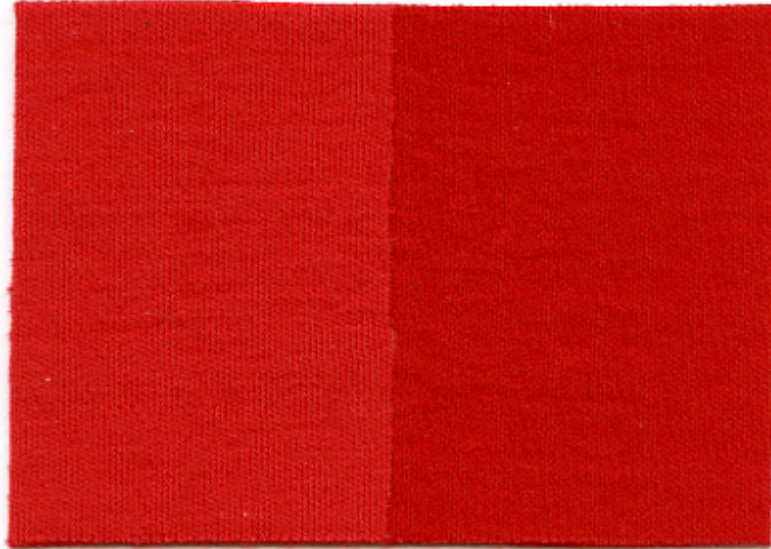
Mercedised



INTERLOCK

Not mercerised

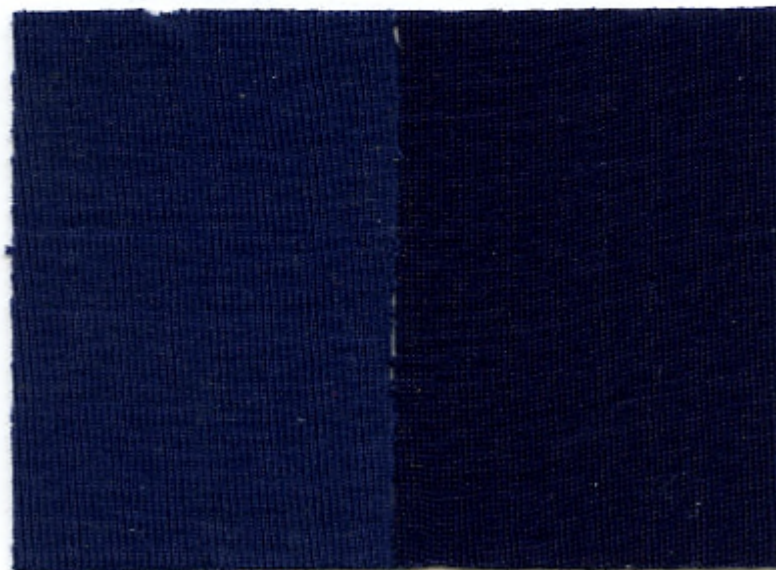
Mercedised



1 x 1 RIB

Not mercerised

Mercedised



Levafix Black EB

	Unmercerised			Pre-Mercerised		
	Rep 1	Rep.2	Rep.3	Rep 1	Rep 2	Rep.3
1%						
2%						
4%						
6%						
9%						
12%						



Procion Blue H-EG

	Unmercerised			Mercerised		
	R.1	2	3	R.1	2	3
1%	[Sample]			[Sample]		
2%	[Sample]			[Sample]		
4%	[Sample]			[Sample]		
6%	[Sample]			[Sample]		
9%	[Sample]			[Sample]		
12%	[Sample]			[Sample]		

All with 100g/l Glaubers Salt  
20g/l Soda Ash.

PROCION YELLOW HE4R

	Un mercerised			Pre-mercerised		
	Rep. 1	2.	3.	Rep. 1	2.	3.
1%						
2%						
4%						
6%						
9%						
12%						

All shades with 100g/l Glaubers Salt  
20g/l Soda Ash.

LEVAFIX NAVY BLUE E4RA

	<u>Unmercerised</u>			<u>Pre-mercerised</u>		
	Rep. 1	Rep. 2	Rep. 3	Rep. 1	Rep. 2	Rep. 3
1%						
2%						
4%						
6%						
9%						
12%						

1% and 2% shade with:  
 { 50g/l Glaubers Salt  
 { 15g/l Soda Ash

4%, 6%, 9% + 12% with  
 { 80g/l Glaubers Salt  
 { 20g/l Soda Ash.

WINCH DYEING OF SINGLE JERSEY COTTON  
EFFECT OF MERCERISING ON COLOUR YIELD

	DYE	CONC. O.W.F.	UNMERCERISED			MERC.
			2%	4%	6%	4%
REACTIVE "M"	PROCION YELLOW MX-GR					
	PROCION RED MX-8B					
	PROCION BLUE MX-R					
REACTIVE "H"	PROCION YELLOW H-4R					
	PROCION BRILL RED H-7BS					
	PROCION BLUE H-4R					
REACTIVE "H-E"	PROCION YELLOW H-E3G					
	PROCION RED H-E3B					
	PROCION BLUE H-E6R					
DIRECT	CHRYSOPHENINE G					
	DURAZOL RED 2B					
	DURAZOL BLUE 8G					
VAT	CALEDON YELLOW 5G		4% 	8% 	12% 	8% 
	CALEDON RED 2G					
SULPHUR	SULPHOSOL BLACK 5G		5% 	10% 	15% 	10% 