

JBS : 1 x 1 RIB FABRICS

S U M M A R Y

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## C O N T E N T S

1. INTRODUCTION
2. RESULTS
3. OBSERVATIONS
  - 3.1. Yarn
  - 3.2. Stitch Length
  - 3.3. Finished Fabric Dimensions
4. COMPARISON WITH STARFISH

TABLES 1-12  
FIGURES 1-46

APPENDIX - IIC TEST REPORT

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## INTRODUCTION

In 1984 the Danish Clothing and Textile Institute (DBTI) signed an agreement with IIC to become the STARFISH user-centre for Denmark. As part of this agreement DBTI undertook to obtain samples of 1 x 1 rib fabric to help expand the database. To do this, DBTI made an arrangement with the company JBS Underbojet A/S, cotton knitters and garment makers of Herning, Denmark, which allowed for samples of their 14 gauge and 22 gauge 1 x 1 rib production to be collected at intervals subject to availability.

During the last two years or so, we have received 54 samples of 14 gauge fabric knitted using Ne 1/24 (27 grey and the corresponding 27 finished from four processing routes) and 52 samples of 22 gauge fabric knitted using Ne 1/60 (26 grey and the corresponding 26 finished from three processing routes). All the finished samples received were processed by Martensens Fabrik A/S of Brandt, the second largest commission dyehouse in Denmark.

In 1986 an interim report based on some of the data obtained from 16 grey and 16 winch bleached samples was prepared in the form of a case study (RR 218) in order to provide both JBS and DBTI with some preliminary feedback from the project. More recently, a series of graphs and tables summarising some of the results from all the samples now received was assembled in preparation for a visit to both DBTI and JBS.

The main objective of this recent series was to illustrate the influence of variations in knitted yarn count and stitch length on fabric dimensions and performance. JBS do not monitor yarn deliveries for count and more importantly they do not measure stitch length/course length on the knitting machines. In addition several different types of bleaching/dyeing machine are utilised by the finisher Martensens. The results were therefore presented in the form of quality control charts which allow the variation between individual samples to be seen compared to the average for each quality. In addition graphs showing the relationship between the STARFISH curves for reference courses and wales compared to the measured data obtained from the JBS fabrics were also prepared.

A summary of these graphs and tables is included in this report along with information concerning the knitting and processing of the individual samples. A full analysis of all the data obtained from the JBS fabrics has not so far been carried out. However, some preliminary observations can be made based on the results presented here.

## 2. RESULTS

Copies of the full IIC test reports on all the samples are included for reference at the back of this report. All the samples were tested both "as received" and after relaxation to the Reference State. Shrinkage, courses and wales were also measured after one cycle of washing and tumble drying.

Tables 1 (14g) and 2 (22g) summarise the knitting/processing details for each sample. Tables 3 (14g) and 4 (22g) summarise the basic yarn test results obtained from the grey fabrics "as received".

The basic STARFISH dimensional data is summarised in Tables 5-8, Figures 1-12 for 14 gauge and Tables 9-12, Figures 13-24 for 22 gauge. Plots showing the correspondence between the STARFISH curves for reference courses and wales and the measured data are shown in Figures 25-45.

### 3. OBSERVATIONS

#### 3.1. Yarn Tables 3 and 4, Figures 1 and 13.

The average results obtained for the Ne 1/24 yarn are Tex = 24.81 (Ne 23.8), s.d. = 0.32, CV% = 1.29 and for the Ne 1/60 yarn, Tex = 9.86 (Ne 59.89), s.d. = 0.19, CV% = 1.92. These indicate that on average the yarns were delivered to specified count although an examination of the tables and figures show some individual differences which can presumably be associated with different deliveries. This is most apparent with the Ne 1/60 yarn, and accounts for the higher level of variation.

The most important point to note however is that the level of twist in the yarns is high. On average English twist factor is calculated to be almost 4.0 for Ne 1/24 and 4.3 for Ne 1/60. Similarly to count, individual differences between deliveries can be seen, particularly from the Ne 1/24 yarn.

The potential influence of variations in yarn count and twist on fabric dimensions was discussed in Research Record 218 in relation to the 14 gauge winch bleached fabrics produced from two different types of yarn.

Twist levels in the Ne 1/60 yarns appear to be more consistent than for the Ne 1/24's although at a much higher level than we have previously experienced.

#### 3.2. Stitch Length Tables 5 and 9, Figures 2 and 14

The variation found in stitch length measured in the grey fabric 'as knitted' illustrates the consequences of inadequate controls on the knitting machine. The fabrics of similar yarn count are supposed to be knitted to the same quality. JBS do not however measure stitch length/course length on the knitting machine and therefore high levels of variation are inevitable. This is particularly apparent for the Ne 1/60 fabrics which were all in fact produced on the same knitting machine although at different times. It is apparent that each time the machine was set up the stitch length was set at different levels. For the 14 gauge fabrics the variation is associated primarily with different machine diameters.

Overall variation for the 14 gauge fabrics was found to be  $\bar{x} = 0.3124$ , s.d. = 0.0061, CV% = 1.95 and for the 22 gauge fabrics,  $\bar{x} = 0.2189$ , s.d. = 0.0082, CV% = 3.75.

### 3.3. Finished Fabric Dimensions Figures 3-10, 15-22

The total variation in the reference state dimensions of the finished fabrics expressed as the coefficient of variation was:-

<u>14 gauge</u>	<u>CV%</u>
courses	2.91
wales	2.93
measured weight	3.75
calculated weight	3.91

<u>22 gauge</u>	<u>CV%</u>
courses	3.98
wales	4.93
measured weight	3.49
calculated weight	3.80

These values reflect the variation found in yarn and stitch length and also the fact that the fabrics were processed through different bleaching/dyeing machines. They suggest that most of the time the dimensions (and therefore the shrinkage) will vary by approximately  $\pm 3\%$  from the intended values and that some of the time the discrepancy will be  $\pm 6\%$  or more.

The variation coefficients for the finished fabrics 'as delivered' give an indication of how well the finisher has coped with the fabric that he has been given. He can not be expected to deliver the fabric with much less variation than is present in the reference state, but a poor finisher can introduce a greater level of variation if his processing is not under good control.

The variability of the dimensions of the finished 'as delivered' fabrics were:

<u>14 gauge</u>	<u>CV%</u>
courses	3.71
wales	1.65
measured weight	4.43
calculated weight	3.79

<u>22 gauge</u>	<u>CV%</u>
courses	4.45
wales	3.48
measured weight	4.32
calculated weight	4.42

It is apparent that the finisher has endeavoured to keep tight control over fabric width. For both fabrics, the CV% for wales is lower in the fabrics 'as delivered' than in the reference state. This has however resulted in increases in the CV% for courses and weight.

The inevitable consequence of the high levels of variation in knitted stitch length coupled with the additional variation introduced by the use of several different bleaching/dyeing machines is that the resulting fabrics exhibit high levels of variation in shrinkage.

This is illustrated in Figures 11, 12 for 14 gauge and Figures 23, 24 for 22 gauge.

#### 4. COMPARISON WITH STARFISH

During the development of the STARFISH Model V87:4.22 a substantial reanalysis of the database was carried out in order to improve the overall accuracy of the prediction equations. For rib fabrics the new equations were developed on a database which had been significantly broadened by the Rib 85 trials and the inclusion of average case study data from JBS and others.

The inclusion of this additional data has resulted in a significant improvement in the overall predictive power of the model for 1 x 1 rib fabrics, particularly those produced from finer counts of yarn.

Figures 25-32 show the JBS finished reference state data for courses and wales compared to the original curves from V84:2.11. Figures 35-42 show the same data compared to the curves for V87:4.22. Figures 33 and 34 show the fit for grey reference state courses and wales. These equations were not revised during the recent reanalysis and are identical to those of V84:2.11. Figures 43-46 show the same data and curves arranged by gauge, 14 gauge and 22 gauge respectively.

Although the inclusion of recent data has improved the overall predictive power of the equations and consequently broadened their range of applicability, two points should be kept in mind for future consideration.

1. Recent data from our own trials and some case studies may have biased the equations towards yarns with higher twist levels than those used in the original CP78 fabrics. So far the influence of yarn twist and/or fibre type on reference dimensions has not been quantified and it has not been taken into account in the development of the current STARFISH equations. There is however an increasing amount of evidence that the influence of twist and/or fibre type may be significant.

2. The current analysis has resulted in equations for winch bleaching and winch dyeing which are modified only by the changes in tex which take place between the two processes. From the evidence of the JBS samples it would appear that this is not sufficient to predict reference dimensions for winch dyed fabrics as precisely as possible. The databases for winch bleached and winch dyed rib fabrics should therefore be reanalysed to ensure that the equations are describing the current data as accurately as possible.

It is also interesting to note that the equations for R-Jet 95 (deep) are apparently predicting the reference state courses and wales of fabrics dyed on ATYC and Gaston County machines with good precision.

## JBS 1x1 RIB FABRICS : SUMMARY

14 GAUGE : NOMINAL Ne 1/24 : FINISHER MARTENSENS FABRIK A/S

## MACHINERY/PROCESSING DETAILS

Sample Ref. No.	Machine No	Gauge	Diam	Needles #2	Design No	Colour
-----						
Winch Bleached (Greek Yarn)						
D6052	34 1	14	14 2	660 *	300	White
D2396	32 2	14	15 3	660	300	"
C8106	32 2	14	15 3	660	300	"
D2417	33 3	14	16 4	696	300	"
C8138	36 4	14	18 5	792	300	"
D2453	36 4	14	18 5	792	300	"
D2350	1 5	14	20 6	876	300	"
D2342	1 5	14	20 6	876	300	"
Winch Bleached (Egyptian Yarn)						
P4903	23 6	15	12 1	564	300	"
P4899	34 1	14	14 2	660 *	300	"
D1532	32 2	14	15 3	660	300	"
D1298	22 7	14	16 4	696	300	"
D1285	33 3	14	16 4	696	300	"
P4976	36 4	14	18 5	792	300	"
D2535	1 5	14	20 6	876	300	"
D2226	26 8	14	22 7	972	300	"
Winch Dyed (Reactive)						
D2439	33 3	14	16 4	696	350	Off White
D6006	33 3	14	16 4	696	350	"
D2360	30 9	14	18 5	792	350	"
D4983	26 8	14	22 7	972	350	"
Overflow Jet Dyed ATYC (Reactive)						
C7983	31 10	14	16 4	696	341	Medium Blue
C7969	30 11	14	18 5	792	341	"
C7944	1 5	14	20 6	876	341	"
Jet Dyed Gaston County (Reactive)						
D2398	34 1	14	14 2	660 *	341	"
D2426	31 10	14	16 4	696	341	"
D2436	33 3	14	16 4	696	341	"
D6005	26 8	14	22 7	972	341	"
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\* Denotes non standard number of needles



## JBS 1x1 RIB FABRICS : SUMMARY

22 GAUGE : NOMINAL Ne 1/60 : FINISHER MARTENSENS FABRIK A/S

## MACHINERY/PROCESSING DETAILS

Sample Ref. No.	Machine No	Gauge	Diam	Needles *2	Design No	Colour
Winch Bleached						
C7998	4	22	16	1104	230	White
B1604	4	22	16	1104	230	"
B1610	4	22	16	1104	230	"
B1611	4	22	16	1104	230	"
B1612	4	22	16	1104	230	"
B1613	4	22	16	1104	230	"
B1614	4	22	16	1104	230	"
B1615	4	22	16	1104	230	"
B1616	4	22	16	1104	230	"
Winch Dyed (Reactive)						
D9983	4	22	16	1104	238	Black
6454	4	22	16	1104	246	Bordeaux
D4920	4	22	16	1104	240	Off White
B2014	4	22	16	1104	261	Light Blue
Overflow Jet Dyed ATYC (Reactive)						
D3851	4	22	16	1104	236	Red
6451	4	22	16	1104	237	Dark Blue
D8668	4	22	16	1104	251	Medium Blue
C7991	4	22	16	1104	251	"
D1632	4	22	16	1104	236	Red
D1551	4	22	16	1104	237	Navy
D1552	4	22	16	1104	237	"
D1553	4	22	16	1104	237	"
D1554	4	22	16	1104	237	"
D1555	4	22	16	1104	237	"
D1556	4	22	16	1104	237	"
D1557	4	22	16	1104	237	"
D1558	4	22	16	1104	237	"

JBS 1x1 RIB FABRICS : SUMMARY

14 GAUGE : NOMINAL Ne 1/24 : GREY FABRIC CONTROLS

IIC TEST DATA : YARN TAKEN FROM GREY FABRIC AS RECEIVED

Sample Ref. No.	Tex	%Ext	SES	TpM	aTex	TFe
-----						
Controls for Winch Bleach (Greek Yarn)						
D6052	24.78	7.55	343	810	40.32	4.21
D2396	24.76	7.16	325	783.5	38.99	4.08
C8106	24.91	7.67	326.5	782	39.03	4.08
D2417	24.66	7.76	355	777.5	38.61	4.04
C8138	25.24	7.79	345.5	807.5	40.57	4.24
D2453	24.5	8.17	345.5	775.5	38.38	4.01
D2350	24.69	7.83	339	767.5	38.14	3.99
D2342	24.48	7.79	340.8	782.5	38.71	4.05
mean	24.75	7.71	340	785.8	39.09	4.09
sd	0.24	0.28	10	15.1	0.89	0.09
-----						
Controls for Winch Bleach (Egyptian Yarn)						
P4903	24.38	6.75	380	726.5	35.87	3.75
P4899	24.59	7.23	398.7	711	35.26	3.69
D1532	24.73	6.48	402.2	744	37	3.87
D1298	24.6	6.73	420.7	727	36.05	3.77
D1285	24.4	7.07	414.3	733.5	36.23	3.79
P4976	24.1	6.88	420.3	704.5	34.58	3.61
D2535	24.91	7.01	420.1	730	36.43	3.81
D2226	25.21	7.38	455.5	713	35.8	3.74
mean	24.61	6.94	414	723.7	35.9	3.75
sd	0.34	0.29	22	13.2	0.74	0.08
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Controls for Winch Dye						
D2439	25.12	8.53	362.6	826	41.4	4.33
D6006	25.49	8.33	354.2	829	41.85	4.37
D2360	25.11	7.86	355.3	740.5	37.1	3.88
D4983	25.16	8.45	364.5	786	39.43	4.12
mean	25.22	8.29	359.1	795.4	39.95	4.18
sd	0.18	0.3	5.1	41.5	2.17	0.23
-----						
Controls for Overflow Jet Dye ATYC						
C7983	24.76	6.89	305.5	758.5	37.74	3.94
C7969	24.94	7.62	321.7	746	37.25	3.89
C7944	24.99	6.84	309.4	771.5	38.57	4.03
mean	24.9	7.12	312.2	758.7	37.85	3.96
sd	0.12	0.44	8.5	12.8	0.67	0.07
-----						
Controls for Jet Dye Gaston County						
D2398	25.12	6.39	318.8	769.5	38.57	4.03
D2426	24.63	6.71	309.5	795	39.45	4.12
D2436	25.1	6.66	302.9	757.5	37.95	3.97
D6005	24.62	7.44	314.2	746	37.02	3.87
mean	24.87	6.8	311.3	767	38.25	4
sd	0.28	0.45	6.8	21	1.03	0.11
mean	24.81	7.37	357.4	763	38.01	3.97
sd	0.32	0.61	42.6	34.2	1.84	0.19
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1) aTex = alpha Tex (TpM/100\*SqrTex)  
 2) TFe = English Twist Factor (aTex/9.567)

## JBS 1x1 RIB FABRICS : SUMMARY

22 GAUGE : NOMINAL Ne 1/60 : GREY FABRIC CONTROLS

IIC TEST DATA : YARN TAKEN FROM GREY FABRIC AS RECEIVED

Sample Ref. No.	Tex	%Ext	SES	TpM	aTex	TFe
Control for Winch Bleach (1)						
C7998	9.7	5.96	127.7	1323	41.21	4.31
Controls for Winch Bleach (2)						
B1604	9.98	5.98	131.2	1296.5	40.95	4.28
B1610	9.92	6.09	138	1297.5	40.86	4.27
B1611	9.93	6.4	138	1342.5	42.31	4.42
B1612	10.05	5.62	123.9	1263	40.04	4.19
B1613	9.92	6.19	137.2	1287	40.53	4.24
B1614	9.98	6.22	141.4	1346.5	42.55	4.45
B1615	9.84	6	134.7	1239	38.86	4.06
B1616	10.06	5.93	134.9	1345	42.67	4.46
mean	9.93	6.04	134.1	1304.4	41.11	4.3
sd	0.11	0.22	5.6	38.1	1.25	0.13
Controls for Winch Dye						
D9983	9.77	5.94	128.2	1317	41.16	4.3
6454	9.79	6.44	136.9	1299	40.65	4.25
D4920	9.8	6.19	129.8	1325	41.47	4.34
B2014	9.76	6.56	137.5	1443.5	45.09	4.71
mean	9.78	6.28	133.1	1346.1	42.09	4.4
sd	0.02	0.28	4.8	65.8	2.03	0.21
Controls for Overflow Jet Dye ATYC (1)						
D3851	9.48	5.59	124.9	1319.5	40.62	4.25
6451	9.57	5.53	124.6	1252.5	38.74	4.05
D8668	9.54	5.71	131.8	1303	40.24	4.21
C7991	9.49	5.65	124.9	1294	39.87	4.17
D1632	9.61	5.47	127.8	1282.5	39.77	4.16
mean	9.54	5.59	126.8	1290.3	39.85	4.17
sd	0.06	0.1	3.1	25.1	0.71	0.07
Controls for Overflow Jet Dye ATYC (2)						
D1551	10.01	6.08	139.3	1297.5	41.05	4.29
D1552	9.92	6.06	142.3	1330	41.89	4.38
D1553	10.04	6.27	152.3	1322.5	41.91	4.38
D1554	10.03	6.32	151.9	1277.5	40.45	4.23
D1555	10.04	5.99	139.1	1298.5	41.15	4.3
D1556	10.04	6.51	151.1	1365.5	43.26	4.52
D1557	10.04	5.9	137.5	1277	40.46	4.23
D1558	9.96	6.12	143.9	1341.5	42.35	4.43
mean	10.01	6.16	144.7	1313.8	41.56	4.34
sd	0.05	0.2	6.2	31.5	0.97	0.1
mean	9.86	6.03	135.8	1311	41.16	4.3
sd	0.19	0.3	8.3	40.8	1.37	0.14

1) aTex = alpha Tex (TpM/100\*SqrTex)

2) TFe = English Twist Factor (aTex/9.567)

## JBS 1 x 1 RIB FABRICS SUMMARY

14 GAUGE : NOMINAL YARN COUNT Ne 1/24 : GREY FABRIC CONTROLS

IIC TEST DATA : GREY FABRIC AS RECEIVED

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt
-----						
Controls for Winch Bleach						
D6052	24.78	0.3111	13.97	8.45	174.84	182.04
D2396	24.76	0.3089	13.83	8.73	187.07	184.83
C8106	24.91	0.3156	13.5	8.77	181.35	186.12
D2417	24.66	0.3086	13.9	8.73	186.86	184.76
C8138	25.24	0.3153	13.93	8.8	193.49	195.19
D2453	24.5	0.3157	13.63	8.73	192.2	184.17
D2350	24.69	0.3181	13.67	8.65	178.48	185.73
D2342	24.48	0.3172	13.6	8.6	179.31	181.62
P4903	24.38	0.33	12.47	9.7	189.34	194.57
P4899	24.59	0.3114	14	8.37	175.45	179.45
D1532	24.73	0.3087	14.37	8.7	195.8	190.83
D1298	24.6	0.3199	13.7	8.33	181.55	179.64
D1285	24.4	0.3095	14.03	8.83	186.5	187.27
P4976	24.1	0.2939	14.6	8.47	177.02	175.1
D2535	24.91	0.3124	14.27	8.57	191.75	190.23
D2226	25.21	0.3086	14.4	8.57	191.23	191.91
mean	24.68	0.3128	13.87	8.69	185.14	185.84
sd	0.3	0.0076	0.49	0.31	6.89	5.65
-----						
Controls for Winch Dye						
D2439	25.12	0.3088	14.4	8.79	195.54	196.46
D6006	25.49	0.3087	14.47	8.5	194.16	193.54
D2360	25.11	0.3109	13.9	9.03	189.94	196.05
D4983	25.16	0.3129	14.2	8.43	187.17	188.61
mean	25.22	0.3104	14.24	8.69	191.7	193.67
sd	0.18	0.002	0.25	0.28	3.85	3.61
-----						
Controls for ATYC Dye						
C7983	24.76	0.3145	14.2	8.82	187.22	194.97
C7969	24.94	0.3164	13.93	9	190.46	197.92
C7944	24.99	0.3157	14.2	8.99	191.13	201.51
mean	24.9	0.3156	14.11	8.94	189.61	198.13
sd	0.12	1.0E-3	0.15	0.1	2.09	3.28
-----						
Controls for Gaston County Dye						
D2398	25.12	0.3095	14.33	8.68	184.32	193.55
D2426	24.63	0.3137	14.13	8.75	186.1	191.1
D2436	25.1	0.3078	14.5	8.82	189.37	197.6
D6005	24.62	0.3097	14.43	8.6	184.69	189.31
mean	24.87	0.3102	14.35	8.71	186.12	192.89
sd	0.28	0.0025	0.16	0.09	2.3	3.59
mean	24.81	0.3124	14.02	8.72	186.75	189.41
sd	0.32	0.0061	0.44	0.27	6.03	6.6

## JBS 1x1 RIB FABRICS : SUMMARY

14 GAUGE : NOMINAL Ne 1/24 : GREY FABRIC

IIC TEST DATA : GREY FABRIC REFERENCE STATE

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt	5*LS%	5*WS%
-----								
Controls for Winch Bleach								
D6052	24.66	0.3072	17.25	10.35	258.54	270.48	20.67	22.58
D2396	24.16	0.3031	17.37	10.23	256.01	260.29	20.84	16.83
C8106	24.44	0.3097	16.93	10.3	259.02	264.04	21.76	15.84
D2417	24.84	0.3026	17.1	10.33	255.05	265.62	21.06	16.83
C8138	25.01	0.3066	17.33	10.3	263.74	273.82	20.38	14.96
D2453	24.13	0.3096	17.17	10.3	253.18	264.24	21.31	15.85
D2350	24.46	0.3112	17.03	10.33	256.37	268.01	20.23	15.82
D2342	24.27	0.3129	16.87	10.17	250.94	260.47	20.5	15.97
P4903	23.94	0.3249	15.67	10.17	234.67	247.81	20.14	3.94
P4899	24.25	0.3106	16.78	10.35	249.31	261.64	16.96	18.17
D1532	24.68	0.3046	17.2	10.47	262.18	270.72	15.94	16
D1298	23.92	0.3165	16.6	10.2	248.05	256.38	16.26	18.04
D1285	23.85	0.3053	17.1	10.57	252.82	263.19	16.75	15.62
P4976	23.84	0.2941	17.9	10.87	262.02	272.84	18.4	21.43
D2535	24.51	0.3101	17.03	10.37	258.85	268.45	15.57	16.56
D2226	25.21	0.3056	17.2	10.47	263.6	277.42	15.54	17.71
mean	24.39	0.3084	17.03	10.36	255.27	265.34	18.9	16.38
sd	0.42	0.0067	0.46	0.17	7.37	7.32	2.31	3.92
-----								
Controls for Winch Dye								
D2439	24.74	0.3012	17.87	10.8	278.93	287.66	20.76	19.13
D6006	24.83	0.3028	17.97	10.57	281.1	285.53	20.73	19.3
D2360	24.59	0.3048	17.57	10.33	262.6	272.1	21.48	12.95
D4983	25.06	0.3063	17.55	10.43	267.13	281.09	19.64	20.81
mean	24.81	0.3038	17.74	10.53	272.44	281.6	20.65	18.05
sd	0.2	0.0022	0.21	0.2	8.98	6.9	0.76	3.48
-----								
Controls for ATVC Dye								
C7983	24.74	0.3083	17.3	10.42	267.96	274.92	19.74	18.4
C7969	24.16	0.3031	17.37	10.23	256.01	260.29	20.84	16.83
C7944	24.88	0.3101	17.37	10.35	268.13	277.29	19.77	15.6
mean	24.59	0.3072	17.34	10.33	264.04	270.83	20.12	16.94
sd	0.38	0.0036	0.04	0.09	6.95	9.21	0.62	1.4
-----								
Controls for Gaston County Dye								
D2398	24.31	0.307	17.67	10.57	264.58	278.62	21.15	19.35
D2426	24.56	0.3083	17.33	10.47	260.99	274.68	20.41	17.65
D2436	24.51	0.3025	17.43	10.5	262.01	271.48	19.94	18.11
D6005	24.51	0.3036	17.6	10.6	265.93	277.71	19.93	19.86
mean	24.47	0.3053	17.51	10.53	263.38	275.62	20.36	18.74
sd	0.11	0.0027	0.15	0.06	2.27	3.24	0.57	1.04
mean	24.48	0.3072	17.24	10.41	259.99	269.88	19.51	17.04
sd	0.37	0.0056	0.46	0.17	9.28	9.12	1.95	3.38
=====								

## JBS 1x1 RIB FABRICS SUMMARY

14 GAUGE : NOMINAL YARN COUNT Ne 1/24 : FINISHED FABRIC

IIC TEST DATA : FINISHED FABRIC AS RECEIVED

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt
-----						
Winch Bleached						
D6052	24.15	0.3079	14.47	9	190.18	193.6
D2396	23.98	0.3043	14.67	8.93	183.7	191.2
C8106	23.65	0.3098	14.17	9.3	193.34	193.05
D2417	24.17	0.3037	14.7	9.07	193.35	195.67
C8138	24.51	0.3082	14.53	8.93	190.12	196.14
D2453	23.95	0.3083	14.73	8.97	189.74	195.2
D2350	24.03	0.3114	14.43	9.07	188.01	195.91
D2342	24.02	0.312	14.23	8.87	182.22	189.22
P4903	23.26	0.3263	12.8	9	171.6	174.85
P4899	23.76	0.3088	14.42	9.05	177.78	191.48
D1532	24.19	0.3051	14.73	8.83	186.12	192.11
D1298	24.5	0.3145	14.02	9.15	188.11	197.62
D1285	24.06	0.3062	14.43	9.13	187.98	194.26
P4976	23.35	0.2939	15.33	9.13	182.12	192.23
D2535	24.17	0.3083	14.27	9.33	196	198.41
D2226	23.87	0.3064	14.7	9.27	194.32	199.21
mean	23.98	0.3084	14.41	9.06	187.17	193.14
sd	0.35	0.0066	0.53	0.15	6.46	5.61
Winch Dyed						
D2439	24.69	0.3024	14.43	9.02	193.02	194.34
D6006	24.92	0.3024	15.17	9	196.28	205.71
D2360	24.45	0.3052	14	9	187.56	188.08
D4983	25.17	0.3076	14.33	9.22	199.51	204.6
mean	24.81	0.3044	14.48	9.06	194.09	198.18
sd	0.31	0.0025	0.49	0.11	5.1	8.46
ATYC Dyed						
C7983	24.44	0.3069	14.93	8.97	205.62	200.92
C7969	24.25	0.3104	13.97	9.43	192.87	198.37
C7944	24.67	0.31	15	8.95	204.94	205.38
mean	24.45	0.3091	14.63	9.12	201.14	201.55
sd	0.21	0.0019	0.58	0.27	7.17	3.55
Gaston County Dyed						
D2398	24.39	0.3031	15.37	8.97	202.14	203.88
D2426	24.34	0.3075	15.17	9.3	204.12	211.15
D2436	24.32	0.3019	15.07	9.26	201.22	204.86
D6005	24.71	0.3025	15.23	9.13	201.84	208.04
mean	24.44	0.3038	15.21	9.17	202.33	206.98
sd	0.18	0.0025	0.13	0.15	1.25	3.3
mean	24.22	0.3072	14.57	9.08	191.99	196.87
sd	0.44	0.0056	0.54	0.15	8.5	7.47

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## JBS 1x1 RIB FABRICS : SUMMARY

14 GAUGE : NOMINAL Ne 1/24 : FINISHED FABRIC

IIC TEST DATA : FINISHED FABRIC REFERENCE STATE

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt	5*LS%	5*WS%
-----								
Sample								
-----								
Winch Bleached								
D6052	24.02	0.3051	16.73	10.27	247.12	251.8	13.47	14.7
D2396	23.81	0.3027	16.77	10.1	237.17	244.08	13.77	15.64
CB106	23.49	0.3102	16.37	10.2	238.24	243.21	13.62	10.41
D2417	24.25	0.3012	16.6	10.47	240.89	253.83	13.41	15.2
CB138	24.36	0.3064	16.65	9.95	238.2	247.32	12.31	12.16
D2453	23.86	0.3068	16.67	9.93	237.25	242.41	12.82	12.47
D2350	24.1	0.3087	16.28	10.05	234.75	243.55	13.15	13.07
D2342	23.89	0.3095	16.28	9.91	232.68	238.69	13.86	12.58
P4903	23.39	0.3228	14.87	10.17	219.98	228.26	13.87	10.13
P4899	23.33	0.3082	15.97	10.3	226.77	236.51	10.94	12.81
D1532	24.06	0.3025	16.4	10.57	241.31	252.3	9.84	15.28
D1298	24.3	0.3132	15.57	9.9	235.18	234.62	11.86	10.13
D1285	24.02	0.3041	16.27	10.4	236.75	247.11	11.2	11.31
P4976	23.01	0.2918	17.33	10.9	242.05	253.72	10.23	15.1
D2535	24.03	0.3073	16.2	10.43	238.96	249.71	11.05	7.41
D2226	24.25	0.3031	16.17	10.23	239.01	243.18	10.37	11.52
mean	23.89	0.3065	16.32	10.24	236.65	244.39	12.24	12.49
sd	0.39	0.0065	0.55	0.27	6.28	7.28	1.44	2.32
-----								
Winch Dyed								
1.59								
D2439	24.69	0.3002	16.85	10.67	257.26	266.41	13.04	16.14
D6006	24.34	0.3008	17.07	10.9	262.65	272.44	12.57	16.28
D2360	24.22	0.3035	16.57	10.45	244.71	254.48	13.57	10.85
D4983	25.02	0.3053	16.7	10.5	254.5	267.82	11.78	14.28
mean	24.57	0.3025	16.8	10.63	254.78	265.29	12.74	14.39
sd	0.36	0.0024	0.21	0.2	7.52	7.65	0.76	2.53
-----								
ATYC Dyed								
1.58								
C7983	24.44	0.3068	16.37	9.93	249.74	243.81	9.7	12.26
C7969	24.44	0.3079	16.37	10.17	241.26	250.42	14.45	8.68
C7944	24.89	0.3075	16.93	9.77	243.69	253.17	10.56	7.71
mean	24.59	0.3074	16.56	9.96	244.9	249.14	11.57	9.55
sd	0.26	6.0E-4	0.33	0.2	4.37	4.81	2.53	2.39
-----								
Gaston County Dyed								
1.66								
D2398	24.48	0.3051	16.57	10.17	250.47	251.56	10.09	11.79
D2426	24.52	0.3072	16.5	10	244.66	248.61	10.24	9.14
D2436	24.3	0.3005	16.83	10.3	252.64	253.24	12.05	9.9
D6005	24.29	0.3007	16.83	9.97	245.98	245.1	12.88	8.85
mean	24.4	0.3034	16.68	10.11	248.44	249.63	11.32	9.92
sd	0.12	0.0033	0.18	0.15	3.75	3.58	1.37	1.33
mean	24.14	0.3055	16.47	10.24	242	248.79	12.1	12.07
sd	0.46	0.0054	0.48	0.3	9.08	9.72	1.48	2.62
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## JBS 1x1 RIB FABRICS SUMMARY

22 GAUGE : NOMINAL YARN COUNT Ne 1/60 : GREY FABRIC CONTROLS

IIC TEST DATA : GREY FABRIC AS RECEIVED

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt
-----						
Controls for Winch Bleach						
C7998	9.7	0.2093	20.13	12.47	100.68	101.95
B1604	9.98	0.2206	18.7	12.73	108.1	104.84
B1610	9.92	0.2209	18.95	12.72	106.35	105.57
B1611	9.93	0.2216	18.98	12.87	105.38	107.5
B1612	10.05	0.2211	19.22	12.52	107.32	106.92
B1613	9.92	0.2213	18.88	12.57	105.59	104.17
B1614	9.98	0.221	18.85	12.57	106.83	104.54
B1615	9.84	0.2212	18.77	12.62	105.65	103.04
B1616	10.06	0.2209	18.93	12.57	108.33	105.76
mean	9.96	0.2211	18.91	12.64	106.69	105.29
sd	0.07	3.0E-4	0.16	0.12	1.15	1.46
-----						
Controls for Winch Dye						
D9983	9.77	0.2087	20.57	12.07	99.91	101.18
6454	9.79	0.2079	20.5	12.17	101.26	101.54
D4920	9.8	0.2087	20.43	12.03	98.53	100.54
B2014	9.76	0.2094	20.67	12.37	106.51	104.45
mean	9.78	0.2087	20.54	12.16	101.55	101.93
sd	0.02	6.0E-4	0.1	0.15	3.49	1.73
-----						
Controls for ATYC Dye						
D3851	9.48	0.209	21.07	12.53	101.31	104.61
6451	9.57	0.2086	20.8	12.4	100.99	102.96
D8668	9.54	0.2089	20.6	12.8	100.46	105.08
C7991	9.49	0.2158	20.2	12.93	103.3	107.06
mean	9.52	0.2106	20.67	12.67	101.51	104.93
sd	0.04	0.0035	0.37	0.24	1.24	1.69
-----						
D1632	9.61	0.2086	20.97	12.53	104.79	105.4
D1551	10.01	0.2283	18.47	13.17	108.4	111.12
D1552	9.92	0.229	18.23	12.9	104.8	106.88
D1553	10.04	0.2288	18.3	12.63	105.55	106.25
D1554	10.03	0.2277	18.33	12.77	108.09	106.85
D1555	10.04	0.2285	18.27	12.87	106.22	107.88
D1556	10.04	0.2282	18.43	12.8	107.3	108.09
D1557	10.04	0.2287	18.33	12.87	109.06	108.32
D1558	9.96	0.2278	18.37	13	108.61	108.4
mean	9.97	0.2262	18.63	12.84	106.98	107.69
sd	0.14	0.0066	0.88	0.19	1.68	1.64
mean	9.86	0.2189	19.38	12.63	104.97	105.42
sd	0.19	0.0082	1.02	0.28	3.14	2.55
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1.93 3.75



## JBS 1x1 RIB FABRICS SUMMARY

22 GAUGE : NOMINAL YARN COUNT Ne 1/60 : GREY FABRIC CONTROLS

IIC TEST DATA : GREY FABRIC REFERENCE STATE

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt	5*LS%	5*WS%
-----								
Controls for Winch Bleach								
C7998	9.41	0.205	25.3	15.83	151.99	154.58	20.32	20.36
B1604	9.71	0.217	23.18	14.82	150.15	144.68	20.44	13.61
B1610	9.7	0.2176	23.3	14.68	149.03	144.44	20.38	14.62
B1611	9.71	0.2173	23.22	15.05	150.3	147.49	20.05	14.76
B1612	9.8	0.2176	23.83	14.82	151.49	150.68	18.99	14.4
B1613	9.74	0.217	23.53	14.88	150.57	148.12	20.22	14.71
B1614	9.89	0.2166	23.48	14.88	150.05	149.7	19.6	14.5
B1615	9.64	0.2175	23.67	14.98	148.77	148.69	20.16	14.32
B1616	9.69	0.2178	23.78	14.95	149.99	150.08	19.91	13.35
mean	9.74	0.2173	23.5	14.88	150.04	147.99	19.97	14.28
sd	0.08	4.0E-4	0.25	0.11	0.85	2.35	0.48	0.52
Controls for Winch Dye								
D9983	9.66	0.2055	25.33	15.63	150.82	157.31	19.71	24.09
6454	9.56	0.2053	25.37	15.97	152.11	159.01	19.48	23.83
D4920	9.72	0.2059	25.15	15.93	154.85	160.43	19.66	24.23
B2014	9.49	0.206	25.23	15.7	157.65	154.82	17.76	21.42
mean	9.61	0.2057	25.27	15.81	153.86	157.89	19.16	23.39
sd	0.1	3.0E-4	0.1	0.17	3.03	2.41	0.93	1.32
Controls for ATYC Dye								
D3851	9.67	0.2048	25.07	15.7	152	155.89	19.13	23.12
6451	9.51	0.2049	25.32	15.95	152.48	157.44	20.05	23.54
D8668✓	9.48	0.2055	25.02	15.85	151.52	154.6	19.53	22.9
C7991	9.44	0.2119	24.42	15.53	146.44	151.75	18.91	18.19
mean	9.53	0.2068	24.95	15.76	150.61	154.92	19.4	21.94
sd	0.1	0.0034	0.38	0.18	2.81	2.41	0.5	2.51
D1632	9.54	0.2055	25.7	15.57	148.92	156.95	18.65	21.25
D1551	9.71	0.2259	22.87	14.57	142.37	146.19	20.39	9.7
D1552	9.8	0.2261	22.73	14.7	143.14	148.11	20.88	12.21
D1553	9.91	0.2263	22.73	14.63	145.2	149.27	20.91	13.63
D1554	10.07	0.226	22.67	14.5	144.79	149.64	20.32	12.44
D1555	9.81	0.2263	22.67	14.5	144.76	145.96	20.91	12.25
D1556	9.9	0.2268	22.8	14.63	145.05	149.74	20.18	13.3
D1557	9.81	0.2262	22.67	14.57	145.12	146.5	19.73	11.59
D1558	9.86	0.2262	23	14.47	143.41	148.5	20.63	10.57
mean	9.82	0.2239	23.09	14.68	144.75	148.98	20.29	12.99
sd	0.14	0.0069	0.98	0.34	1.87	3.33	0.73	3.33
mean	9.7	0.2157	23.92	15.13	148.96	151.18	19.88	16.65
sd	0.16	0.0087	1.09	0.54	3.84	4.63	0.75	4.85

4.56 3.56 2.58 3.77 29.13

JBS 1x1 RIB FABRICS SUMMARY

22 GAUGE : NOMINAL YARN COUNT Ne 1/60 : FINISHED FABRIC

IIC TEST DATA : FINISHED FABRIC AS RECEIVED

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt
-----						
Winch Bleached						
C7998	9.39	0.2049	20.67	13.97	104.83	111.06
B1604	9.76	0.2185	19.63	14.93	118.67	125.1
B1610	9.75	0.2179	19.12	14.55	112.68	118.21
B1611	9.7	0.2185	19.07	14.83	115.14	119.83
B1612	9.69	0.2182	19.47	14.4	113.86	118.58
B1613	9.55	0.2254	18.43	14.2	115.64	112.68
B1614	9.64	0.219	19.3	14.9	117.37	121.38
B1615	9.69	0.218	19.33	14.27	117.17	116.48
B1616	9.62	0.2185	19.23	14.8	118.68	119.72
mean	9.68	0.2192	19.2	14.61	116.15	119
sd	0.07	0.0025	0.36	0.29	2.2	3.61
Winch Dyed						
D9983	9.66	0.2059	20.83	15.4	124.82	127.63
6454	9.81	0.2055	20.27	14.73	121.88	120.36
D4920	9.52	0.2045	20.33	14.37	112.39	113.72
B2014	9.62	0.2058	20.27	15.17	120.37	121.72
mean	9.65	0.2055	20.42	14.92	119.86	120.86
sd	0.12	6.0E-4	0.27	0.46	5.32	5.71
ATYC Dyed						
D3851	9.61	0.2051	21.53	14.37	120.32	121.95
6451	9.64	0.2041	21.6	13.63	115.17	115.88
D8668	9.37	0.2062	21.67	14.3	116.52	119.75
C7991	9.31	0.2124	20.53	14.4	112.77	116.88
mean	9.48	0.2069	21.33	14.17	116.2	118.62
sd	0.17	0.0037	0.54	0.36	3.16	2.76
D1632	9.8	0.2055	22.27	14.9	131.88	133.64
D1551	10.03	0.225	20.03	13.68	119.31	123.74
D1552	9.92	0.2249	19.83	14.03	121.21	124.25
D1553	9.92	0.2257	20.33	13.8	120.72	125.71
D1554	10.04	0.225	20.37	13.87	121.28	127.63
D1555	9.84	0.2259	19.83	14.17	118.66	124.88
D1556	9.91	0.2253	20.03	13.4	119	119.94
D1557	9.91	0.2247	20.07	14.07	122.97	125.69
D1558	10.02	0.2253	20.4	14.1	123.58	129.81
mean	9.93	0.2231	20.35	14	122.07	126.14
sd	0.08	0.0066	0.75	0.41	4.05	3.9
mean	9.72	0.216	20.17	14.35	118.34	121.39
sd	0.2	0.0086	0.9	0.5	5.11	5.37
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## JBS 1x1 RIB FABRICS SUMMARY

22 GAUGE : NOMINAL YARN COUNT Ne 1/60 : FINISHED FABRIC

IIC TEST DATA : FINISHED FABRIC REFERENCE STATE

Sample Ref. No.	Tex	SL cm	C/cm	W/cm	Wt gsm	CalcWt	5*LS%	5*WS%
-----								
Winch Bleached								
C7998	9.37	0.2045	23.63	15.73	135.32	142.49	11.7	14.42
B1604	9.79	0.2177	22.07	15.5	140.71	145.74	12	4.14
B1610	9.63	0.217	22.2	15.6	139.84	144.69	13.1	4.03
B1611	9.65	0.2176	22	15.53	140.84	143.56	13.41	5.22
B1612	9.57	0.218	22.2	15.32	139.33	141.83	12.02	5.07
B1613	9.45	0.2246	21.5	15.13	136.59	138.13	13.04	4.09
B1614	9.63	0.2174	22.17	15.43	138.87	143.24	13.1	5.37
B1615	9.59	0.2173	22.1	15.28	137.59	140.78	12.15	5.67
B1616	9.64	0.2163	22.2	15.47	141.1	143.22	12.18	5.32
mean	9.62	0.2182	22.05	15.41	139.36	142.65	12.63	4.86
sd	0.09	0.0026	0.24	0.15	1.62	2.39	0.59	0.67
-----								
Winch Dyed								
D9983	9.79	0.205	23.23	16.73	150.19	156.09	10.31	9.69
6454	9.84	0.2048	23.5	16.63	152.05	157.53	14.19	10.76
D4920	9.5	0.2039	23.57	16.63	146.55	151.82	12.66	11.42
B2014	9.85	0.2044	23.03	16.25	142.55	150.67	12.28	8.83
mean	9.74	0.2046	23.33	16.56	147.84	154.03	12.36	10.17
sd	0.17	5.0E-4	0.25	0.21	4.2	3.3	1.6	1.15
-----								
ATYC Dyed								
D3851	9.54	0.2055	23.92	16.45	149.64	154.24	10.66	13.87
6451	9.42	0.2054	24.17	15.47	142.87	144.68	8.15	13.88
D8668	9.38	0.2055	24.17	15.93	142.33	148.5	9.53	11.15
C7991	9.27	0.2119	22.55	15.77	133.66	139.67	11.02	10.64
mean	9.4	0.2071	23.7	15.9	142.12	146.77	9.84	12.38
sd	0.11	0.0032	0.78	0.41	6.55	6.16	1.3	1.73
-----								
D1632	9.54	0.2052	24.5	15.97	151.52	153.11	8.96	7.72
D1551	9.86	0.2252	22.07	14.27	137.72	139.78	9.07	5
D1552	9.84	0.2241	22	14.43	137.41	140.06	10.07	3.89
D1553	10.02	0.2248	21.87	14.57	137.72	143.59	7.89	4.62
D1554	9.89	0.2253	21.87	14.43	139.55	140.64	7.26	4.99
D1555	9.91	0.2251	21.63	14.87	139.35	143.54	7.47	6.23
D1556	9.77	0.2251	22.23	14.23	137.34	139.18	8.81	3.63
D1557	10.02	0.2243	21.73	14.9	142.03	145.63	8.17	3.55
D1558	9.91	0.225	21.97	14.47	141.14	141.67	6.87	3.32
mean	9.86	0.2227	22.21	14.68	140.42	143.02	8.29	4.77
sd	0.15	0.0066	0.88	0.53	4.49	4.34	1.02	1.44
mean	9.68	0.2154	22.62	15.42	141.3	145.16	10.62	7.17
sd	0.21	0.0086	0.9	0.76	4.93	5.52	2.2	3.6
=====								

3.98 4.93

1.467

JBS 1x1 RIB : GREY FABRIC CONTROLS : AS KNITTED

Nominal Yarn Count Ne 1/24 (24.6 Tex)

Tex GBW

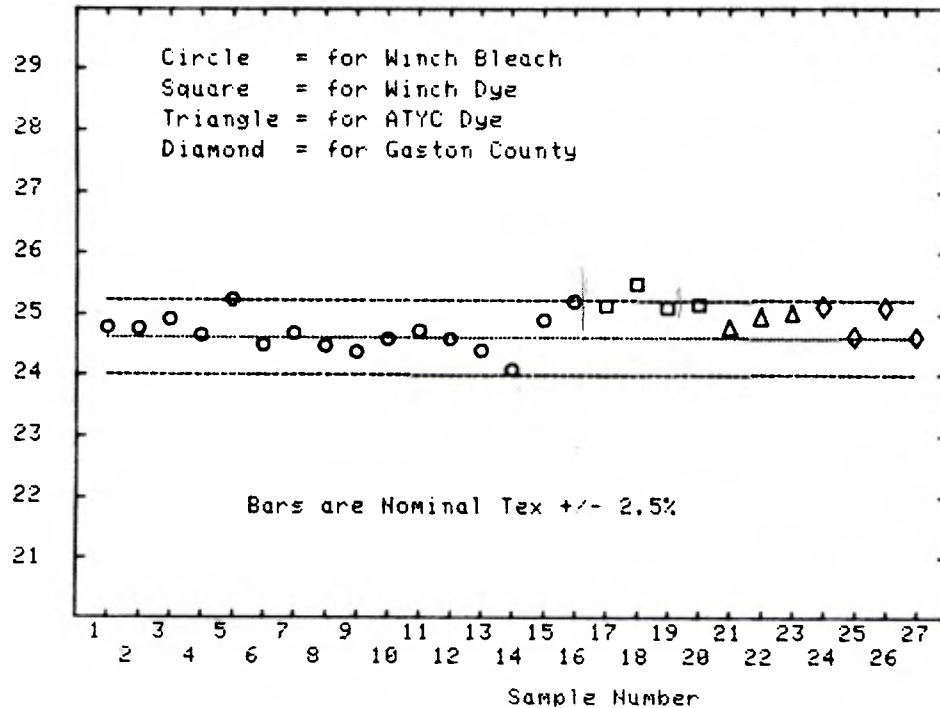


FIGURE 1

JBS 14g 1x1 RIB : GREY FABRIC CONTROLS : AS KNITTED

Stitch Length cm GBW

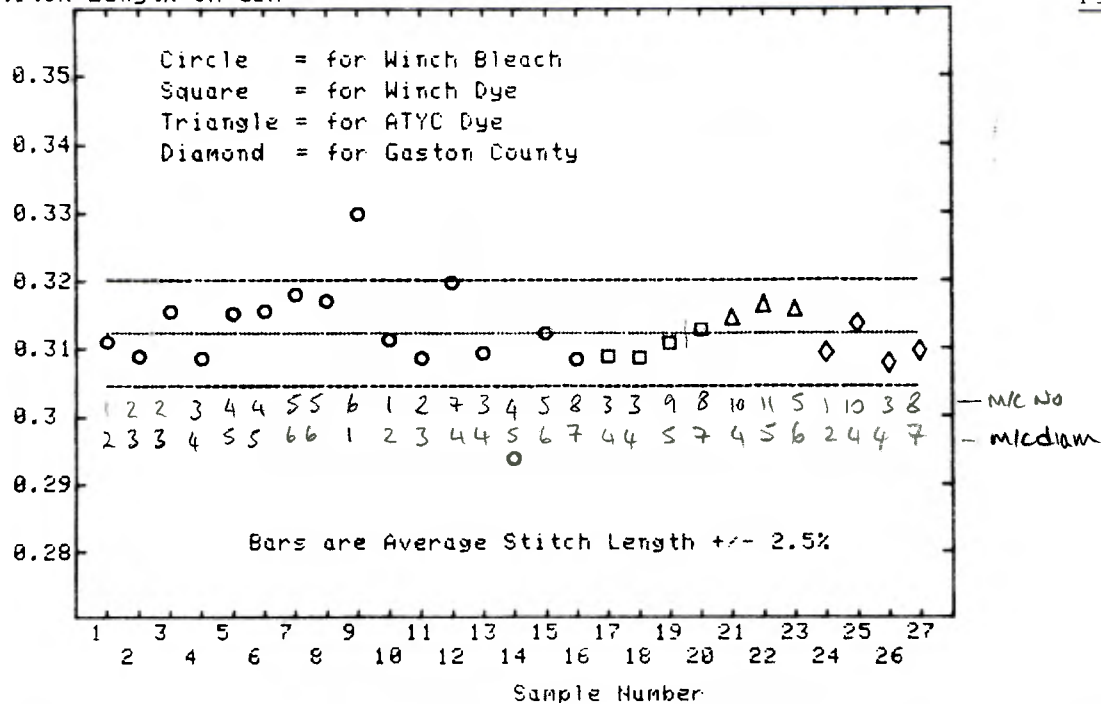


FIGURE 2

JBS 14g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Courses/cm FBW

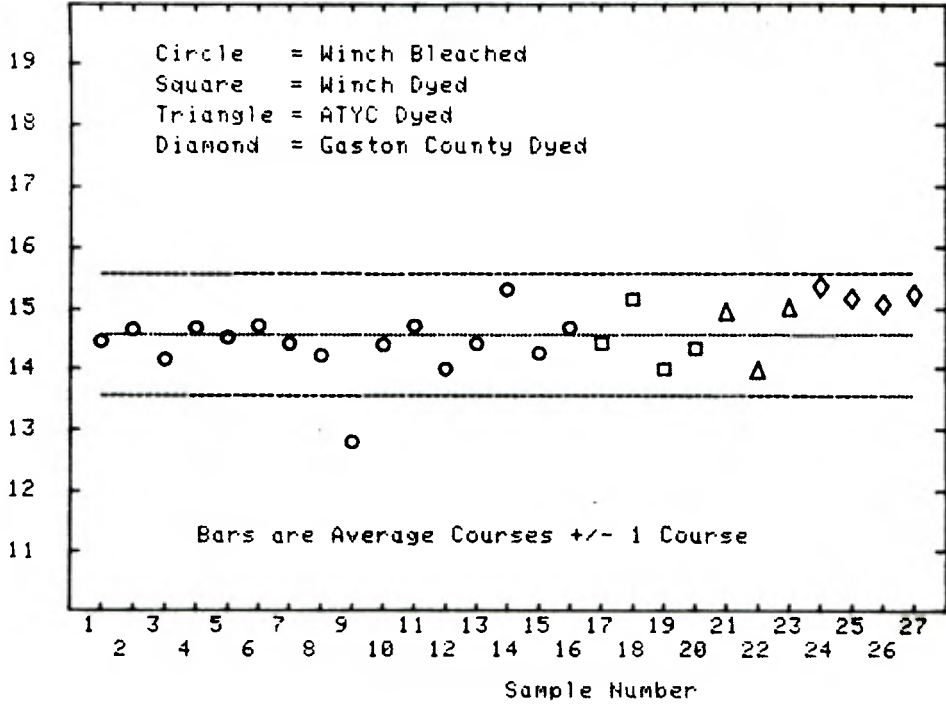


FIGURE 3

JBS 14g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Wales/cm FBW

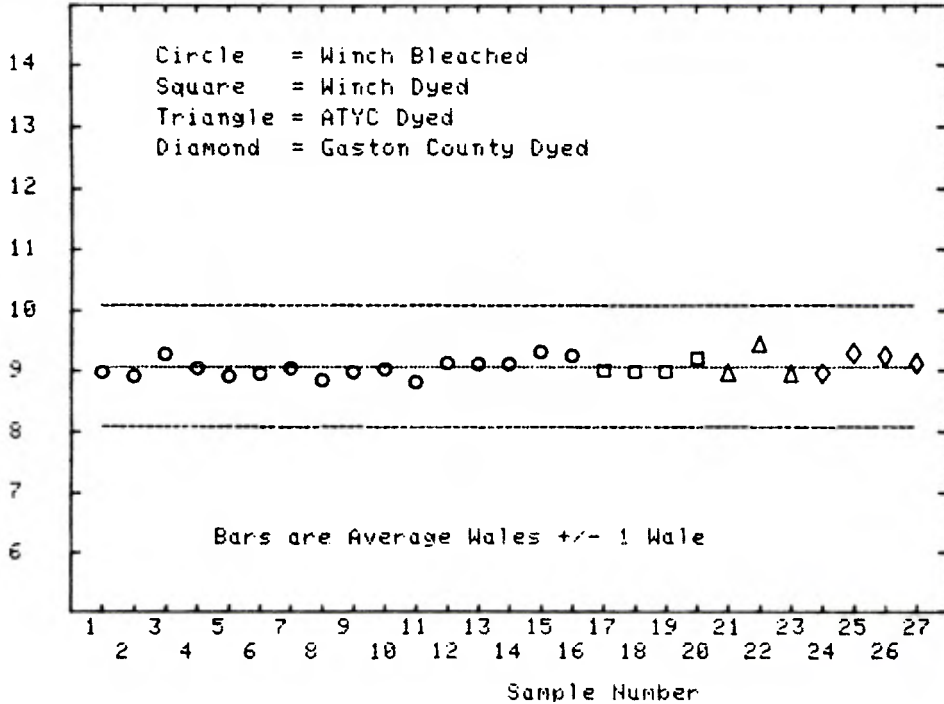


FIGURE 4

JBS 14g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Measured Weight gsm FBW

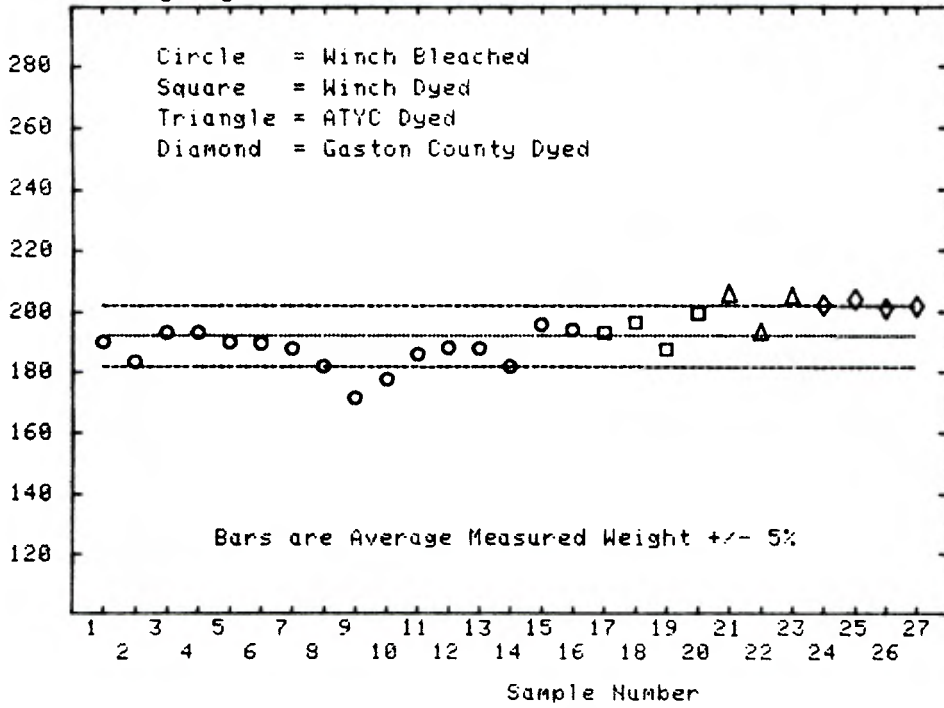


FIGURE 5

JBS 14g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Calculated Weight gsm FBW

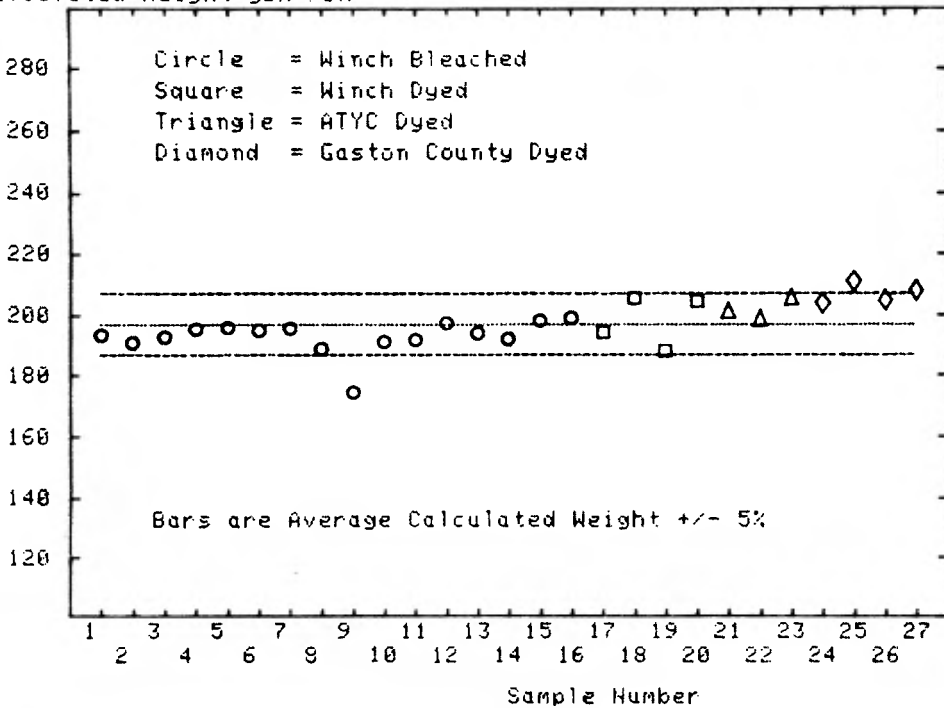


FIGURE 6

JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Courses/cm FAW

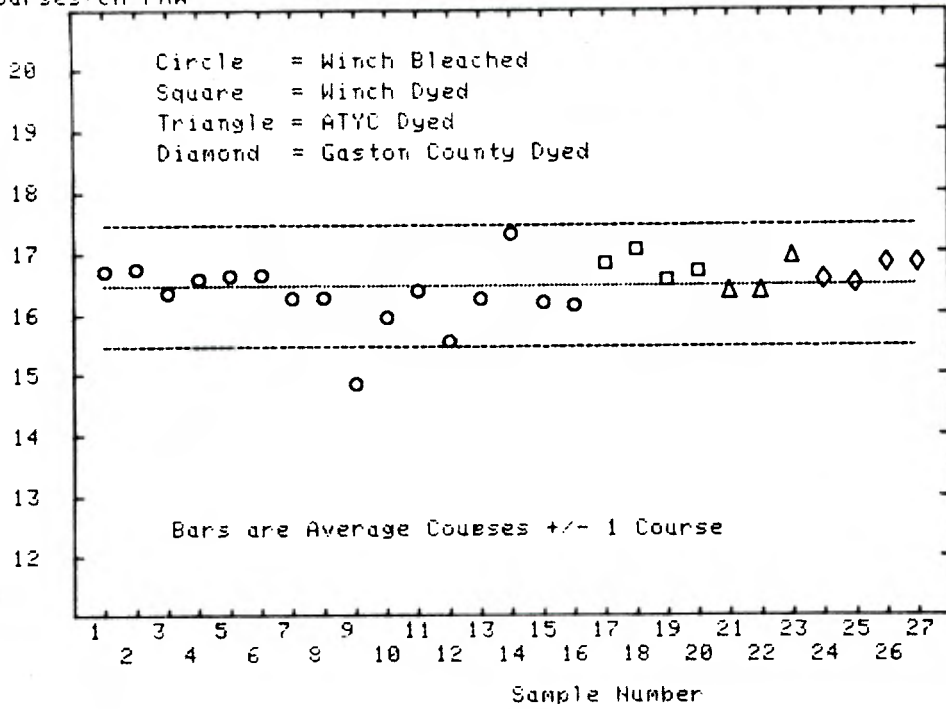


FIGURE 7

JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Wales/cm FAW

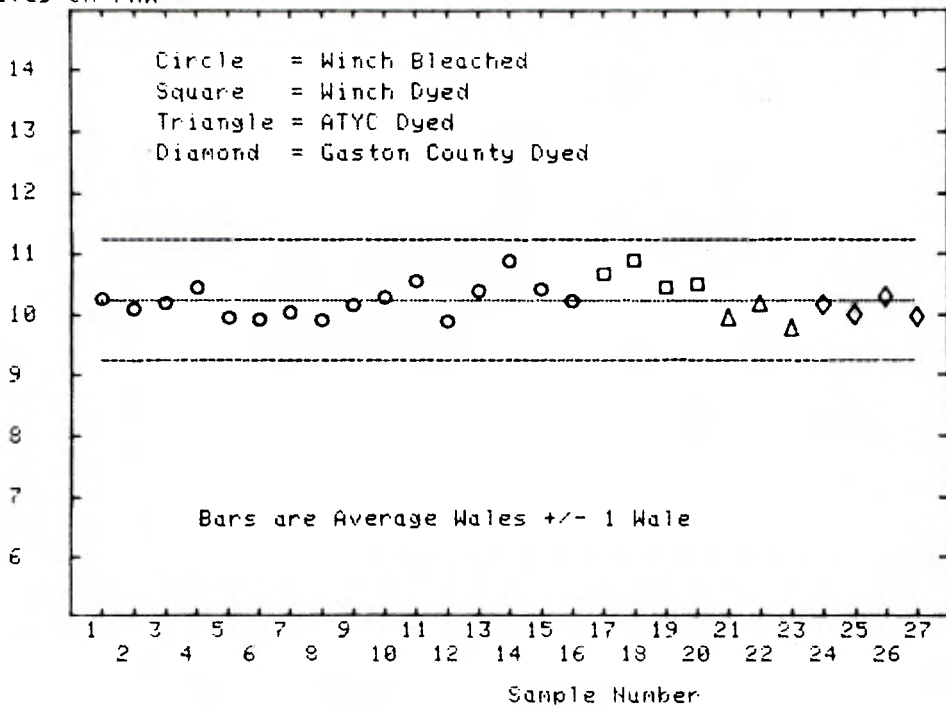
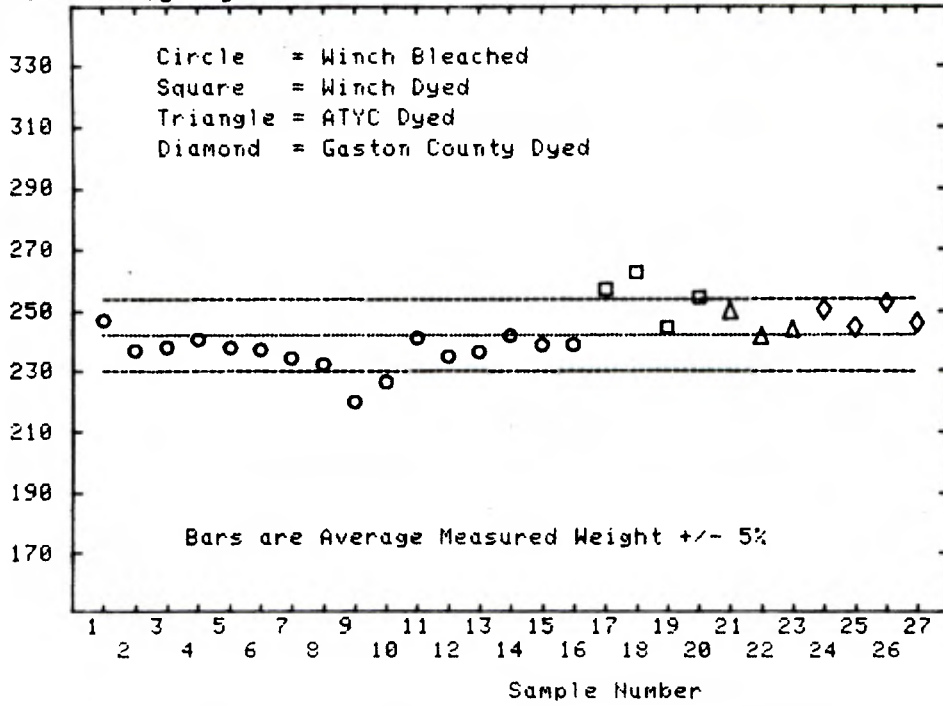


FIGURE 8

JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Measured Weight gsm FAW

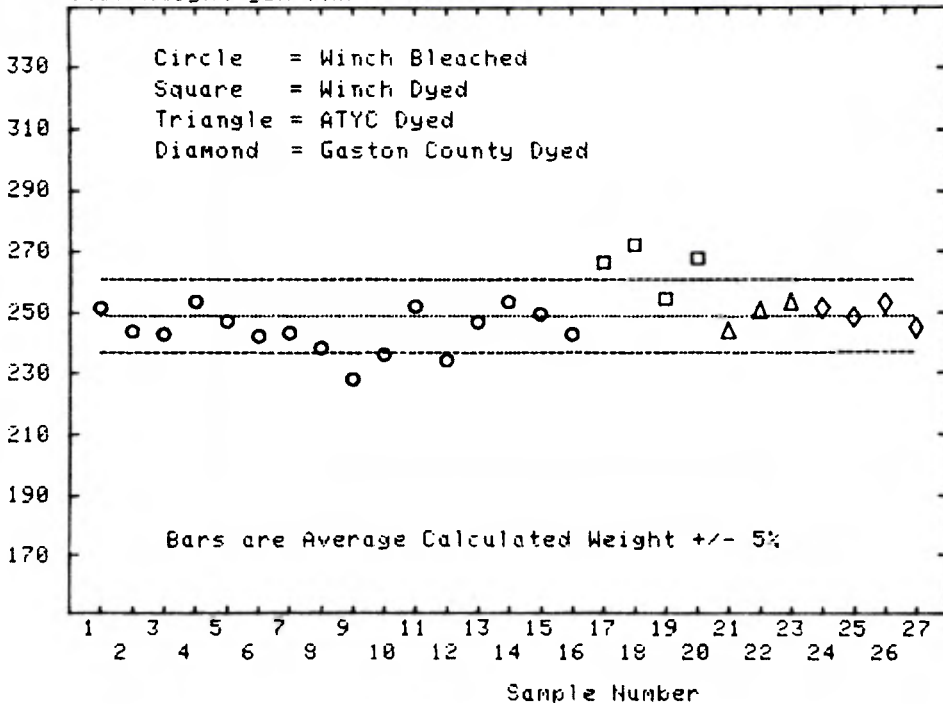
FIGURE 9



JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Calculated Weight gsm FAW

FIGURE 10





JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

5\*Length Shrinkage %

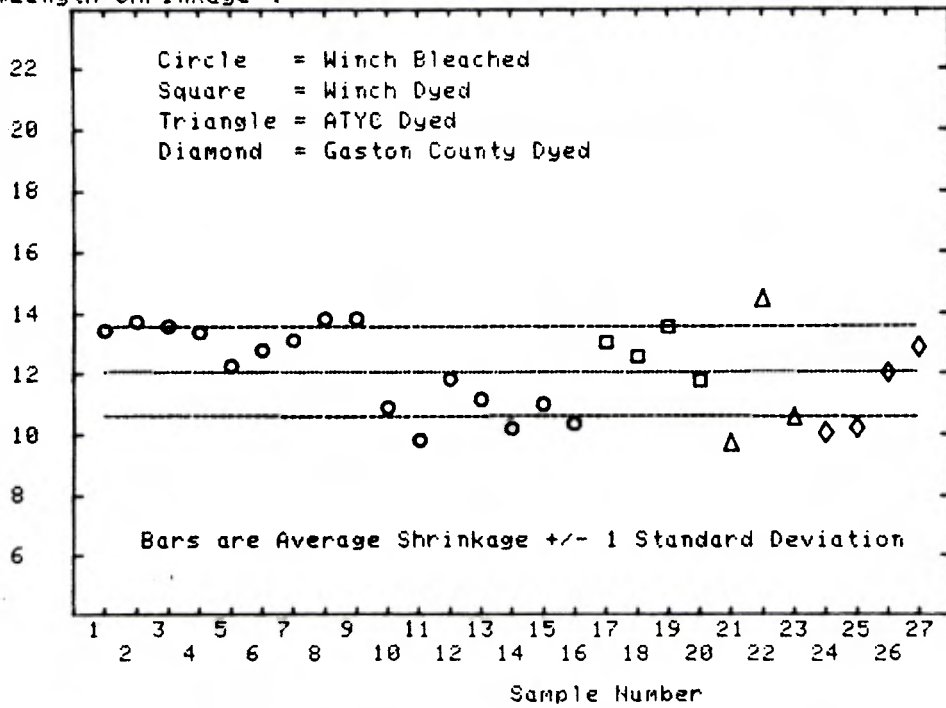


FIGURE 11

JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

5\*Width Shrinkage %

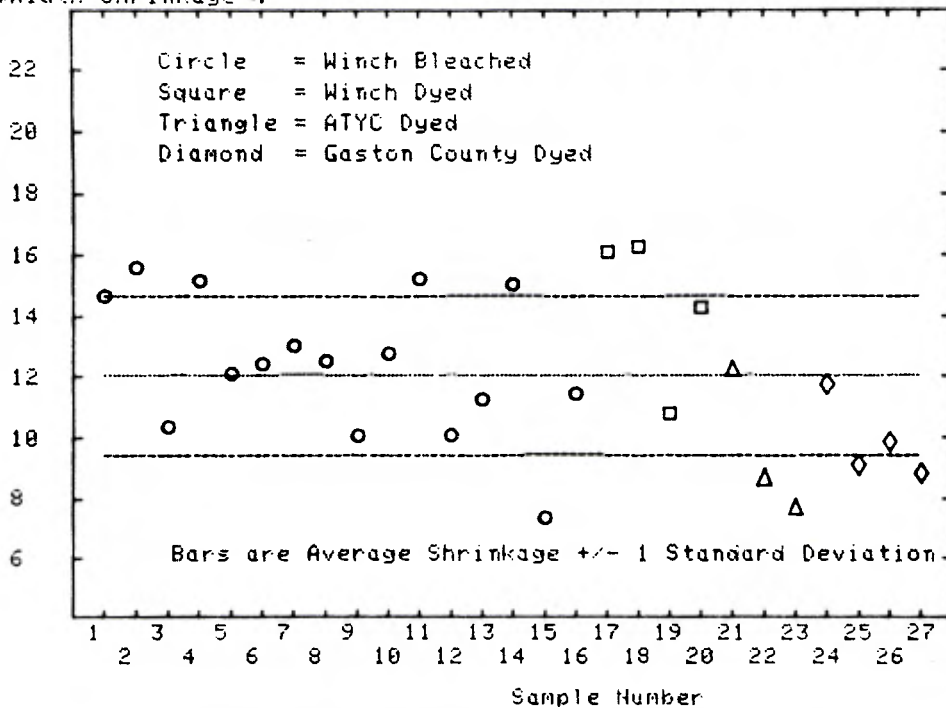


FIGURE 12

JBS 22g 1x1 RIB : GREY FABRIC CONTROLS : AS KNITTED  
 Nominal Yarn Count Ne 1/60 (9.84 Tex)

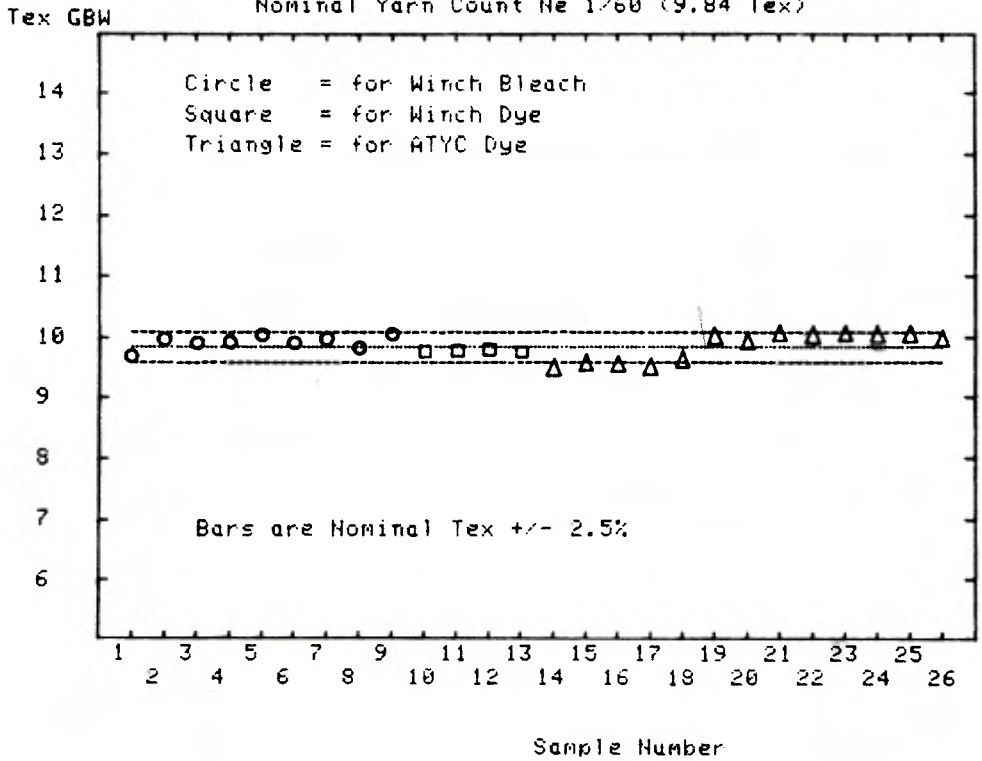


FIGURE 13

JBS 22g 1x1 RIB : GREY FABRIC CONTROLS : AS KNITTED

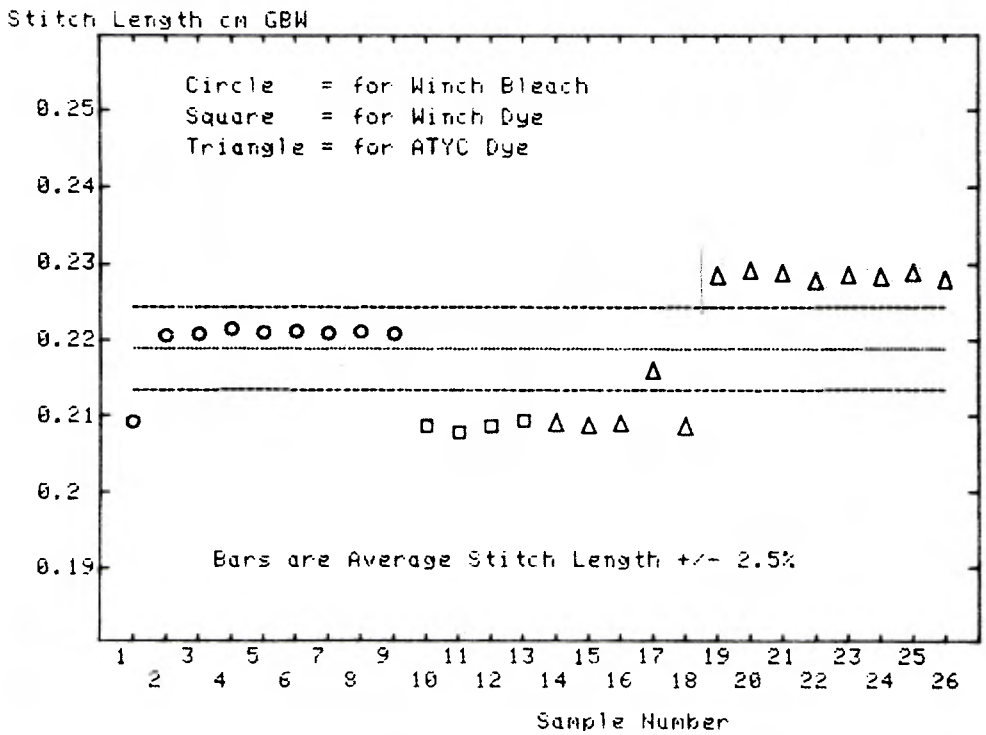


FIGURE 14

JBS 22g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Courses/cm FBW

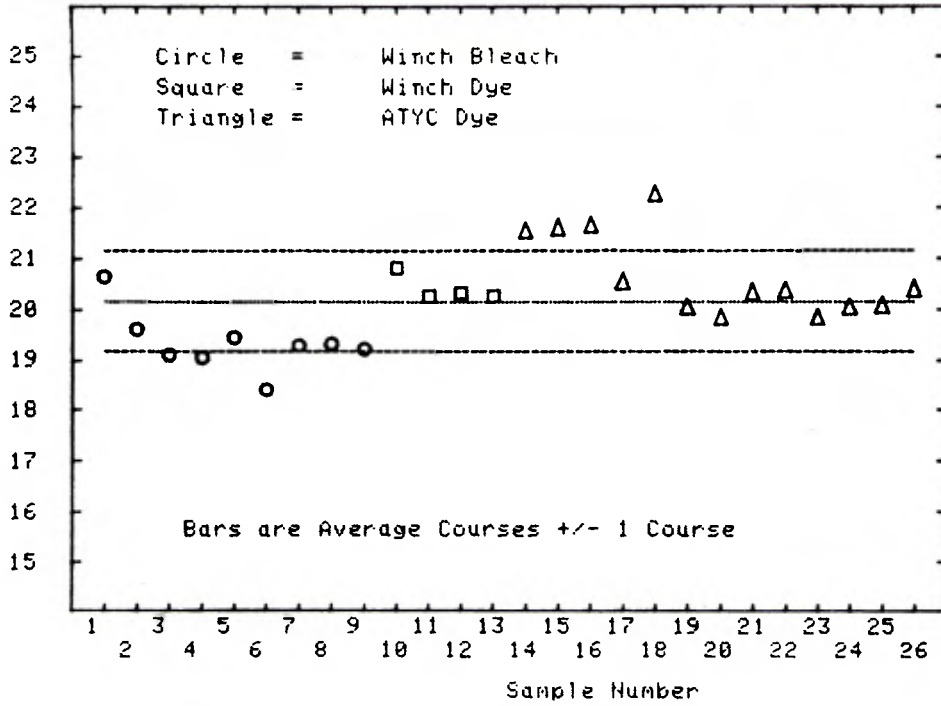


FIGURE 15

JBS 22g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Wales/cm FBW

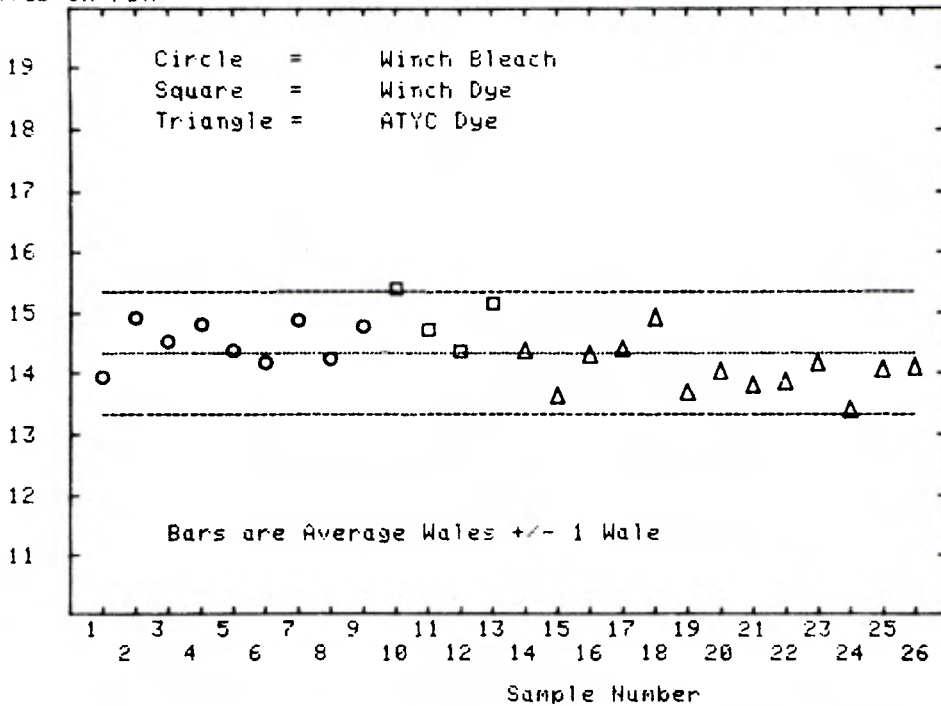


FIGURE 16

JBS 22g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Measured Weight gsm FBW

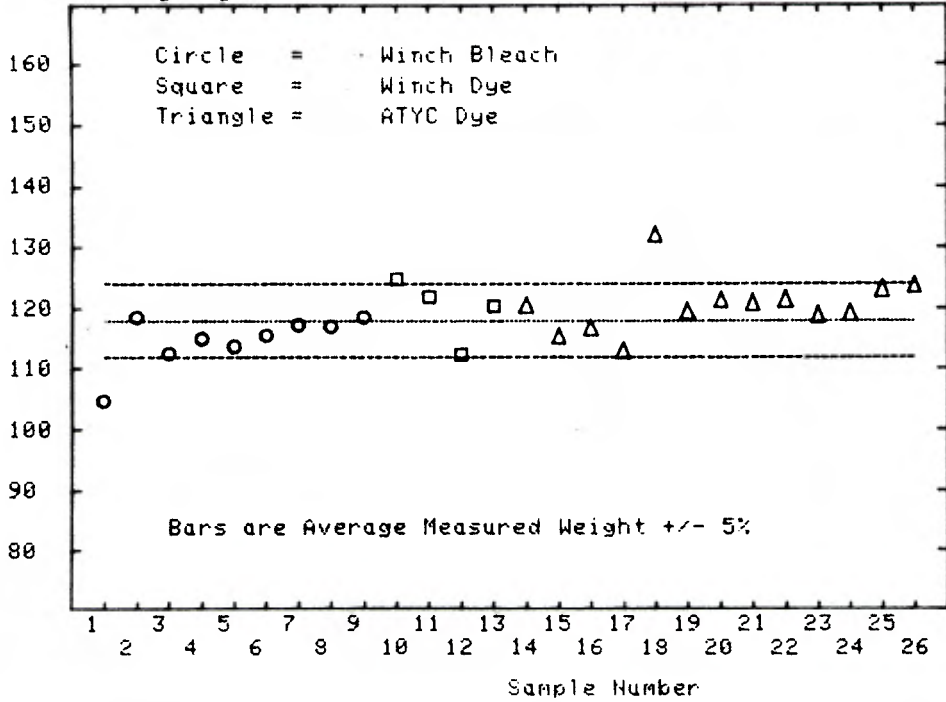


FIGURE 17

JBS 22g 1x1 RIB : FINISHED FABRIC : AS RECEIVED

Calculated Weight gsm FBW

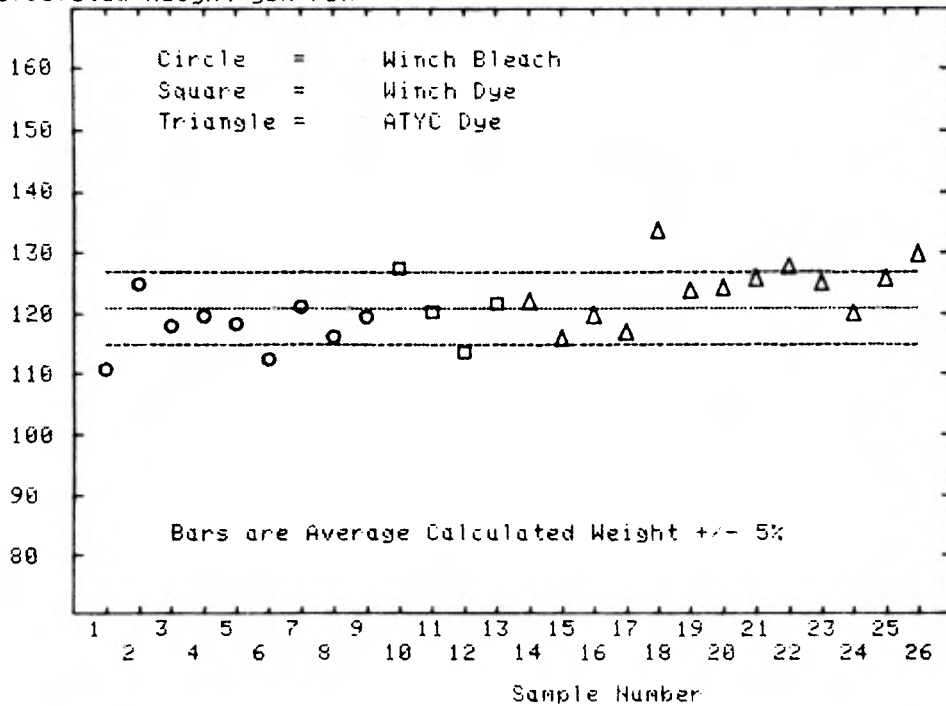


FIGURE 18

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Courses/cm FAW

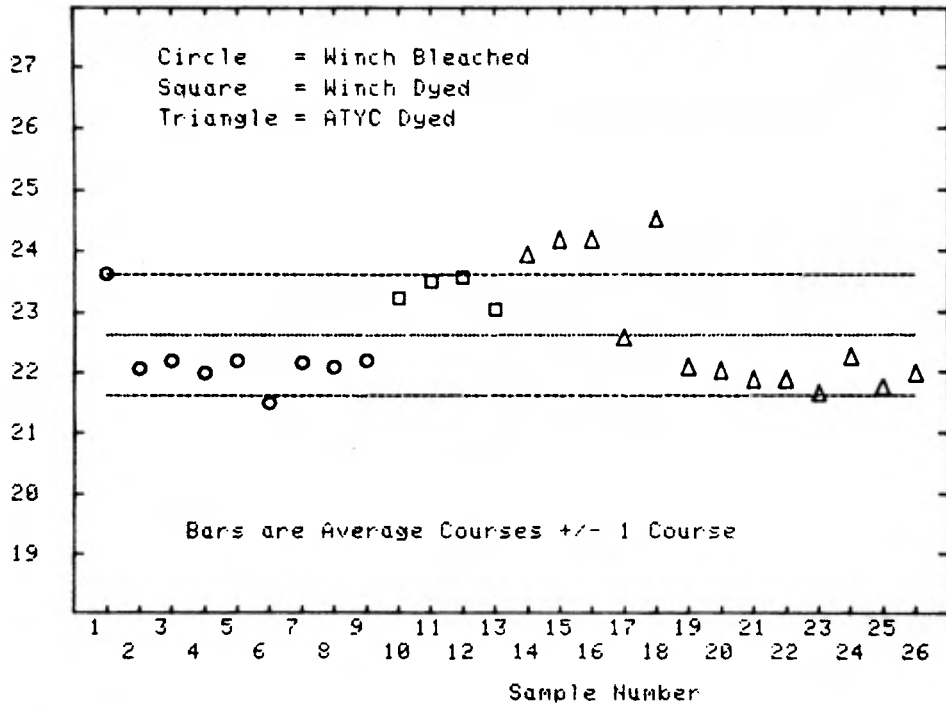


FIGURE 19

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Wales/cm FAW

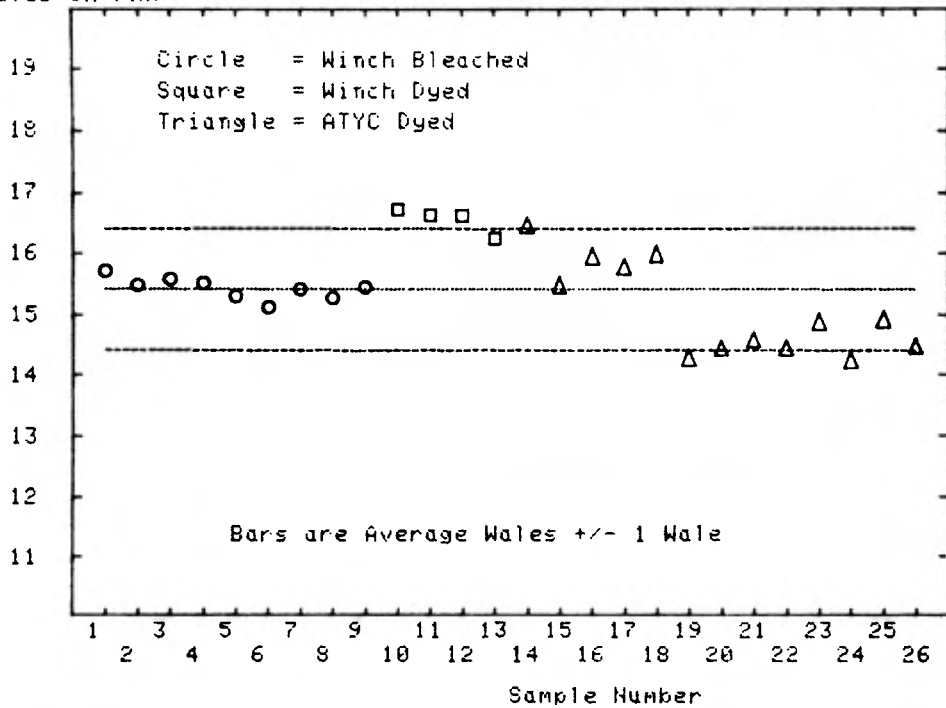


FIGURE 20

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Measured Weight gsm FAW

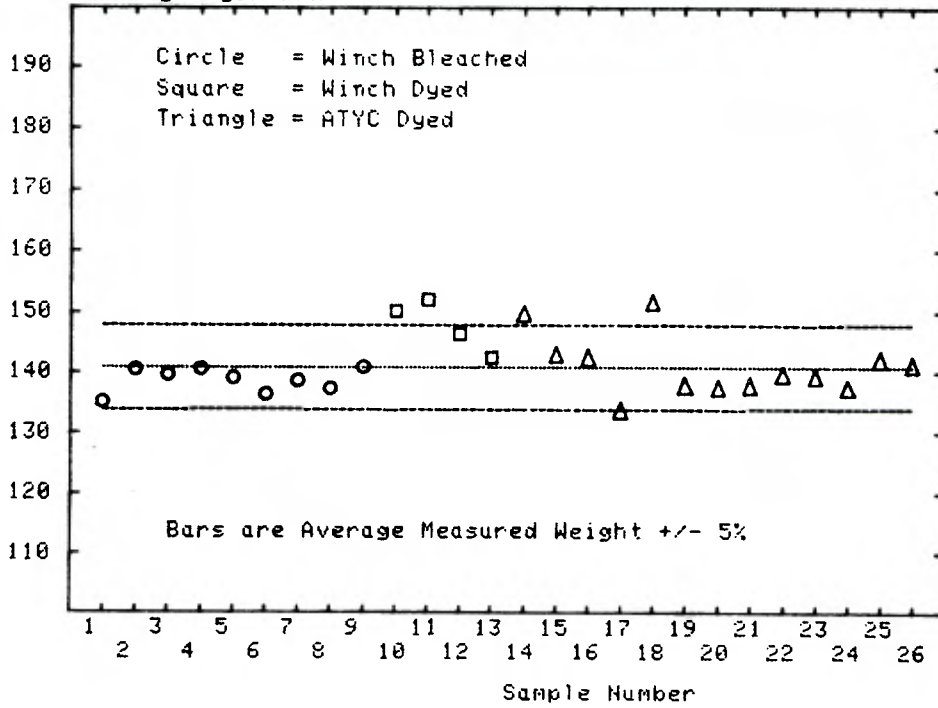


FIGURE 21

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Calculated Weight gsm FAW

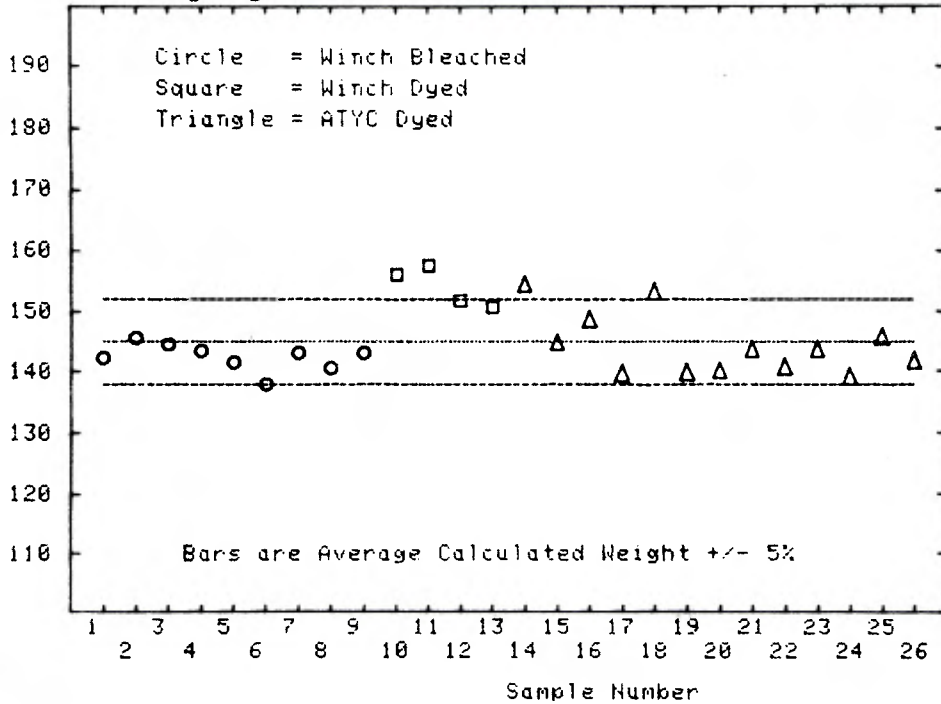


FIGURE 22

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

5\*Length Shrinkage %

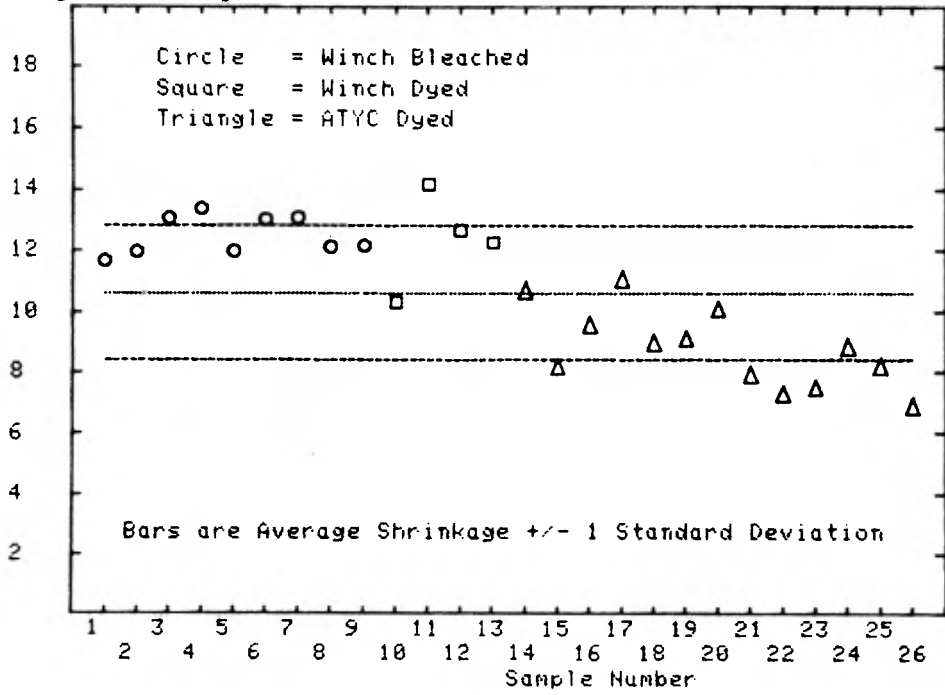


FIGURE 23

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

5\*Width Shrinkage %

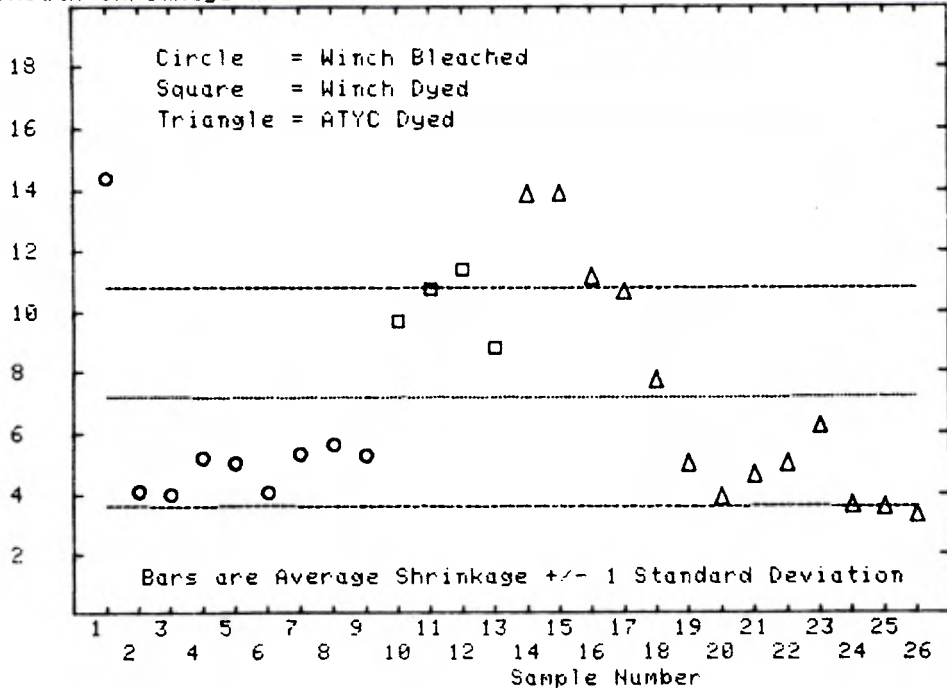


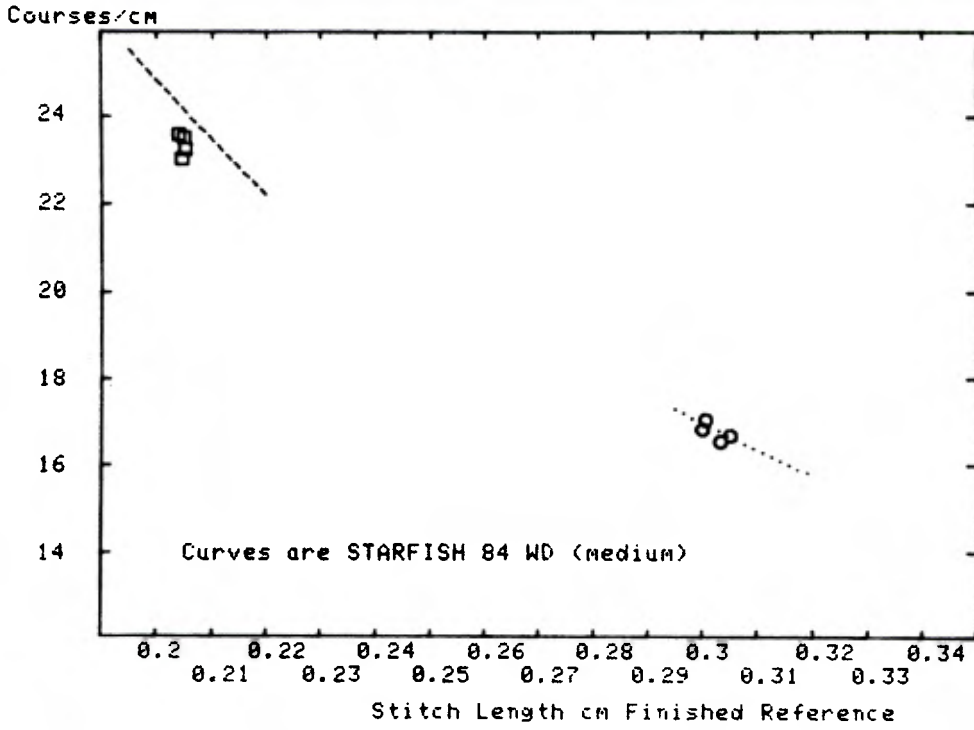
FIGURE 24





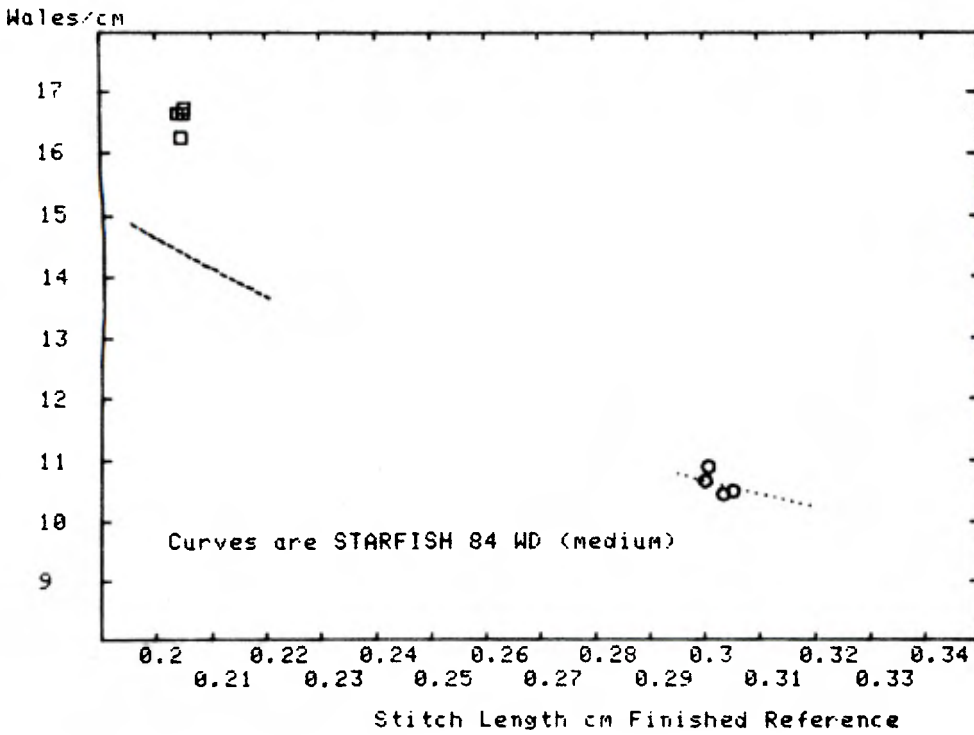
JBS : 1x1 RIB : WINCH DYED FINISHED : REFERENCE STATE

FIGURE 27



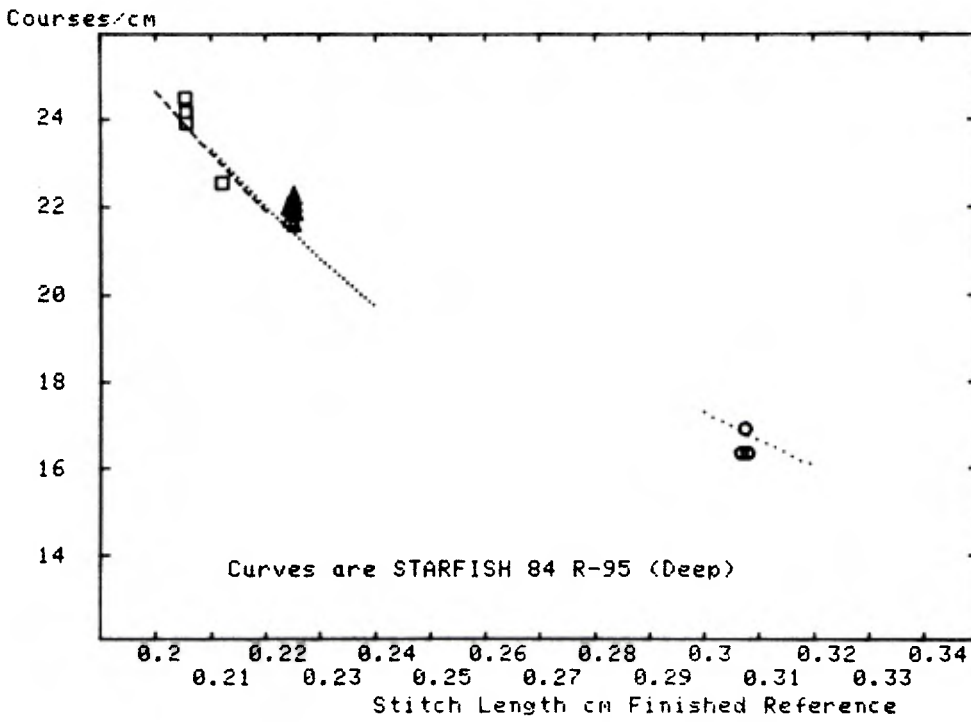
JBS : 1x1 RIB : WINCH DYED FINISHED : REFERENCE STATE

FIGURE 28



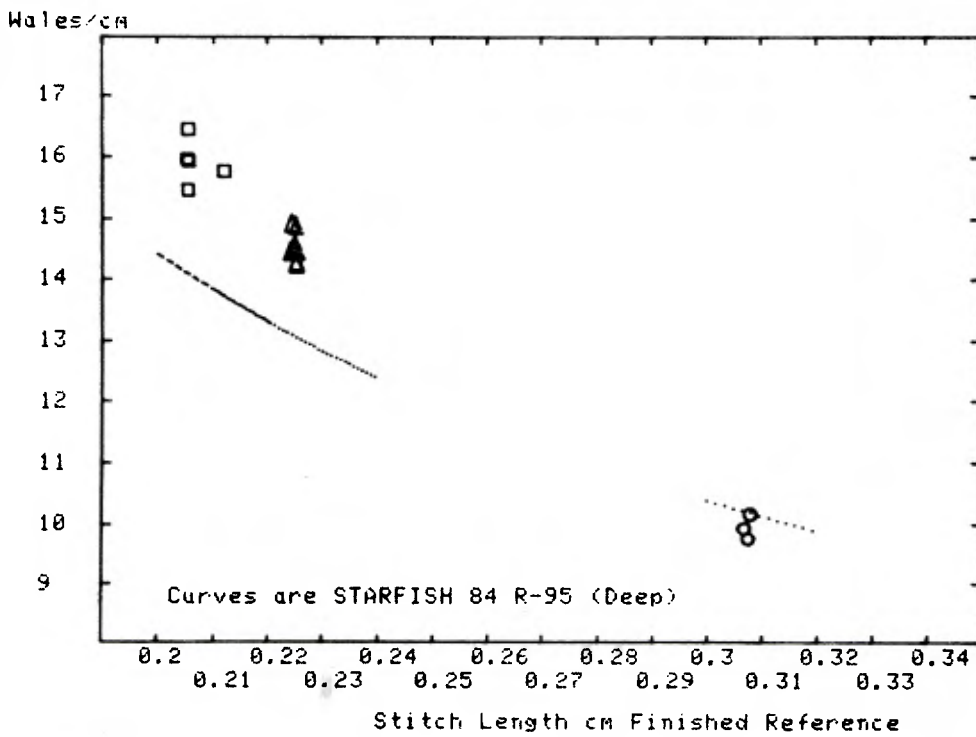
JBS 1x1 RIB : ATYC DYED FINISHED : REFERENCE STATE

FIGURE 29



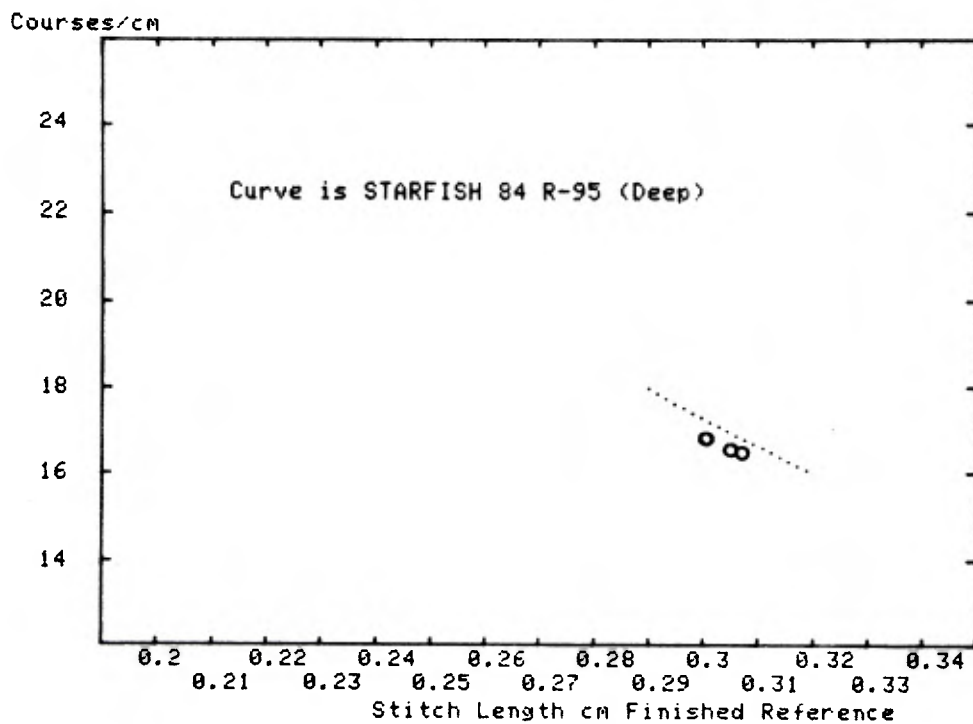
JBS 1x1 RIB : ATYC DYED FINISHED : REFERENCE STATE

FIGURE 30



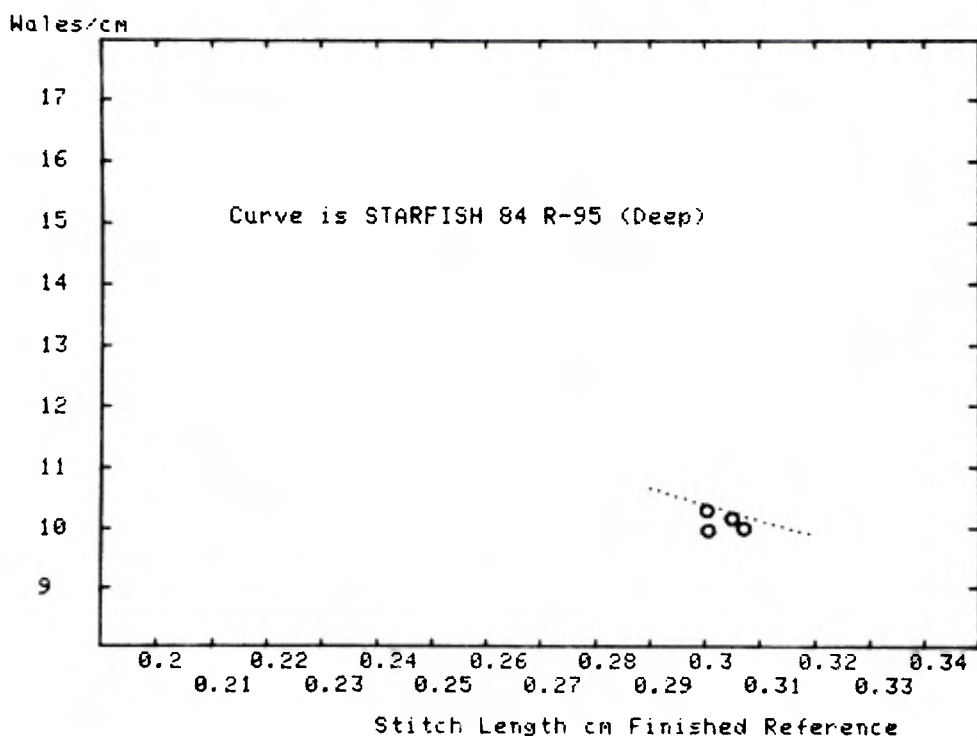
JBS 1x1 RIB : GASTON COUNTY DYED FINISHED : REFERENCE STATE

FIGURE 31



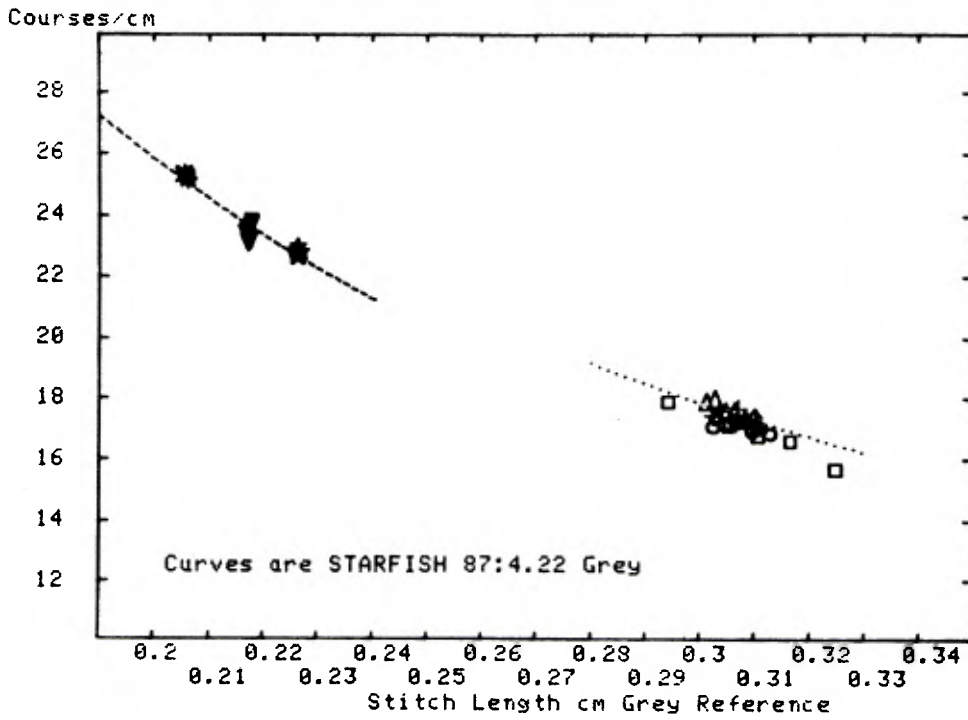
JBS 1x1 RIB : GASTON COUNTY DYED FINISHED : REFERENCE STATE

FIGURE 32



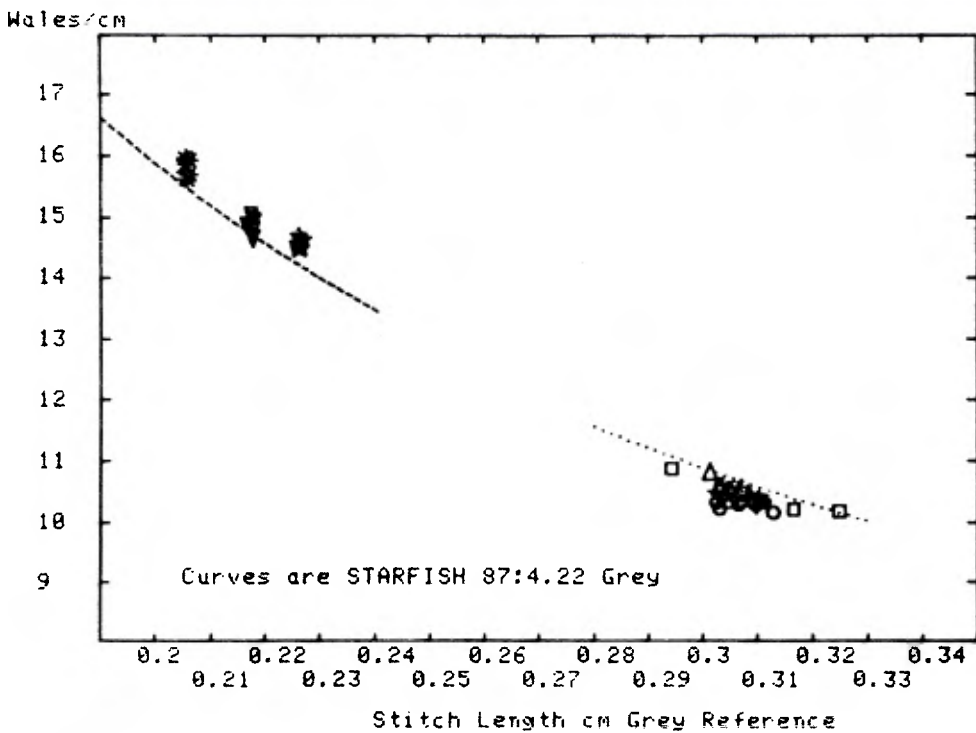
JBS 1x1 RIB : GREY FABRIC CONTROLS : REFERENCE STATE

FIGURE 33



JBS 1x1 RIB : GREY FABRIC CONTROLS : REFERENCE STATE

FIGURE 34



JBS : 1x1 RIB : WINCH BLEACHED FINISHED : REFERENCE STATE

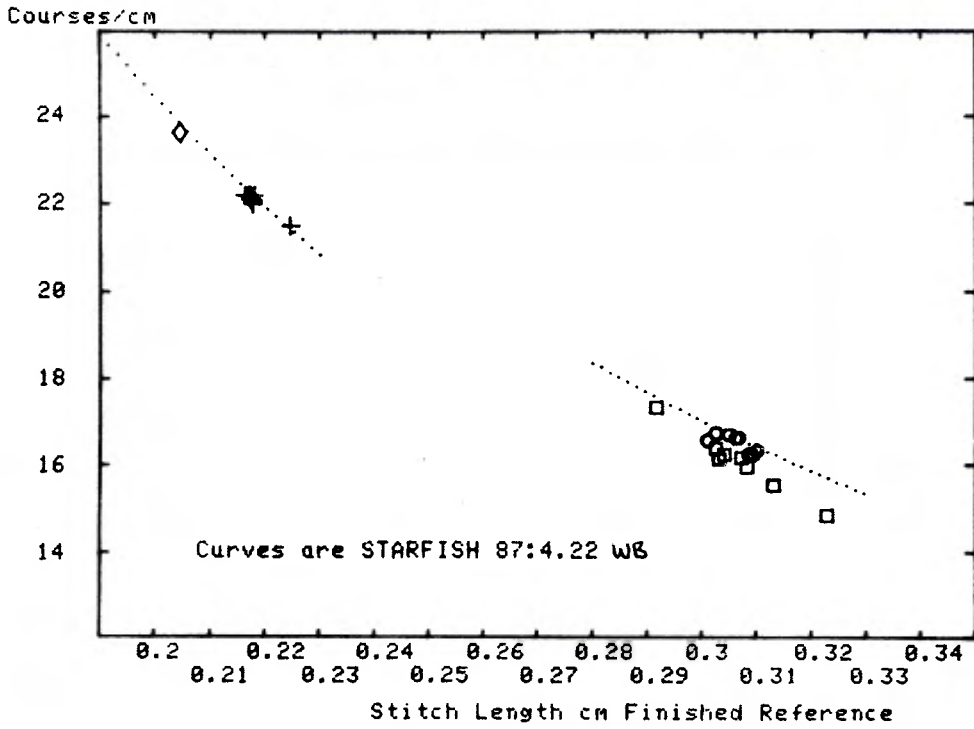


FIGURE 35

JBS : 1x1 RIB : WINCH BLEACHED FINISHED : REFERENCE STATE

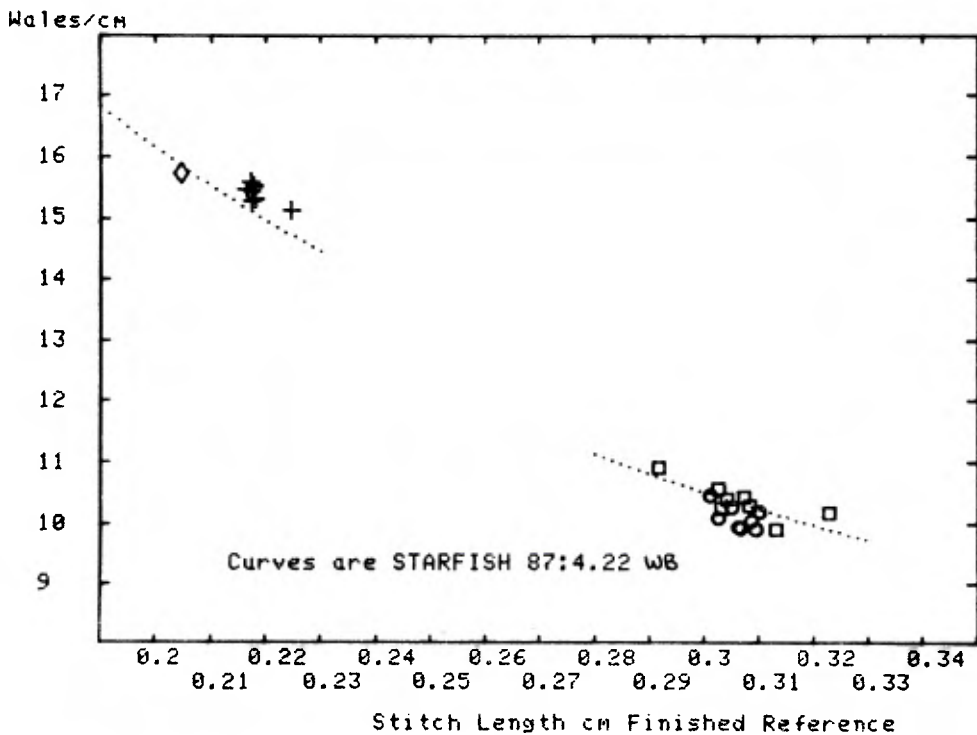
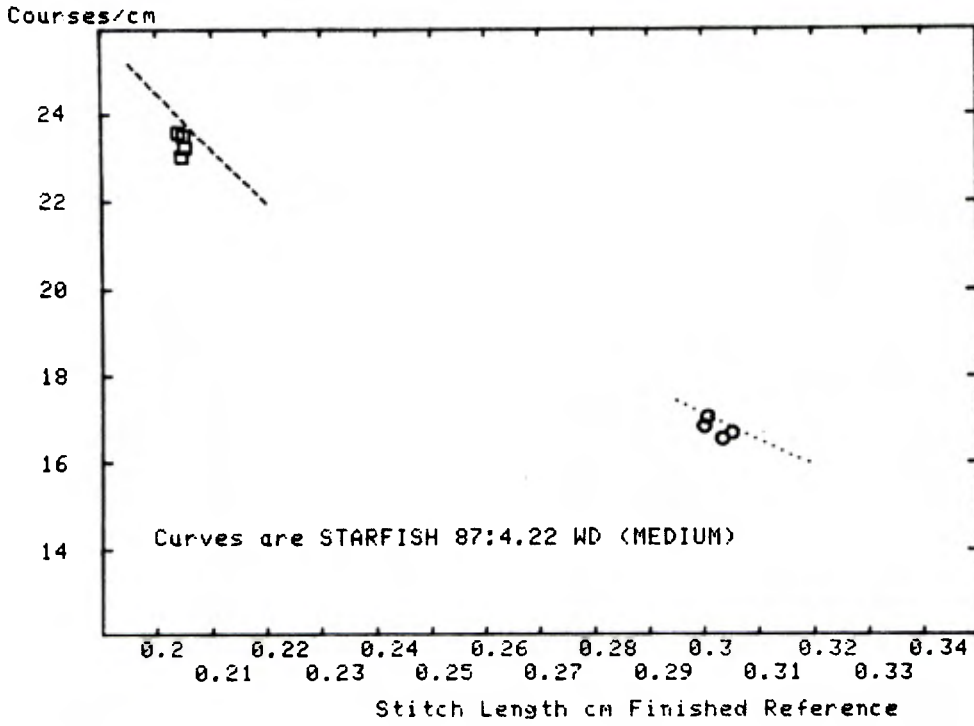


FIGURE 36

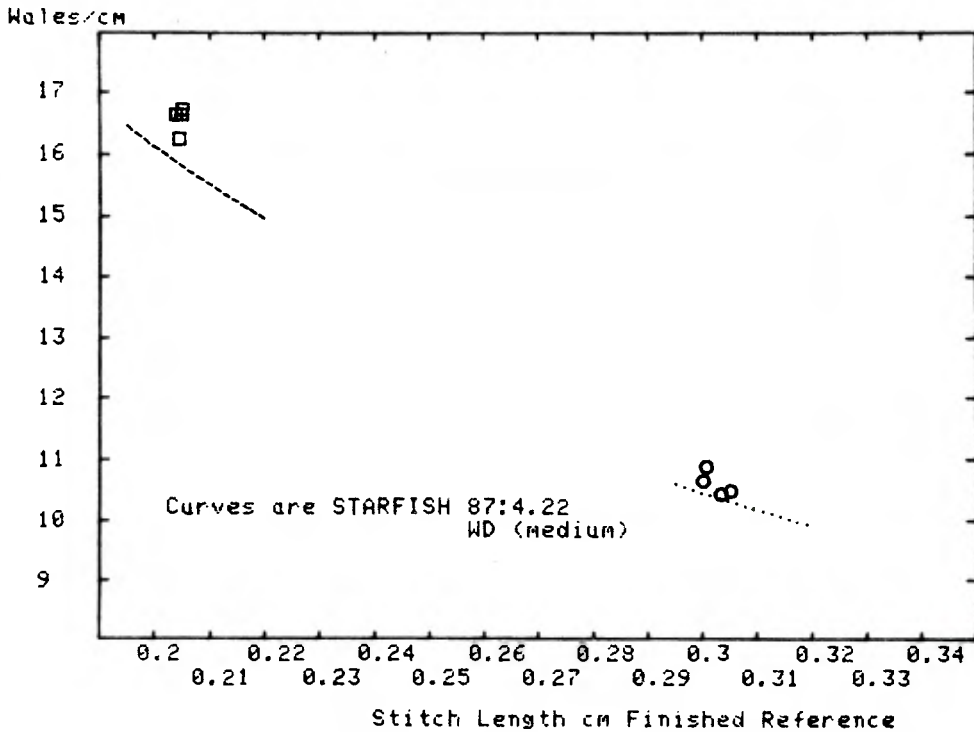
JBS : 1x1 RIB : WINCH DYED FINISHED : REFERENCE STATE

FIGURE 37



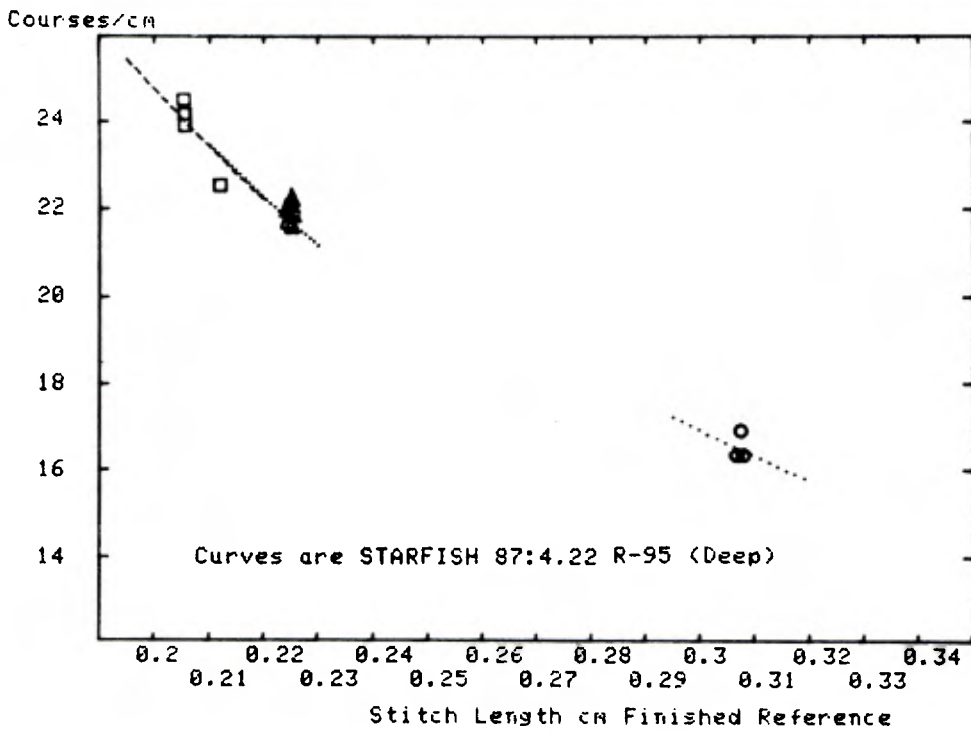
JBS : 1x1 RIB : WINCH DYED FINISHED : REFERENCE STATE

FIGURE 38



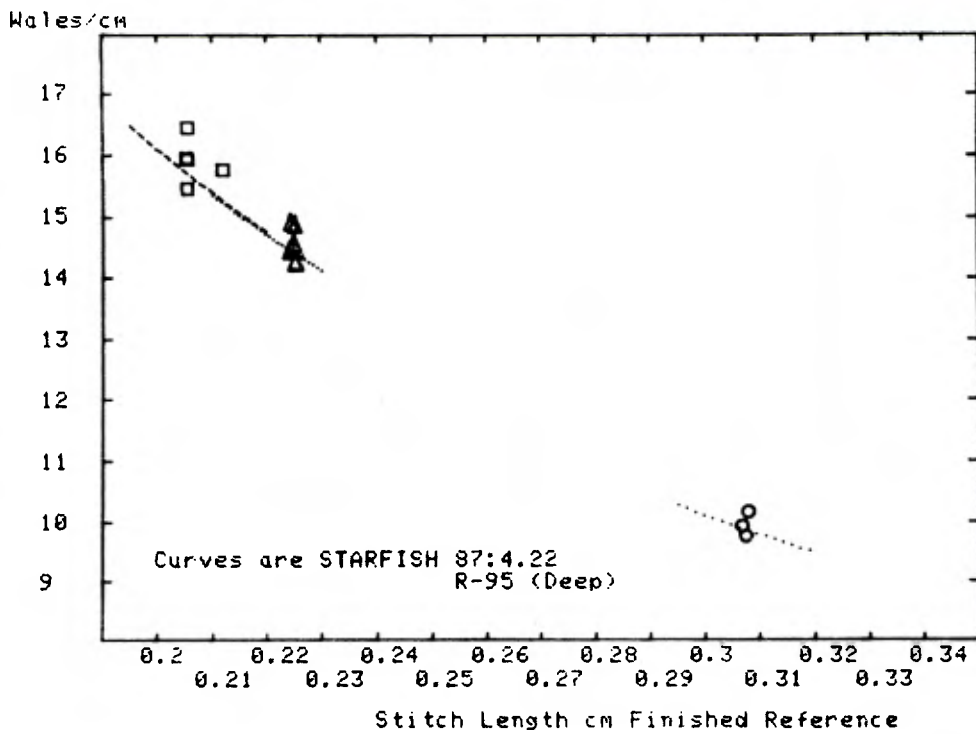
JBS : 1x1 RIB : ATYC DYED FINISHED : REFERENCE STATE

FIGURE 39



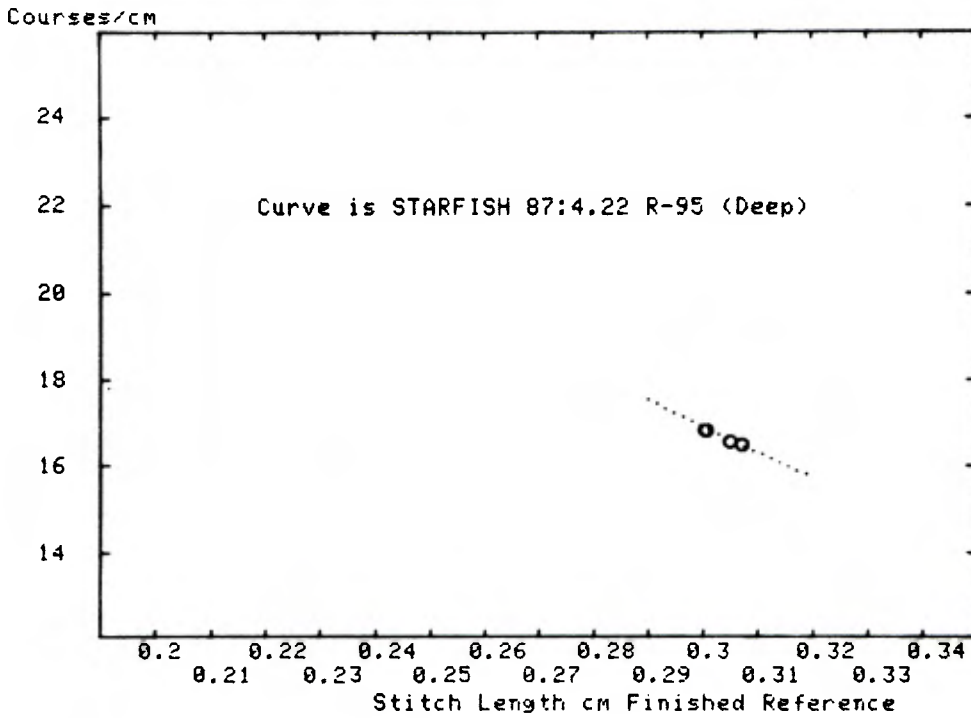
JBS : 1x1 RIB : ATYC DYED FINISHED : REFERENCE STATE

FIGURE 40



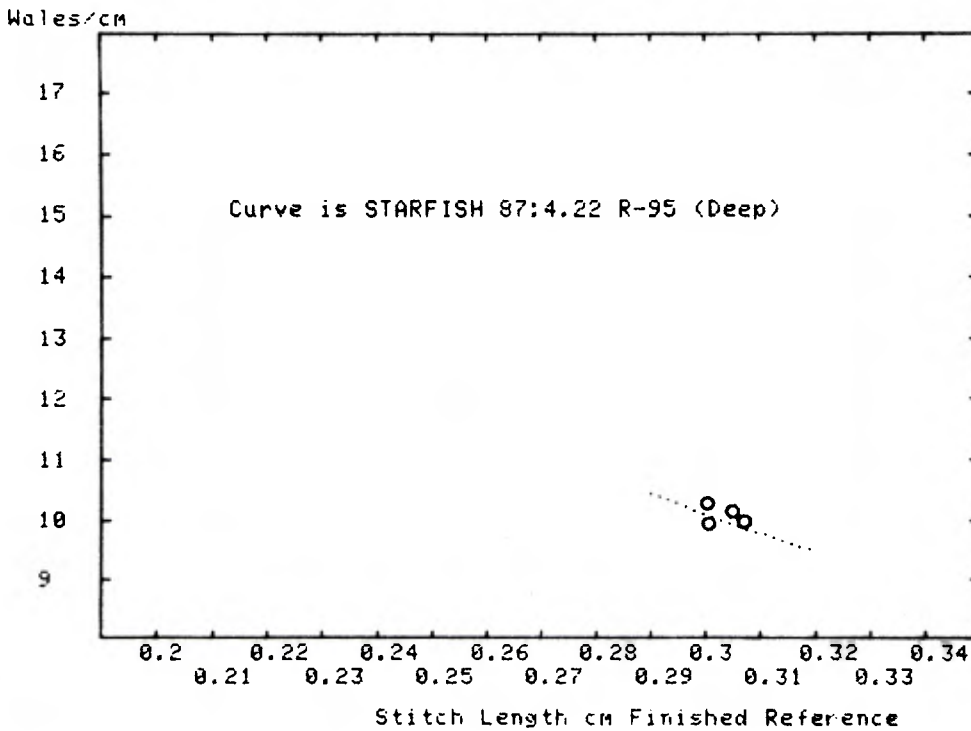
JBS 1x1 RIB : GASTON COUNTY DYED FINISHED : REFERENCE STATE

FIGURE 41



JBS 1x1 RIB : GASTON COUNTY DYED FINISHED : REFERENCE STATE

FIGURE 42





JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Courses/cm FAW

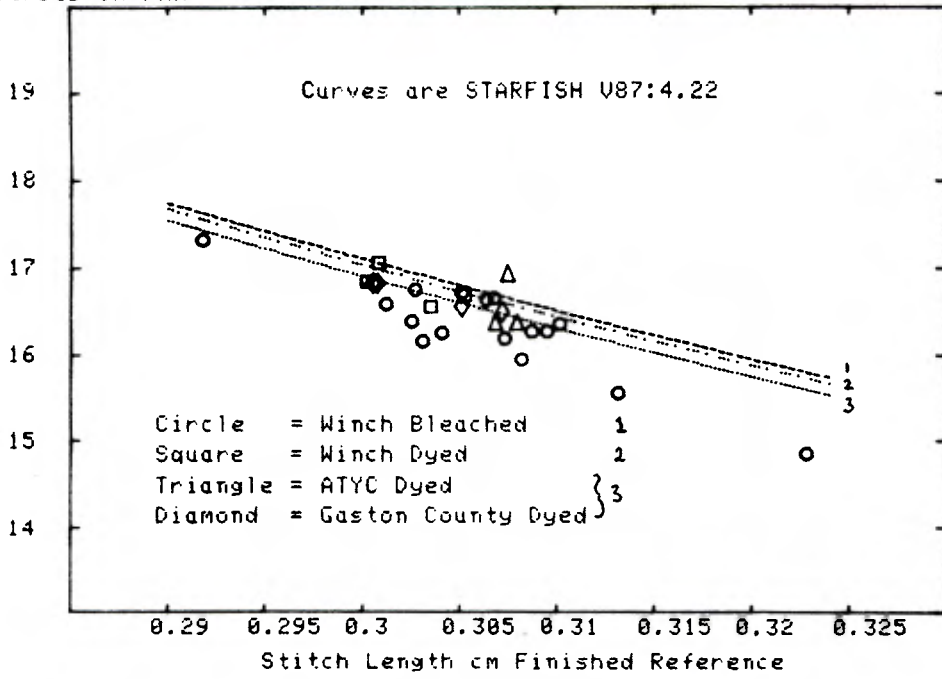


FIGURE 43

JBS 14g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Wales/cm FAW

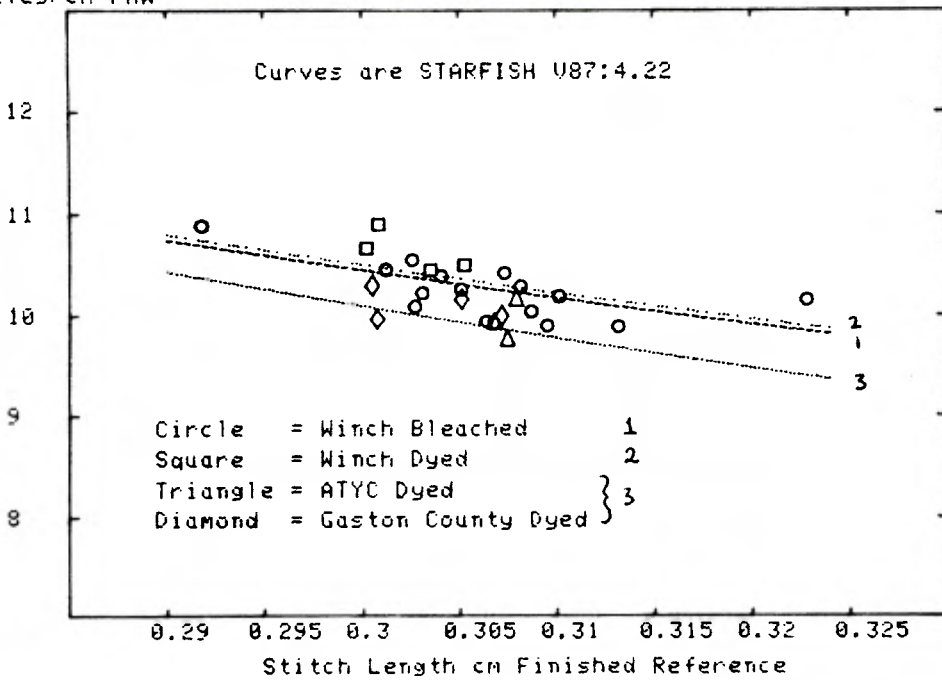


FIGURE 44

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Courses/cm FAW

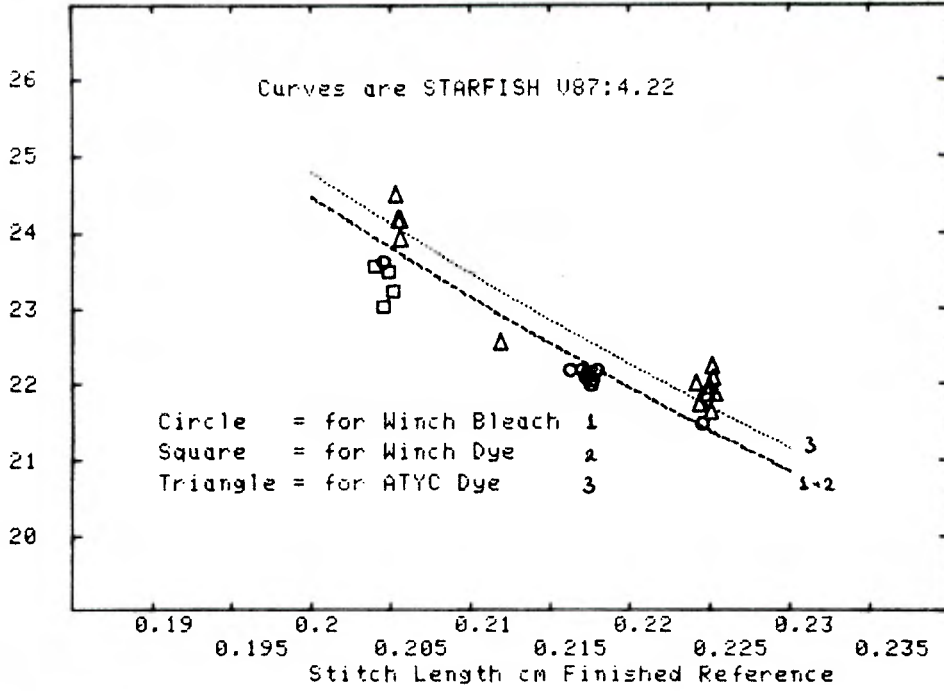


FIGURE 45

JBS 22g 1x1 RIB : FINISHED FABRIC : REFERENCE STATE

Wales/cm FAW

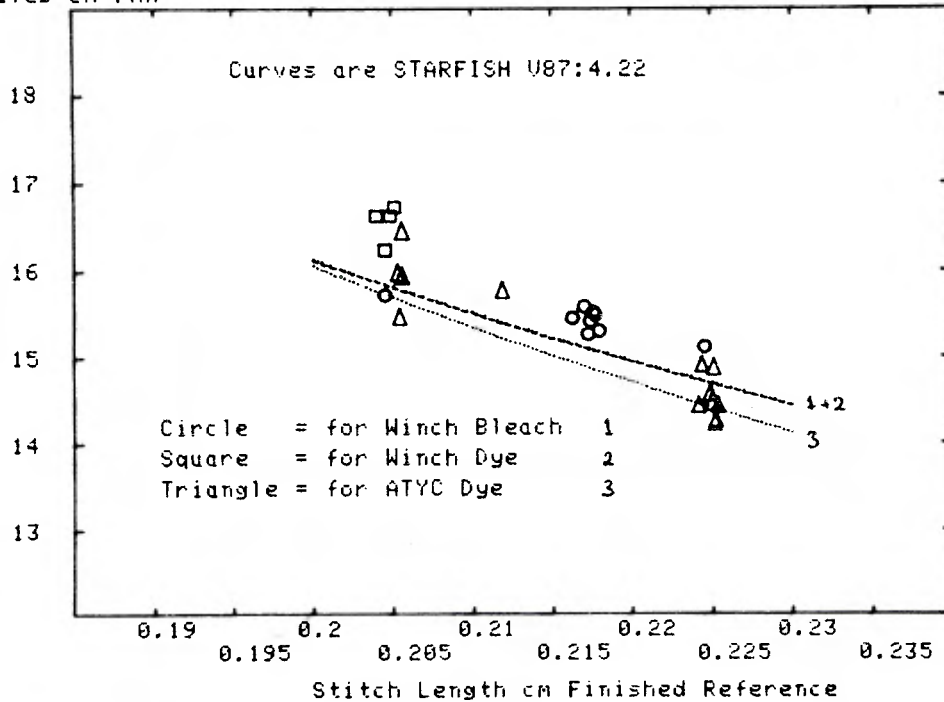


FIGURE 46



## JBS Case Study - 14g winch bleached

## WINCH BLEACHED 14G

Length shrinkage (L), TD	10.72	11.56	11.32	18.21	9.96	10.61	10.49	11.51
Width shrinkage (W), TD	15.36	16.83	13.28	16.94	13.41	13.10	13.92	14.85
Length shrinkage (L), 5x	13.47	13.77	13.62	13.41	12.31	12.82	13.15	13.86
Width shrinkage (W), 5x	14.78	15.44	16.41	15.28	12.16	12.47	13.87	12.58
Weight (gsm), BM	198.18	183.78	193.34	193.35	198.12	189.74	188.81	182.22
Weight (gsm), AM	247.12	237.17	238.74	248.89	238.21	237.25	234.75	232.68
Courses per 3cm, BM	43.48	44.88	42.58	44.18	43.68	44.28	43.38	42.78
Courses per 3cm, TD	49.18	48.78	47.68	48.38	49.08	48.98	48.98	49.38
Courses per 3cm, AM	58.28	58.38	49.18	49.88	49.98	58.88	48.85	48.85
Wales per 3cm, BM	27.88	26.88	27.98	27.28	26.88	26.92	27.28	26.68
Wales per 3cm, TD	31.68	31.48	31.28	31.98	38.98	38.88	38.28	38.28
Wales per 3cm, AM	38.88	38.38	38.68	31.48	29.85	29.88	38.15	29.74
Stitch length (cm), BM	3.88	3.84	3.18	3.84	3.88	3.88	3.11	3.12
Stitch length (cm), AM	3.85	3.83	3.18	3.81	3.86	3.87	3.89	3.18
Burst strength (kPa), BM	693.28	687.88	688.28	731.98	787.88	686.38	679.88	688.18
Burst strength (kPa), AM	661.88	728.48	689.28	727.78	686.38	698.98	644.78	643.58
Distension at burst (mm), BM	19.18	18.55	19.17	19.18	19.51	19.12	19.57	19.34
Distension at burst (mm), AM	21.32	28.84	21.89	21.78	21.33	28.81	21.44	28.87
Angle of spirality, BM	-3.86	2.33	2.58	8.31	1.42	-1.75	6.88	-2.86
Angle of spirality, AM	8.28	2.33	1.32	2.58	-1.57	8.88	1.48	-8.13
Width (cm), BM	33.85	37.35	36.82	38.93	43.67	44.73	49.43	49.57
Yarn strength (g), BM	331.12	373.75	349.13	338.92	326.68	328.76	334.93	317.68
Yarn strength (g), AM	348.64	377.78	388.55	383.65	387.35	482.39	385.59	388.69
Yarn ext. at break (L), BM	7.24	7.42	7.31	6.58	6.68	6.46	7.83	6.82
Yarn ext. at break (L), AM	7.85	6.82	6.81	7.21	7.54	7.56	7.55	7.28
Yarn count (tex), BM	24.15	23.98	23.65	24.17	24.51	23.95	24.83	24.82
Yarn count (tex), AM	24.82	23.81	23.49	24.25	24.36	23.86	24.18	23.89
Thickness (mm x 1000), BM	825	821	868	829	854	843	838	827
Thickness (mm x 1000), AM	1181	1898	1188	1892	1182	1894	1898	1889
Colour - Y value	88.68	87.83	88.19	86.44	88.29	88.27	87.45	86.14
Colour - Y value	89.23	88.58	88.75	87.12	88.92	88.97	88.16	86.87
Colour - Z value	118.98	117.62	117.99	114.62	118.31	118.36	116.65	114.45

## DATA CHECKS

Calc/Obs Wt BM	1.82	1.84	1.88	1.81	1.83	1.83	1.84	1.84
Calc/Obs Wt AM	1.82	1.83	1.82	1.85	1.84	1.82	1.84	1.83
Calc/Obs Courses/3cm BM	1.88	1.81	1.88	1.82	1.88	1.81	1.82	1.81
Calc/Obs Courses/3cm AM	1.83	1.85	1.82	1.87	1.82	1.83	1.84	1.82

## JBS Case Study - 14g winch bleached

## WINCH BLEACHED 14G

Length shrinkage (L), TD	8.62	8.34	8.28	11.79	8.72	8.48	8.48	8.28	18.15
Width shrinkage (W), TD	11.95	15.65	15.48	11.13	8.84	12.12	12.83	18.48	
Length shrinkage (L), 5x	11.28	18.23	9.84	13.87	11.85	18.37	18.94	11.88	
Width shrinkage (W), 5x	11.31	15.18	15.28	18.13	7.41	11.52	12.81	18.13	
Weight (gsm), BM	187.98	182.12	186.12	171.68	196.88	194.32	177.78	188.12	
Weight (gsm), AM	236.75	242.85	241.31	219.98	238.96	239.81	226.77	235.18	
Courses per 3cm, BM	43.38	46.88	44.28	38.48	42.88	44.18	43.25	42.85	
Courses per 3cm, TD	49.88	51.58	48.78	43.18	47.88	48.18	46.78	46.68	
Courses per 3cm, AM	48.88	52.88	49.28	44.68	48.68	48.58	47.98	46.78	
Wales per 3cm, BM	27.48	27.48	26.58	27.88	28.88	27.15	27.45		
Wales per 3cm, TD	31.48	32.68	31.58	31.18	31.48	31.58	31.28	38.58	
Wales per 3cm, AM	31.28	32.78	31.78	38.58	31.38	38.78	38.98	29.78	
Stitch length (cm), BM	3.88	2.94	3.85	3.26	3.88	3.86	3.89	3.14	
Stitch length (cm), AM	3.84	2.92	3.83	3.23	3.87	3.83	3.88	3.15	
Burst strength (kPa), BM	862.98	868.38	831.48	825.78	828.88	851.88	846.58	831.78	
Burst strength (kPa), AM	816.38	852.78	883.38	777.88	778.58	884.28	787.88	884.38	
Distension at burst (mm), BM	19.14	18.55	18.32	18.84	19.44	28.28	19.56	28.39	
Distension at burst (mm), AM	22.44	21.35	28.82	21.33	21.92	21.57	28.81	22.85	
Angle of spirality, BM	-2.41	1.87	-2.68	-2.89	-4.43	-3.61	-4.32	-1.32	
Angle of spirality, AM	8.81	-8.88	-8.83	-8.78	-1.49	-8.22	-1.88	-8.24	
Width (cm), BM	37.27	44.87	36.27	38.98	45.63	52.17	34.48	37.97	
Yarn strength (g), BM	415.71	381.99	416.89	375.13	387.43	385.96	357.83	384.36	
Yarn strength (g), AM	458.45	434.75	428.41	453.59	447.44	427.24	442.61	482.19	
Yarn ext. at break (L), BM	7.21	6.91	7.35	7.41	6.71	7.84	7.15	5.79	
Yarn ext. at break (L), AM	7.44	7.88	6.72	7.85	6.79	6.57	6.57	6.45	
Yarn count (tex), BM	24.86	23.35	24.19	23.26	24.17	23.87	23.76	24.58	
Yarn count (tex), AM	24.82	23.81	24.86	23.39	24.83	24.25	23.33	24.38	
Thickness (mm x 1000), BM	836	828	814	819	873	847	831	858	
Thickness (mm x 1000), AM	1839	1849	1856	1851	1896	1861	1859	1888	
Colour - Y value	77.27	75.98	76.38	75.44	78.53	79.72	76.24	78.84	
Colour - Y value	77.56	76.27	76.57	75.81	78.85	88.18	76.66	79.28	
Colour - Z value	183.76	182.27	182.53	181.42	186.14	187.62	182.13	186.58	

## DATA CHECKS

Calc/Obs Wt BM	1.83	1.86	1.83	1.82	1.81	1.83	1.88	1.85
Calc/Obs Wt AM	1.84	1.83	1.85	1.84	1.84	1.82	1.84	1.88
Calc/Obs Courses/3cm BM	1.88	0.99	1.88	1.88	0.99	1.81	1.81	1.82
Calc/Obs Courses/3cm AM	1.89	0.99	0.99	0.99	0.99	0.97	1.81	1.83

## JBS Case Study - 14g controls for winch dyeing

## GREIGE 14G (Winch dye)

Length shrinkage (L), T0	19.25	19.02	19.98	18.84
Width shrinkage (Z), T0	18.42	19.01	12.43	20.65
Length shrinkage (Z), 5x	20.76	28.73	21.46	19.64
Width shrinkage (Z), 5x	19.13	19.36	12.95	20.81
Weight (gsm), BM	195.35	194.16	189.94	187.17
Weight (gsm), AM	278.93	281.18	262.68	267.13
Courses per 3cm, BM	43.28	43.48	41.70	42.68
Courses per 3cm, T0	52.08	52.68	51.78	51.98
Courses per 3cm, AM	53.68	53.98	52.78	52.65
Wales per 3cm, BM	26.38	26.58	27.18	25.38
Wales per 3cm, T0	31.48	31.58	30.68	30.98
Wales per 3cm, AM	32.48	31.78	31.08	31.38
Stitch length (cm) BM	3.89	3.89	3.11	3.13
Stitch length (cm) AM	3.81	3.83	3.05	3.06
Burst strength (kPa), BM	741.08	740.38	725.78	679.88
Burst strength (kPa), AM	728.88	749.78	746.88	728.88
Distension at burst (cm), BM	18.64	19.28	18.57	18.56
Distension at burst (cm), AM	23.68	23.62	23.58	23.51
Angle of spirality, BM	8.18	-8.52	-8.41	2.89
Angle of spirality, AM	8.31	-8.88	8.51	-1.56
Width (cm), BM	39.48	39.78	42.97	57.17
Yarn strength (g), BM	362.68	354.23	355.27	364.45
Yarn strength (g), AM	338.13	344.49	331.75	331.72
Yarn ext. at break (Z), BM	8.63	8.33	7.86	8.45
Yarn ext. at break (Z), AM	8.68	9.01	8.48	8.48
Yarn count (tex), BM	25.12	25.49	25.11	25.14
Yarn count (tex), AM	24.74	24.83	24.59	25.06
Thickness (mm x 1000), BM	858	866	893	871
Thickness (mm x 1000), AM	1247	1258	1245	1237
Turns per metre, BM	826	829	741	786

## DATA CHECKS

Calc/Obs Mt BM	1.00	1.00	1.02	1.01
Calc/Obs Mt AM	1.03	1.02	1.04	1.05
Calc/Obs Courses/3cm	1.02	1.02	1.01	1.01
Calc/Obs Wales/3cm	1.01	1.00	1.00	1.02

## JBS Case Study - 14g winch dyed

## WINCH DYED 14G

Length shrinkage (L), T0	18.41	18.88	18.08	8.95
Width shrinkage (Z), T0	15.98	16.48	16.54	14.37
Length shrinkage (Z), 5x	13.84	12.57	13.57	11.78
Width shrinkage (Z), 5x	16.14	16.28	18.85	14.28
Weight (gsm), BM	193.82	196.28	187.56	199.51
Weight (gsm), AM	257.26	262.65	244.71	254.58
Courses per 3cm, BM	43.38	43.58	42.08	43.08
Courses per 3cm, T0	49.08	49.08	48.88	48.98
Courses per 3cm, AM	50.55	51.28	49.78	50.18
Wales per 3cm, BM	27.85	27.88	27.08	27.65
Wales per 3cm, T0	32.48	32.58	31.48	32.08
Wales per 3cm, AM	32.08	32.78	31.35	31.58
Stitch length (cm) BM	3.82	3.82	3.05	3.08
Stitch length (cm) AM	3.88	3.81	3.04	3.05
Burst strength (kPa), BM	758.18	725.98	715.88	688.78
Burst strength (kPa), AM	728.78	734.78	697.38	692.18
Distension at burst (cm), BM	19.42	19.91	18.73	20.25
Distension at burst (cm), AM	22.59	22.31	22.27	22.84
Angle of spirality, BM	3.33	-8.36	1.65	1.25
Angle of spirality, AM	8.62	-8.38	8.71	-8.86
Width (cm), BM	38.47	38.53	42.48	52.73
Yarn strength (g), BM	326.67	356.75	351.83	322.52
Yarn strength (g), AM	351.48	356.85	347.95	335.87
Yarn ext. at break (Z), BM	8.09	8.38	8.25	8.13
Yarn ext. at break (Z), AM	7.74	7.56	7.79	8.04
Yarn count (tex), BM	24.69	24.92	24.45	25.17
Yarn count (tex), AM	24.69	24.34	24.22	25.02
Thickness (mm x 1000), BM	868	872	873	866
Thickness (mm x 1000), AM	1143	1148	1144	1159
Colour - I value	71.67	70.63	72.35	70.94
Colour - Y value	73.35	72.79	73.94	72.36
Colour - Z value	68.99	66.44	70.69	67.35

## DATA CHECKS

Calc/Obs Mt BM	1.01	1.05	1.00	1.03
Calc/Obs Mt AM	1.04	1.04	1.04	1.05
Calc/Obs Courses/3cm	0.99	1.02	0.98	0.97
Calc/Obs Wales/3cm	1.01	0.99	0.97	1.02

JBS Case Study - 14g controls for ATYC/Gaston County  
GREIGE 14G (ATYC & Gaston Co)

18.43	19.98	18.12	19.13	18.47	18.00	18.05
16.84	13.54	15.84	18.02	17.12	17.58	18.78
19.74	21.55	19.77	21.15	20.41	19.93	
18.48	14.84	15.68	19.35	17.65	18.11	19.06
187.22	190.46	191.13	184.32	186.11	189.37	184.69
267.97	262.81	268.13	264.58	268.99	262.81	265.93
42.68	41.88	42.68	43.08	42.48	43.58	43.38
52.18	51.68	52.28	52.38	51.68	52.98	52.78
51.98	51.85	52.18	53.08	52.88	52.38	52.88
26.45	27.88	26.98	26.65	26.25	26.45	25.88
31.88	31.48	31.98	32.38	31.98	32.38	31.98
31.25	30.98	31.85	31.78	31.48	31.58	31.88
3.15	3.16	3.16	3.09	3.14	3.08	3.18
3.88	3.18	3.18	3.87	3.88	3.83	3.84
718.18	718.68	784.28	725.78	728.78	735.68	757.58
734.98	733.48	728.98	734.58	717.98	734.98	714.78
18.86	19.49	18.52	17.84	18.32	17.98	18.42
23.79	23.16	24.34	24.12	23.83	24.75	23.65
-8.65	8.17	-1.43	-8.82	-8.85	-8.65	8.11
1.34	2.32	0.26	1.83	1.52	1.88	8.74
48.78	43.83	49.58	35.53	48.47	48.28	55.37
385.54	321.75	389.37	318.82	389.49	382.86	314.17
328.21	316.12	344.56	332.31	314.27	389.91	317.81
6.89	7.62	6.84	6.39	6.71	6.66	7.44
8.11	7.88	8.35	7.42	7.68	7.36	8.11
24.76	24.94	24.99	25.12	24.63	25.18	24.62
24.74	24.53	24.88	24.31	24.56	24.51	24.51
877	898	981	867	881	868	864
1222	1229	1234	1199	1238	1194	1221
759	746	772	778	795	758	746

DATA CHECKS

Calc/Obs Ht BM	1.84	1.84	1.85	1.85	1.83	1.84	1.82
Calc/Obs Ht AW	1.82	1.83	1.83	1.85	1.85	1.84	1.84
Calc/Obs Courses/3cm AW	1.82	1.83	1.82	1.83	1.82	1.84	1.82
Calc/Obs Hates/3cm AW	1.84	1.82	1.83	1.82	1.82	1.83	1.81

JBS Case Study - 14g ATYC/Gaston County dyed  
DYED 14G (ATYC & Gaston Co)

8.88	12.18	8.82	8.89	8.15	9.91	11.82
12.47	9.48	7.83	11.63	9.57	9.81	8.49
9.78	14.45	18.56	18.89	18.24	12.85	12.88
12.26	8.68	7.71	11.79	9.14	9.98	8.85
285.62	192.87	284.94	282.14	284.12	281.22	281.84
249.74	241.26	243.69	258.47	244.66	252.44	245.98
44.88	41.98	45.88	46.18	45.58	45.28	45.78
48.88	48.68	49.88	49.58	49.38	49.58	49.58
49.18	49.18	58.88	49.78	49.58	58.58	58.58
26.98	28.38	26.85	26.93	27.98	27.78	27.48
38.28	38.98	29.35	38.18	38.58	38.68	38.38
29.88	38.58	29.38	38.58	38.88	38.98	29.98
3.87	3.18	3.18	3.83	3.88	3.82	3.83
3.87	3.88	3.88	3.85	3.87	3.81	3.81
697.88	719.78	683.48	678.78	783.88	726.88	671.28
648.88	682.58	674.88	688.98	689.78	677.68	654.78
28.89	19.82	28.48	28.88	28.62	28.38	19.74
22.59	22.47	22.82	22.34	22.68	22.45	22.81
-8.84	8.85	-8.84	1.42	-1.23	8.18	1.29
-8.44	-8.35	-8.34	-8.32	-8.85	8.18	-8.73
38.78	41.23	46.93	32.78	37.68	37.88	52.83
318.35	327.39	388.44	336.88	331.65	316.84	328.16
341.72	345.13	351.97	357.45	357.87	356.49	347.81
7.39	7.79	7.74	7.72	7.62	7.47	7.78
7.83	7.63	8.17	7.97	7.68	7.65	8.88
24.44	24.25	24.67	24.39	24.34	24.32	24.71
24.44	24.44	24.89	24.48	24.52	24.38	24.29
913	891	943	989	928	923	888
1148	1153	1172	1145	1154	1158	1137
14.16	14.17	14.48	14.32	13.93	13.57	14.72
14.49	14.46	14.65	15.48	14.33	14.89	15.22
43.64	43.98	44.28	44.23	42.92	42.34	44.73

DATA CHECKS

Calc/Obs Ht BM	8.98	1.83	1.88	1.81	1.83	1.82	1.83
Calc/Obs Ht AW	8.98	1.84	1.84	1.88	1.82	1.88	1.88
Calc/Obs Courses/3cm AW	1.81	1.88	8.99	1.82	1.82	1.84	1.84
Calc/Obs Hates/3cm AW	1.82	1.82	8.99	1.88	1.82	1.88	1.81

JBS Case Study - 22g controls for winch bleaching

GREIGE 22G (Winch bleach)

	C7998	81684	81618	81611	81612	81613	81614	81615	81616
Length shrinkage (Z), TD	19.17	19.06	18.41	16.66	18.78	18.02	18.45	18.42	18.42
Width shrinkage (Z), TD	20.11	14.85	14.87	15.31	14.66	14.77	14.13	14.87	14.87
Length shrinkage (Z), 5x	28.32	28.38	28.05	18.99	28.72	19.60	28.16	19.92	19.92
Width shrinkage (Z), 5x	28.36	14.62	14.76	14.48	14.71	14.42	14.32	13.35	13.35
Weight (gsm), BM	188.68	186.35	185.38	187.32	185.59	186.83	185.63	188.33	188.33
Weight (gsm), AM	151.99	149.83	150.38	151.49	150.57	150.85	148.77	149.99	149.99
Courses per 3cm, BM	60.48	56.85	56.95	57.45	56.45	56.55	56.38	56.88	56.88
Courses per 3cm, TD	73.38	78.15	69.25	69.58	78.18	69.48	69.48	78.15	78.15
Males per 3cm, BM	75.98	69.98	69.65	71.58	78.68	78.45	71.88	71.35	71.35
Males per 3cm, TD	37.48	38.15	38.68	37.53	37.78	37.78	37.85	37.78	37.78
Males per 3cm, BM	46.18	44.35	44.98	44.75	44.35	44.55	44.98	44.48	44.48
Males per 3cm, TD	47.58	44.85	45.15	44.45	44.65	44.65	44.85	44.85	44.85
Stitch length (cm), BM	2.89	2.21	2.22	2.21	2.21	2.21	2.21	2.21	2.21
Stitch length (cm), AM	2.85	2.18	2.17	2.18	2.17	2.17	2.18	2.18	2.18
Burst strength (kPa), BM	393.48	411.38	418.38	439.38	426.88	419.98	429.48	412.78	412.78
Burst strength (kPa), AM	397.48	389.48	484.68	423.18	394.68	486.38	396.68	415.78	415.78
Distension at burst (mm), BM	16.91	17.41	17.52	19.55	18.28	17.58	18.88	18.89	18.89
Distension at burst (mm), AM	22.75	22.86	22.12	22.89	23.13	23.11	24.17	22.81	22.81
Angle of spirality, BM	-1.82	-1.27	-1.71	-0.79	-1.08	-1.37	-0.98	-1.35	-1.35
Angle of spirality, AM	1.69	1.91	1.81	2.05	2.34	2.92	3.88	1.88	1.88
Width (cm), BM	43.13	42.78	42.75	43.87	43.28	42.72	42.95	42.78	42.78
Yarn strength (g), BM	127.71	137.99	138.88	123.87	137.17	141.43	134.78	134.92	134.92
Yarn strength (g), AM	113.31	132.87	137.26	127.54	131.65	137.17	132.35	131.39	131.39
Yarn ext. at break (Z), BM	5.96	6.89	6.48	5.62	6.19	6.22	6.88	5.93	5.93
Yarn ext. at break (Z), AM	5.72	6.79	7.14	6.39	7.19	7.18	6.72	6.76	6.76
Yarn count (tex), BM	9.78	9.92	9.93	10.85	9.92	9.98	9.84	10.86	10.86
Yarn count (tex), AM	9.41	9.78	9.71	9.88	9.74	9.89	9.64	9.69	9.69
Thickness (mm x 1000), BM	689	813	612	617	685	688	612	612	612
Thickness (mm x 1000), AM	816	855	878	871	857	855	849	849	849
Turns per metre, BM	1323	1298	1343	1263	1287	1347	1239	1345	1345
Colour - Y value									
Colour - Z value									
Colour - I value									
Turns per metre, AM									
Twist liveliness, t/a, BM	1.81	118.35	117.55	114.85	114.75	116.10	113.15	113.55	113.55
Twist liveliness, t/a, AM	1.82	91.38	98.88	94.55	94.78	94.58	97.78	93.58	93.58
DATA CHECKS									
Calc/Obs Mt BM	0.97	0.99	1.02	1.08	0.95	0.98	0.98	0.98	0.98
Calc/Obs Mt AM	0.95	0.97	0.99	0.99	0.93	1.00	1.00	1.00	1.00
Calc/Obs Courses/3cm BM	1.81	1.82	1.82	1.88	1.81	1.88	1.88	1.88	1.88
Calc/Obs Courses/3cm AM	0.97	0.81	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Calc/Obs Males/3cm BM									
Calc/Obs Males/3cm AM									

JBS Case Study - 22g winch bleached

	C7998	81884	81618	81611	81612	81613	81614	81615	81616
Length shrinkage (Z), TD	9.89	18.56	18.92	11.58	18.18	11.25	18.85	18.85	18.85
Width shrinkage (Z), TD	14.39	6.87	5.93	6.81	6.38	7.14	7.06	7.63	6.88
Length shrinkage (Z), 5x	11.78	12.88	13.18	13.41	12.82	13.85	13.18	12.15	12.19
Width shrinkage (Z), 5x	14.42	4.14	4.83	5.23	5.87	4.89	5.37	5.67	5.32
Weight (gsm), BM	184.83	112.68	115.14	113.86	115.64	117.37	117.17	118.68	118.68
Weight (gsm), AM	135.32	139.84	140.84	139.33	136.59	138.87	137.59	141.18	141.18
Courses per 3cm, BM	62.88	58.98	57.36	57.28	58.48	55.38	57.98	58.98	57.78
Courses per 3cm, TD	68.48	64.28	64.18	64.28	65.88	62.88	64.88	64.85	64.38
Males per 3cm, BM	78.98	66.28	66.68	66.88	66.68	64.58	66.58	66.38	66.68
Males per 3cm, TD	41.98	44.88	43.64	44.58	43.28	42.68	44.78	42.88	44.48
Males per 3cm, BM	46.58	47.58	47.55	46.85	46.48	46.48	46.68	46.95	47.18
Males per 3cm, TD	47.28	46.58	46.88	45.95	45.48	46.38	45.85	46.48	46.48
Stitch length (cm), BM	2.85	2.19	2.18	2.19	2.18	2.25	2.19	2.18	2.19
Stitch length (cm), AM	2.85	2.18	2.17	2.18	2.18	2.25	2.17	2.17	2.16
Burst strength (kPa), BM	399.98	376.58	488.58	489.18	384.88	486.88	384.88	396.38	396.38
Burst strength (kPa), AM	399.48	481.78	399.38	488.88	482.28	412.28	399.88	482.78	482.78
Distension at burst (mm), BM	18.16	17.84	17.98	17.89	19.33	18.89	18.82	18.24	18.24
Distension at burst (mm), AM	21.68	19.72	28.86	28.46	19.92	28.34	28.62	28.39	28.39
Angle of spirality, BM	8.91	-3.25	-1.18	0.29	-5.41	-8.29	-8.87	-1.38	-8.85
Angle of spirality, AM	8.91	1.68	1.82	1.54	0.72	2.38	1.74	0.43	-0.17
Width (cm), BM	39.57	37.73	37.77	37.13	39.27	38.83	38.68	37.53	37.53
Yarn strength (g), BM	139.23	133.89	128.47	126.28	134.48	129.64	137.81	138.65	138.65
Yarn strength (g), AM	144.37	157.25	148.97	151.55	158.68	153.75	154.93	154.13	154.13
Yarn ext. at break (Z), BM	7.86	6.78	6.75	6.42	6.41	6.97	6.98	6.45	6.68
Yarn ext. at break (Z), AM	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82
Yarn count (tex), BM	9.39	9.76	9.75	9.78	9.69	9.55	9.64	9.69	9.62
Yarn count (tex), AM	9.37	9.79	9.63	9.65	9.57	9.45	9.63	9.39	9.64
Thickness (mm x 1000), BM	568	615	686	611	622	618	612	612	619
Thickness (mm x 1000), AM	776	767	763	759	765	755	756	766	766
Turns per metre, BM	85.49	1284	1259	1268	1283	1262	1248	1235	1286
Turns per metre, AM	86.55	86.55	86.28	87.28	86.36	86.93	87.38	86.78	86.78
Colour - Y value	115.24	88.34	86.29	87.91	87.17	87.87	88.13	87.18	87.38
Colour - Z value		116.61	112.81	116.25	114.41	115.25	116.72	114.42	114.93
Colour - I value		1195	1197	1283	1288	1156	1213	1282	1241
Turns per metre, AM		81.85	81.39	82.88	88.78	85.98	73.88	81.95	81.88
Twist liveliness, t/a, BM		73.98	74.18	71.88	73.85	77.25	72.85	74.35	73.58
Twist liveliness, t/a, AM									
DATA CHECKS									
Calc/Obs Mt BM	1.86	1.85	1.85	1.84	1.84	1.84	1.83	1.81	1.81
Calc/Obs Mt AM	1.85	1.84	1.83	1.82	1.82	1.81	1.83	1.82	1.82
Calc/Obs Courses/3cm BM	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81
Calc/Obs Courses/3cm AM	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Calc/Obs Males/3cm BM									
Calc/Obs Males/3cm AM									



JBS Case Study - 22g controls for winch dyeing  
GREIGE 22G (Winch dye)

Length shrinkage (Z), TD	18.55	18.48	18.47	16.54
Width shrinkage (Z), TD	23.35	22.98	23.67	21.14
Length shrinkage (Z), 5x	19.71	19.48	19.66	17.76
Width shrinkage (Z), 5x	24.09	23.83	24.23	21.42
Weight (gsl), BM	99.91	181.26	98.53	186.51
Weight (gsl), AM	158.82	152.11	154.85	157.65
Courses per 3cm, BM	61.78	61.58	61.38	62.08
Courses per 3cm, TD	73.58	73.58	73.18	72.48
Courses per 3cm, AM	76.08	76.18	75.45	75.78
Wales per 3cm, BM	36.28	36.58	36.18	37.18
Wales per 3cm, TD	47.38	46.38	47.38	46.68
Wales per 3cm, AM	46.98	47.98	47.88	47.18
Stitch length (mm) BM	2.89	2.88	2.87	2.89
Stitch length (mm) AM	2.86	2.85	2.86	2.86
Burst strength (kPa), BM	386.48	389.78	483.88	399.88
Burst strength (kPa), AM	372.88	377.18	488.68	488.18
Distension at burst (mm), BM	17.51	18.21	17.38	17.95
Distension at burst (mm), AM	22.86	23.84	23.82	23.54
Angle of spirality, BM	8.61	8.25	-1.28	8.56
Angle of spirality, AM	8.35	8.86	-8.88	8.75
Width (cm), BM	45.88	44.83	44.78	43.28
Yarn strength (g), BM	128.24	136.88	129.88	137.47
Yarn strength (g), AM	118.63	118.17	117.18	121.82
Yarn ext. at break (Z), BM	5.94	6.44	6.19	6.56
Yarn ext. at break (Z), AM	6.46	5.61	5.78	6.28
Yarn count (tex), BM	9.77	9.79	9.88	9.76
Yarn count (tex), AM	9.66	9.56	9.72	9.49
Thickness (mm x 1000), BM	549	563	554	593
Thickness (mm x 1000), AM	828	832	834	845
Turns per metre, BM	1317	1299	1325	1444

DATA CHECKS

Calc/Obs Mt BM	1.81	1.88	1.82	8.98
Calc/Obs Mt AM	1.84	1.85	1.84	8.98
Calc/Obs Courses/3cm BM	1.81	1.88	1.81	1.88
Calc/Obs Courses/3cm AM	1.82	1.88	1.88	1.88

JBS Case Study - 22g winch dyed  
WINCH DYED 22G

Length shrinkage (Z), TD	8.42	11.57	18.52	9.89
Width shrinkage (Z), TD	9.58	9.33	11.57	9.33
Length shrinkage (Z), 5x	18.31	14.19	12.66	12.28
Width shrinkage (Z), 5x	9.69	18.76	11.42	8.83
Weight (gsl), BM	124.82	121.88	112.39	128.37
Weight (gsl), AM	158.19	152.85	146.55	142.55
Courses per 3cm, BM	62.58	64.88	61.88	68.88
Courses per 3cm, TD	66.88	68.48	66.78	68.38
Courses per 3cm, AM	69.78	78.58	78.78	69.18
Wales per 3cm, BM	46.28	44.28	43.18	45.58
Wales per 3cm, TD	49.38	58.28	49.38	49.38
Wales per 3cm, AM	58.28	49.98	49.98	48.75
Stitch length (mm) BM	2.86	2.86	2.85	2.86
Stitch length (mm) AM	2.85	2.85	2.84	2.84
Burst strength (kPa), BM	484.48	382.48	416.48	415.58
Burst strength (kPa), AM	388.68	392.28	443.68	417.68
Distension at burst (mm), BM	28.83	19.25	18.31	18.25
Distension at burst (mm), AM	21.92	21.84	21.62	21.94
Angle of spirality, BM	1.63	8.62	8.74	8.85
Angle of spirality, AM	8.42	-8.46	8.74	8.85
Width (cm), BM	35.78	36.93	36.77	36.23
Yarn strength (g), BM	132.51	123.89	135.48	138.96
Yarn strength (g), AM	124.84	128.89	139.93	142.91
Yarn ext. at break (Z), BM	6.38	6.53	6.92	7.53
Yarn ext. at break (Z), AM	6.23	6.32	6.48	6.68
Yarn count (tex), BM	9.66	9.81	9.52	9.62
Yarn count (tex), AM	9.79	9.84	9.58	9.85
Thickness (mm x 1000), BM	621	685	591	684
Thickness (mm x 1000), AM	765	768	759	749
Colour - Y value	1.42	6.86	71.97	17.59
Colour - Y value	1.44	3.87	73.64	18.77
Colour - Z value	1.89	4.13	69.47	37.81

DATA CHECKS

Calc/Obs Mt BM	1.82	0.99	1.81	1.81
Calc/Obs Mt AM	1.84	1.84	1.84	1.86
Calc/Obs Courses/3cm BM	1.88	1.81	0.99	1.88
Calc/Obs Courses/3cm AM	1.82	0.99	0.98	1.82



GREIGE 22G (ATYC)

	038%	641%	086%	C7991	D1632
Length shrinkage (Z), 1E	17.85	18.17	16.41	17.52	17.13
Width shrinkage (Z), 1D	22.88	22.53	22.45	18.67	19.75
Length shrinkage (Z), 5x	19.13	28.85	19.53	18.91	18.65
Width shrinkage (Z), 5x	23.12	23.54	22.98	18.19	21.25
Weight (gsm), BM	181.31	188.99	188.46	183.38	184.79
Weight (gsm), AM	152.00	152.48	151.52	146.44	148.92
Courses per 3cm, BM	63.28	62.48	61.88	68.68	62.98
Courses per 3cm, 1D	75.58	74.88	75.18	73.58	74.98
Courses per 3cm, BM	75.28	75.95	75.85	73.25	77.18
Wales per 3cm, BM	37.68	37.28	38.48	38.88	37.68
Wales per 3cm, 1D	48.88	48.48	48.48	48.38	46.38
Wales per 3cm, AM	47.18	47.85	47.55	46.68	46.78
Stitch length (mm) BM	2.85	2.89	2.89	2.16	2.89
Stitch length (mm) AM	2.85	2.85	2.86	2.12	2.86
Burst strength (kPa), BM	395.98	388.88	384.38	352.88	425.98
Burst strength (kPa), AM	395.28	389.58	418.18	385.48	485.88
Distension at burst (mm), BM	18.21	17.97	17.35	18.32	18.66
Distension at burst (mm), AM	24.17	23.89	23.19	23.49	24.45
Angle of spirality, BM	-1.18	-1.81	-0.68	-0.58	-1.58
Angle of spirality, AM	-0.83	-0.36	-0.24	-0.48	-2.33
Width (cm), BM	44.83	44.78	44.87	42.48	43.83
Yarn strength (g), BM	123.85	119.15	118.87	115.51	128.42
Yarn strength (g), AM	5.59	5.53	5.71	5.65	5.47
Yarn ext. at break (Z), BM	5.76	5.38	5.39	5.37	7.88
Yarn ext. at break (Z), AM	9.48	9.57	9.54	9.49	9.61
Yarn count (text), BM	9.67	9.51	9.48	9.44	9.54
Yarn count (text), AM	575	635	564	587	574
Thickness (mm x 1000), BM	864	853	873	858	844
Turns per metre, BM	1328	1253	1383	1294	1283

DATA CHECKS

Calc/Obs Wt BM	1.83	1.82	1.85	1.84	1.81
Calc/Obs Wt AM	1.83	1.83	1.82	1.84	1.85
Calc/Obs Courses/3cm	1.84	1.83	1.82	1.82	1.88
Calc/Obs Wales/3cm	1.84	1.82	1.85	1.82	1.82

GREIGE 22G (ATYC)

	01551	01552	01553	01554	01555	01556	01557	01558
Length shrinkage (Z), 1E	18.44	18.34	19.31	18.83	19.45	19.88	19.41	19.14
Width shrinkage (Z), 1D	11.44	13.78	14.88	13.75	14.13	14.59	12.95	12.94
Length shrinkage (Z), 5x	28.39	28.88	28.91	28.32	28.91	28.18	19.73	28.63
Width shrinkage (Z), 5x	9.78	12.21	13.63	12.44	12.25	13.31	11.59	18.57
Weight (gsm), BM	188.48	184.88	185.55	188.89	186.22	187.38	189.86	188.61
Weight (gsm), AM	142.37	143.14	145.28	144.79	144.76	145.85	145.12	143.41
Courses per 3cm, BM	55.48	54.78	54.98	55.84	54.88	55.38	55.88	55.18
Courses per 3cm, 1D	67.18	66.78	67.58	66.58	67.38	66.68	66.88	67.78
Courses per 3cm, AM	68.68	68.28	68.28	68.88	68.88	68.48	68.88	69.88
Wales per 3cm, BM	39.58	38.78	37.98	38.38	38.68	38.48	38.68	39.88
Wales per 3cm, 1D	44.58	44.58	44.48	44.48	44.48	44.78	44.18	44.78
Wales per 3cm, AM	43.78	44.18	43.98	43.58	43.58	43.98	43.78	43.48
Stitch length (mm) BM	2.28	2.29	2.29	2.28	2.28	2.28	2.28	2.28
Stitch length (mm) AM	2.24	2.26	2.26	2.26	2.26	2.27	2.26	2.26
Burst strength (kPa), BM	429.88	444.58	442.88	432.48	421.18	443.88	448.28	445.18
Burst strength (kPa), AM	378.48	393.98	427.58	386.98	488.88	386.88	384.78	394.98
Distension at burst (mm), BM	18.28	17.89	18.49	28.86	18.95	18.26	17.58	19.68
Distension at burst (mm), AM	22.33	22.23	22.26	22.37	22.18	23.13	22.15	22.21
Angle of spirality, BM	-8.35	6.25	-1.88	-8.83	6.23	-6.22	-8.18	-8.59
Angle of spirality, AM	1.84	2.86	2.48	2.59	2.46	2.15	2.37	3.85
Width (cm), BM	41.87	42.58	42.87	42.58	42.53	42.83	42.28	42.38
Yarn strength (g), BM	139.32	142.29	152.32	151.88	139.87	151.89	137.55	143.91
Yarn strength (g), AM	136.91	139.48	143.21	144.64	133.99	137.33	134.13	138.75
Yarn ext. at break (Z), BM	6.88	6.86	6.27	6.32	5.99	6.51	5.98	6.12
Yarn ext. at break (Z), AM	6.66	7.14	7.32	7.24	7.83	6.96	6.96	6.89
Yarn count (text), BM	18.81	9.92	18.84	18.83	18.84	18.84	18.84	9.96
Yarn count (text), AM	9.71	9.88	9.91	18.87	9.81	9.98	9.81	9.86
Thickness (mm x 1000), BM	627	613	614	689	623	629	622	621
Thickness (mm x 1000), AM	981	882	887	871	871	883	886	876
Turns per metre, BM	1298	1358	1323	1278	1299	1366	1277	1342

DATA CHECKS

Calc/Obs Wt BM	1.83	1.82	1.81	0.99	1.82	1.81	0.99	1.88
Calc/Obs Wt AM	1.83	1.83	1.83	1.83	1.81	1.83	1.81	1.84
Calc/Obs Courses/3cm	1.81	1.81	1.82	1.82	1.82	1.81	1.81	1.81
Calc/Obs Wales/3cm	1.88	1.88	1.88	1.81	1.81	1.81	1.81	1.88

## JBS Case Study - 22g AYTC dyed

## 22G AYTC DYED

Length shrinkage (L1), TD	8.35	7.41	7.45	9.68	7.21
Width shrinkage (L1), TD	13.97	13.61	18.96	18.39	7.51
Length shrinkage (L1), 5x	18.66	8.15	9.53	11.82	8.96
Width shrinkage (L1), 5x	13.87	13.88	11.15	18.64	7.72
Weight (gs), BM	120.32	115.17	116.52	112.77	131.88
Weight (gs), AM	149.64	142.87	142.33	133.66	151.52
Courses per 3cm, BM	64.68	64.88	65.68	61.68	66.88
Courses per 3cm, TD	71.58	72.48	78.78	67.28	71.38
Courses per 3cm, AM	71.75	72.98	72.58	67.65	73.58
Males per 3cm, BM	43.18	48.98	42.98	43.28	44.78
Males per 3cm, TD	49.98	46.68	48.18	49.88	49.88
Males per 3cm, AM	49.35	46.48	47.88	47.38	47.98
Stitch length (mm), BM	2.85	2.84	2.86	2.12	2.86
Stitch length (mm), AM	2.86	2.85	2.86	2.12	2.85
Burst strength (kPa), BM	377.48	345.18	382.68	371.18	397.68
Burst strength (kPa), AM	399.58	372.38	383.48	397.88	422.38
Distension at burst (mm), BM	19.59	28.87	28.14	28.53	21.22
Distension at burst (mm), AM	23.34	22.87	21.88	22.83	23.83
Angle of spirality, BM	-8.62	-8.21	1.19	8.32	8.92
Angle of spirality, AM	-1.91	-1.14	-8.27	-8.84	8.28
Width (cm), BM	36.93	48.87	38.53	37.77	36.97
Yarn strength (g), BM	115.72	121.17	128.93	125.88	188.15
Yarn strength (g), AM	119.54	122.16	129.32	124.27	115.41
Yarn ext. at break (Z), BM	5.48	5.69	5.54	5.69	5.79
Yarn ext. at break (Z), AM	5.13	5.21	5.54	5.78	5.68
Yarn count (text), BM	9.61	9.64	9.37	9.31	9.89
Yarn count (text), AM	9.54	9.42	9.38	9.27	9.54
Thickness (mm x 1000), BM	624	688	622	599	640
Thickness (mm x 1000), AM	831	785	885	793	799
Colour - 1 value	9.59	5.33	28.22	28.61	22.98
Colour - Y value	38.34	3.89	9.77	18.82	18.56
Colour - Z value	4.23	13.94	45.96	46.47	4.12

## DATA CHECKS

Calc/Obs Wt BM	1.81	1.81	1.83	1.84	1.81
Calc/Obs Wt AM	1.83	1.81	1.84	1.84	1.81
Calc/Obs Courses/3cm	1.81	8.97	8.99	1.82	1.88
Calc/Obs Males/3cm	1.81	1.82	1.81	1.82	1.81

## JBS Case Study - 22g AYTC dyed

## 22G AYTC DYED

Length shrinkage (L1), TD	8.26	9.42	7.56	6.65	6.66	8.38	7.64	6.36
Width shrinkage (L1), TD	6.33	5.47	6.31	6.87	7.78	5.51	4.78	5.51
Length shrinkage (L1), 5x	9.87	18.87	7.89	7.26	7.47	8.81	8.17	6.87
Width shrinkage (L1), 5x	5.88	3.89	4.62	4.99	6.23	3.56	3.56	3.32
Weight (gs), BM	119.31	121.21	128.72	121.28	118.66	119.88	122.97	123.58
Weight (gs), AM	137.72	137.41	137.72	139.35	139.34	137.34	142.83	141.14
Courses per 3cm, BM	68.18	59.58	61.88	61.18	59.58	68.18	68.28	61.28
Courses per 3cm, TD	65.88	65.88	65.58	65.18	64.18	65.28	64.88	64.88
Courses per 3cm, AM	66.28	66.88	65.68	65.68	64.98	66.78	65.28	65.98
Males per 3cm, BM	41.85	42.18	41.48	41.68	42.58	48.28	42.28	42.38
Males per 3cm, TD	43.88	43.78	43.68	43.58	44.98	42.98	44.38	44.38
Males per 3cm, AM	42.88	43.38	43.78	43.38	44.68	42.78	44.78	43.48
Stitch length (mm), BM	2.25	2.25	2.26	2.25	2.26	2.25	2.25	2.25
Stitch length (mm), AM	2.25	2.24	2.25	2.25	2.25	2.25	2.24	2.25
Burst strength (kPa), BM	379.88	388.68	486.78	398.28	381.38	382.98	371.98	415.78
Burst strength (kPa), AM	353.98	357.88	388.38	381.28	369.28	378.58	363.48	365.58
Distension at burst (mm), BM	18.64	19.68	19.69	19.24	18.88	19.35	28.12	28.32
Distension at burst (mm), AM	28.93	28.87	28.95	28.83	28.77	28.53	28.73	28.94
Angle of spirality, BM	-1.42	-8.57	-1.41	-2.72	-2.78	-3.93	-1.59	-3.34
Angle of spirality, AM	-8.79	-8.57	-8.84	-1.44	-2.88	-8.82	-8.75	-8.73
Width (cm), BM	41.33	41.87	48.37	48.28	39.37	48.83	48.33	48.88
Yarn strength (g), BM	133.28	138.83	125.55	133.44	138.45	136.28	134.43	133.41
Yarn strength (g), AM	138.75	148.45	138.85	138.92	131.15	136.72	136.96	146.92
Yarn ext. at break (Z), BM	6.64	6.52	6.16	6.71	6.58	6.79	6.72	6.68
Yarn ext. at break (Z), AM	6.98	7.81	7.83	6.85	6.55	6.91	6.81	7.85
Yarn count (text), BM	18.83	9.92	9.92	18.84	9.84	9.91	9.91	18.82
Yarn count (text), AM	9.86	9.84	18.82	9.89	9.91	9.77	18.82	9.91
Thickness (mm x 1000), BM	628	685	638	628	638	612	636	646
Thickness (mm x 1000), AM	778	759	777	786	781	756	777	774
Turns per metre, BM	1243	1285	1276	1287	1198	1288	1283	1273
Colour - X value	5.19	5.16	5.26	5.14	5.83	5.33	5.27	5.24
Colour - Y value	4.14	4.89	4.21	4.18	3.99	4.27	4.19	4.28
Colour - Z value	15.89	15.21	15.38	15.13	14.81	15.41	15.46	15.13
Turns per metre, AM	1258	1247	1277	1185	1195	1219	1178	1385
Twist liveliness, t/e, BM	98.75	89.55	92.68	89.38	88.75	88.48	87.85	81.38
Twist liveliness, t/e, AM	81.48	84.95	83.65	79.35	88.45	84.48	82.55	83.55

## DATA CHECKS

Calc/Obs Wt BM	1.84	1.83	1.84	1.85	1.85	1.81	1.82	1.85
Calc/Obs Wt AM	1.81	1.82	1.84	1.81	1.83	1.81	1.87	1.88
Calc/Obs Courses/3cm	1.88	1.88	1.81	1.88	8.99	1.81	1.88	1.88
Calc/Obs Males/3cm	1.81	1.81	8.99	1.81	1.82	8.98	8.98	1.81