

**Starfish 84 Equations for 1x1 Rib fabrics
Greige and Winch-Bleached**

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Note that the Starfish equations have changed their form since this was written

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1. Introduction

In order to extend the STARFISH 1x1 rib database a series of 25 fabrics was knitted and finished at Meridian Fabrics, Nottingham (see Research Records 204 and 206).

This report presents the results of laboratory tests on these fabrics together with the results of regression analysis to estimate the STARFISH equations for the fabric - process involved. In addition, a brief comparison is made with the CP78 project data for 1x1 rib.

2. Fabrics

Knitting

25 qualities were produced on 2 gauges of 1x1 rib machine (14G and 18G), using five counts of yarn, Ne 20's, 26's, 32's, 36's, and 42's, at different stitch lengths. Five metres from each yarn count - stitch length combination were sent for testing. Full details are given in Research Record 204.

Finishing

All fabrics were processed at Meridian which consisted of a winch bleach, detwist, wet stretch on Calator Airtex, and dry using a Ruckh relax dryer. The fabric was returned to IIC, sampled and tested. Full details are given in Research Record 206.

3. Results

The complete raw test data are given in the Appendix.

Table 1 shows some of the yarn properties as measured on the original cones compared to those measured on yarn taken from the grey fabrics.

There was no significant difference in the yarn count (tex) so the weighted mean was calculated for each yarn and used in all further analysis. There was also no significant difference in yarn strength, although extension at break was significantly higher in the yarn taken from fabric.

The level of twist in the yarn taken from the fabric was significantly higher than that in the original yarn. If this is a real effect and is a normal feature of circular knitting then it needs further investigation since the level of twist is important in predicting dimensional properties of the finished fabrics.

Tables 2-5 give the results of the standard internal data consistency checks. *Table 2* shows the comparison of measured vs. calculated shrinkages for the grey fabrics. The differences are not significant overall. The largest individual difference in the length is 2.3% and in the width 3.6%. Such figures are normal for 1x1 rib fabrics. The same data are shown plotted in *Figure 1*. *Table 3* and *Figure 2* show the shrinkage comparisons for the bleached fabrics. Again the differences are not significant. Obviously, the measured and calculated courses and wales must also be in good agreement (*Figures 3, 4 and 5*).

Table 4 shows the comparison of measured vs. calculated weight for the grey fabrics. For the as-received (BW) fabrics the difference is less than 2% and is statistically insignificant, although it looks systematic. However, for the Reference State (AW) fabrics the difference is more than 6% and is significant at the 99.9% level.

Table 5 shows the weight comparisons for the bleached fabric. In this case, the as-received and the Reference State differences are both significant, though the offset is a little less than that for grey Reference State.

At the time of this analysis we were uncertain as to the origin of such weight differences which are seen from time to time. It has now been found that, for certain fabrics, especially in the Reference State, the cutting die cuts a specimen for weighing which is less than the standard area. For these samples, the measured weight is consistently low. In this case, the error ranged from about 3% up to more than 10%. The reference weight comparisons are also shown plotted in *Figure 6* where the systematic offset is very clearly seen.

4. Starfish Equations

Standard linear and multiple linear regression analysis was applied to the data using the STARFISH 84 model equations, i.e.

STEP 1 $T = C1 * \text{ave tex as knitted}$
 $L = C2 * \text{ave St.Len as knitted}$

STEP 2 $C = C3 + C4 / L + C5 * \sqrt{T}$
 $W = C6 + C7 / L + C8 * \sqrt{T}$
 $S = C9 + C10 / L^2 + C11 * T$
 $Wt = C12 + C13 * T / L$

The resulting estimates for the coefficients $C1$ to $C13$ are given in *Table 6*. The linear correlation coefficients for the STEP 1 equations were $R^2 = 0.999$ for all four equations.

Tables 7 to 14 show the comparison between measured and calculated values for the STEP 2 equations. Multiple linear correlation coefficients for these equations were as follows:

	R-squared	
	Grey	Bleached
Courses	0.971	0.987
Wales	0.965	0.971
Stitches	0.988	0.996
Weight	0.997	0.997

Figures 7 to 12 show how the equations model the data. On the whole the agreement is pretty good. A most interesting point to note is that there is apparently no significant effect of tex on the reference stitches per sq. cm. in the bleached fabric (*Figure 11*), whereas for courses and wales separately, the effect of tex is most marked in the bleached fabric (*Figures 9 and 10*).

5. Comparison With CP78 Data

Tables 15 and 16 show the original CP78 database values for grey and winch bleached 1x1 rib fabrics, including the results of some case studies. It is because our original winch bleached database was so poor that the present series was run.

It is not intended to make a detailed comparison of the old data with the new at this point, but a quick comparison is useful as a preview to the detailed study to see how compatible the two sets of data are. *Figures 13 to 15* show the CP78 data for courses, wales, and stitches alongside the 1x1 rib 85 curves drawn from the new 1x1 rib 85 STARFISH 84 equations. Agreement is fair for courses but poor for wales. *Figures 16 to 18* show the opposite comparison, i.e. the new data against the old equations. The same conclusion applies. *Figures 19 and 20* show both comparisons on the same plots for the weight. Agreement is reasonable in the grey and may be just tolerable in the bleached fabrics, but systematic differences are clearly to be seen.

Thus on the face of it, the two data sets are not compatible and so it is not possible to conclude that they can be combined at this stage. It will have to be left to the more detailed analysis to decide on the likely reasons for the discrepancies and how to proceed.

The main differences between the two sets were as follows:-

- The 1x1 rib 85 set was processed through a wet stretcher and a relax dryer;
- The CP78 set are averages of two sets, namely WB and WBT. The latter set went through a Tubetex compactor: neither wet stretching nor relax drying were used.

Conclusions

1. STARFISH 84 model equations have been derived for a new set of 1x1 rib fabrics, grey and winch bleached, in the yarn count range 20 to 42 Ne.
2. The measured weight per unit area data are suspect.
3. These new data can not be directly combined with the old 1x1 rib (CP78) data without more careful analysis and comparison of the two sets.

Table 1

1 x 1 RIB 85

YARN PROPERTIES : CONE VS FABRIC

		<u>Mean</u>	<u>Mean Difference</u>	<u>s.d. of Differences</u>	<u>Student's t</u>	
Tex	: Cone	20.27	0.24	0.28	1.79	N.S.
	Fabric	20.03				
Strength	: Cone	256	2.0	18.2	0.22	N.S.
	Fabric	254				
Extension	: Cone	6.55	-0.9	0.37	5.03	***
	Fabric	7.49				
Twist	: Cone	764	-79	40.5	3.88	***
	Fabric	843				

Table 2

RIB 85

GREIGE DATA

Comparison of Measured vs Calculated - %Shrinkage (5x)

	Smpl I.D.	Mea.Sh (Len)	Cal.Sh (Len)	% Diff	Mea.Sh (Wid)	Cal.Sh (Wid)	% Diff
1	Rb 14/1-20/285	10.37	10.00	-0.37	24.46	22.42	-2.04
2	Rb 14/1-20/306	14.72	13.75	-0.97	18.75	18.94	0.19
3	Rb 14/1-20/326	17.71	18.24	0.52	14.43	16.39	1.97
4	Rb 14/1-20/350	20.05	19.91	-0.13	8.84	10.37	1.53
5	Rb 14/1-20/368	21.50	21.84	0.34	4.80	5.88	1.08
6	Rb 14/1-26/267	10.91	10.28	-0.64	28.58	27.75	-0.83
7	Rb 14/1-26/285	14.68	14.81	0.13	23.44	23.35	-0.09
8	Rb 14/1-26/306	18.31	17.56	-0.75	17.74	16.31	-1.43
9	Rb 14/1-26/326	20.60	18.26	-2.34	11.37	13.87	2.50
10	Rb 14/1-26/350	22.38	23.23	0.84	5.12	7.24	2.13
11	Rb 18/1-32/275	19.84	18.80	-1.03	13.32	10.83	-2.48
12	Rb 18/1-32/289	21.21	22.84	1.63	9.49	11.58	2.09
13	Rb 18/1-32/303	24.28	24.98	0.62	5.05	4.82	-0.23
14	Rb 18/1-32/318	27.78	27.91	0.13	1.99	3.12	1.12
15	Rb 18/1-32/334	27.60	28.03	0.42	-5.30	-5.08	0.21
16	Rb 18/1-36/275	21.31	20.74	-0.57	13.08	10.58	-2.49
17	Rb 18/1-36/289	22.95	23.93	0.98	9.38	9.46	0.08
18	Rb 18/1-36/303	26.10	26.02	-0.08	3.59	4.20	0.61
19	Rb 18/1-36/318	28.15	29.92	1.77	-1.74	-0.63	1.11
20	Rb 18/1-36/334	30.21	30.70	0.49	-7.38	-4.28	3.10
21	Rb 18/1-42/260	21.48	20.74	-0.74	17.97	14.32	-3.65
22	Rb 18/1-42/275	23.14	21.67	-1.47	11.81	9.70	-2.11
23	Rb 18/1-42/289	25.14	22.85	-2.30	7.82	4.93	-2.89
24	Rb 18/1-42/303	26.66	24.32	-2.34	1.54	1.22	-0.32
25	Rb 18/1-42/318	30.60	31.01	0.41	-6.00	-3.59	2.40

	Ave.	21.91	21.69	-0.22	9.29	9.35	0.06
	Std.d	5.43	5.75	1.12	9.48	8.66	1.90

Table 3

RIB '85

WINCH BLEACHED DATA

Comparison of Measured vs Calculated - %Shrinkage (5x)

	Smpl I.D.	Mea.Sh (Len)	Cal.Sh (Len)	% Diff	Mea.Sh (Wid)	Cal.Sh (Wid)	% Diff
1	Rb 14/1-20/285	4.42	4.34	-0.08	9.48	10.34	0.86
2	Rb 14/1-20/306	5.67	5.17	-0.50	9.34	10.68	1.34
3	Rb 14/1-20/326	6.30	7.56	1.26	9.01	5.61	-3.41
4	Rb 14/1-20/350	8.01	7.49	-0.52	10.37	7.79	-2.57
5	Rb 14/1-20/368	8.40	7.87	-0.52	11.96	10.85	-1.11
6	Rb 14/1-26/267	5.28	4.91	-0.37	11.24	11.34	0.10
7	Rb 14/1-26/285	5.99	4.95	-1.04	10.70	11.31	0.61
8	Rb 14/1-26/306	7.32	7.58	0.26	12.47	12.62	0.15
9	Rb 14/1-26/326	9.87	9.98	0.10	10.54	12.21	1.67
10	Rb 14/1-26/350	9.88	9.95	0.08	14.03	13.40	-0.63
11	Rb 18/1-32/275	7.91	7.55	-0.37	10.34	11.38	1.04
12	Rb 18/1-32/289	9.92	10.14	0.22	8.54	6.29	-2.25
13	Rb 18/1-32/303	10.51	11.27	0.76	4.66	1.81	-2.85
14	Rb 18/1-32/318	12.26	11.60	-0.66	6.17	3.01	-3.16
15	Rb 18/1-32/334	13.76	14.58	0.82	3.96	2.92	-1.05
16	Rb 18/1-36/275	10.18	9.31	-0.87	6.16	5.42	-0.74
17	Rb 18/1-36/289	10.92	11.13	0.21	4.95	4.20	-0.75
18	Rb 18/1-36/303	12.24	12.77	0.52	3.69	1.58	-2.11
19	Rb 18/1-36/318	13.03	11.98	-1.05	4.74	1.84	-2.90
20	Rb 18/1-36/334	15.20	12.56	-2.64	6.76	3.12	-3.64
21	Rb 18/1-42/260	8.05	8.54	0.49	10.52	13.70	3.17
22	Rb 18/1-42/275	10.41	10.70	0.29	7.00	7.91	0.91
23	Rb 18/1-42/289	12.05	12.33	0.28	6.40	6.69	0.29
24	Rb 18/1-42/303	12.95	12.63	-0.32	2.23	2.24	0.00
25	Rb 18/1-42/318	15.45	15.33	-0.12	2.95	3.47	0.52
Ave.		9.84	9.69	-0.15	7.93	7.27	-0.66
Std.d		3.08	3.04	0.78	3.26	4.18	1.81

Table 4

RIB 85

GREIGE DATA

Comparison of Measured vs Calculated - Weight (gm) (5x)

	Smpl I.D.	Mea.Wt (BW)	Cal.Wt (BW)	% Diff	Mea.Wt (AW)	Cal.Wt (AW)	% Diff
1	Rb 14/1-20/285	240.37	250.67	4.11	335.49	350.05	4.16
2	Rb 14/1-20/306	238.60	242.11	1.45	315.56	330.96	4.65
3	Rb 14/1-20/326	228.93	229.48	0.24	296.74	315.64	5.99
4	Rb 14/1-20/350	215.64	217.57	0.89	272.51	290.19	6.09
5	Rb 14/1-20/368	206.36	212.95	3.09	260.90	279.35	6.60
6	Rb 14/1-26/267	190.31	193.78	1.79	276.40	287.81	3.97
7	Rb 14/1-26/285	186.69	184.27	-1.32	260.23	269.63	3.49
8	Rb 14/1-26/306	180.43	183.85	1.86	241.55	255.87	5.60
9	Rb 14/1-26/326	169.46	173.89	2.55	225.89	238.42	5.26
10	Rb 14/1-26/350	168.83	171.34	1.47	207.73	231.40	10.23
11	Rb 18/1-32/275	165.11	166.51	0.84	211.96	221.46	4.29
12	Rb 18/1-32/289	156.70	157.49	0.50	199.53	221.65	9.98
13	Rb 18/1-32/303	152.34	150.82	-1.01	190.94	203.30	6.08
14	Rb 18/1-32/318	139.34	143.02	2.58	178.84	198.12	9.73
15	Rb 18/1-32/334	141.65	141.12	-0.37	165.95	182.10	8.87
16	Rb 18/1-36/275	138.73	139.74	0.72	180.46	191.29	5.66
17	Rb 18/1-36/289	132.25	132.63	0.29	172.59	184.08	6.24
18	Rb 18/1-36/303	129.10	130.72	1.24	162.21	176.30	7.99
19	Rb 18/1-36/318	121.23	125.73	3.58	155.80	171.12	8.96
20	Rb 18/1-36/334	116.82	119.92	2.58	139.85	156.62	10.71
21	Rb 18/1-42/260	124.75	124.46	-0.23	171.48	176.57	2.88
22	Rb 18/1-42/275	123.12	123.66	0.43	161.20	168.78	4.45
23	Rb 18/1-42/289	115.68	122.64	5.68	153.32	159.01	3.58
24	Rb 18/1-42/303	112.69	121.17	7.00	142.67	156.14	8.63
25	Rb 18/1-42/318	105.81	109.53	3.40	131.88	147.91	10.84
Ave.		160.04	162.76	1.73	208.47	222.55	6.60
Std.d		41.33	41.81	1.99	58.65	59.72	2.50

Table 5

RIB '85

WINCH BLEACHED DATA

Comparison of Measured vs Calculated - Weight(gsm) (5x)

	Smpl I.D.	Mea.Wt (BW)	Cal.Wt (BW)	% Diff	Mea.Wt (AW)	Cal.Wt (AW)	% Diff
1	Rb 14/1-20/285	279.16	278.74	-0.15	317.54	329.54	3.64
2	Rb 14/1-20/306	263.59	263.56	-0.01	295.98	311.23	4.90
3	Rb 14/1-20/326	238.51	250.73	4.87	277.52	284.15	2.33
4	Rb 14/1-20/350	216.22	232.48	7.00	253.38	270.72	6.41
5	Rb 14/1-20/368	198.80	212.78	6.57	240.14	252.02	4.71
6	Rb 14/1-26/267	220.04	223.23	1.43	261.27	262.60	0.51
7	Rb 14/1-26/285	209.62	211.13	0.71	247.69	246.62	-0.43
8	Rb 14/1-26/306	191.30	188.09	-1.71	229.72	233.28	1.53
9	Rb 14/1-26/326	172.45	175.04	1.48	213.40	220.30	3.13
10	Rb 14/1-26/350	157.86	158.92	0.67	196.55	203.97	3.63
11	Rb 18/1-32/275	170.33	179.27	4.99	202.30	212.49	4.80
12	Rb 18/1-32/289	164.42	168.90	2.65	192.45	202.68	5.05
13	Rb 18/1-32/303	156.17	164.49	5.06	182.87	189.68	3.59
14	Rb 18/1-32/318	150.28	154.49	2.72	170.34	181.14	5.96
15	Rb 18/1-32/334	137.69	145.10	5.10	159.20	172.69	7.81
16	Rb 18/1-36/275	149.76	156.74	4.45	174.84	184.26	5.11
17	Rb 18/1-36/289	141.01	149.86	5.91	166.44	176.23	5.56
18	Rb 18/1-36/303	134.93	141.19	4.43	154.30	162.72	5.18
19	Rb 18/1-36/318	128.29	138.07	7.09	148.70	157.51	5.60
20	Rb 18/1-36/334	121.78	127.32	4.35	135.55	146.84	7.69
21	Rb 18/1-42/260	136.65	139.03	1.71	165.68	170.75	2.97
22	Rb 18/1-42/275	134.15	134.38	0.17	155.17	163.30	4.98
23	Rb 18/1-42/289	129.48	129.52	0.03	152.23	158.74	4.11
24	Rb 18/1-42/303	118.76	123.36	3.73	138.30	145.22	4.76
25	Rb 18/1-42/318	114.68	117.55	2.44	132.33	141.35	6.38
Ave.		169.44	174.56	3.03	198.55	207.20	4.40
Std.d		46.07	46.25	2.52	53.20	53.55	1.99

1 x 1 RIB 85STARFISH 84 COEFFICIENTS

	<u>GREIGE</u>	<u>WINCH BLEACHED</u>
C1	0.96617	0.95292
C2	0.98420	0.98106
C3	-3.17223	-7.92716
C4	5.42697	5.981653
C5	0.59722	1.05404
C6	1.949603	5.174659
C7	2.858906	2.574358
C8	-0.12098	-0.646553
C9	1.634881	0.94424
C10	16.33577	16.1557
C11	0.441921	0.04803
C12	-21.9275	-9.74729
C13	3.59633	3.28584 .

Table 7

1x1 RIB 85 Greige Courses(cm) AW

a = -3.17223, b = 5.42697, c = 0.59722, $R^2 = 0.970748$

Id	Meas.	X1	X2	Calc.	M - C
1	19.3333	3.5152	5.3633	19.1080	0.2254
2	17.7000	3.2814	5.3633	17.8388	-0.1388
3	16.6333	3.0683	5.3633	16.6824	-0.0491
4	15.2333	2.8558	5.3633	15.5293	-0.2959
5	14.5000	2.7163	5.3633	14.7720	-0.2720
6	20.4333	3.7327	4.6938	19.8885	0.5449
7	19.1333	3.5152	4.6938	18.7082	0.4252
8	17.4667	3.2814	4.6938	17.4390	0.0277
9	16.0667	3.0683	4.6938	16.2826	-0.2160
10	15.5000	2.8558	4.6938	15.1295	0.3705
11	18.9667	3.6721	4.2173	19.2747	-0.3081
12	18.5333	3.4999	4.2173	18.3401	0.1932
13	17.1333	3.3215	4.2173	17.3723	-0.2389
14	16.6000	3.1762	4.2173	16.5836	0.0164
15	15.7000	3.0221	4.2173	15.7471	-0.0471
16	18.8000	3.6721	3.9262	19.1009	-0.3009
17	17.9667	3.4999	3.9262	18.1663	-0.1996
18	17.1667	3.3215	3.9262	17.1984	-0.0317
19	16.6000	3.1762	3.9262	16.4097	0.1903
20	15.6333	3.0221	3.9262	15.5732	0.0601
21	19.9333	3.8888	3.7039	20.1441	-0.2108
22	18.7667	3.6721	3.7039	18.9681	-0.2014
23	17.8000	3.4999	3.7039	18.0335	-0.2335
24	17.2667	3.3215	3.7039	17.0656	0.2011
25	16.7667	3.1762	3.7039	16.2769	0.4897
Ave.	17.4253			17.4253	0.0000

$$X1 = 1/\text{ave st len}$$

$$X2 = \text{save tex}$$

Table 8

1x1 RIB 85 Greige Wale (cm) AW

a = 1.949603, b = 2.858906, c = -0.12098, $R^2 = 0.965268$

Id	Meas.	X1	X2	Calc.	M - C
1	11.0000	3.5152	5.3633	11.3505	-0.3505
2	10.6500	3.2814	5.3633	10.6819	-0.0319
3	10.1667	3.0683	5.3633	10.0728	0.0939
4	9.4833	2.8558	5.3633	9.4653	0.0181
5	9.0667	2.7163	5.3633	9.0664	0.0003
6	11.9500	3.7327	4.6938	12.0533	-0.1033
7	11.3500	3.5152	4.6938	11.4315	-0.0815
8	10.8333	3.2814	4.6938	10.7629	0.0704
9	10.3333	3.0683	4.6938	10.1537	0.1796
10	9.6667	2.8558	4.6938	9.5463	0.1204
11	12.0000	3.6721	4.2173	11.9375	0.0625
12	11.8000	3.4999	4.2173	11.4452	0.3548
13	11.0667	3.3215	4.2173	10.9353	0.1314
14	10.7000	3.1762	4.2173	10.5198	0.1802
15	9.8333	3.0221	4.2173	10.0792	-0.2458
16	11.9667	3.6721	3.9262	11.9728	-0.0061
17	11.6333	3.4999	3.9262	11.4804	0.1529
18	11.1000	3.3215	3.9262	10.9705	0.1295
19	10.6000	3.1762	3.9262	10.5551	0.0449
20	9.8667	3.0221	3.9262	10.1144	-0.2477
21	12.5667	3.8888	3.7039	12.6192	-0.0525
22	12.0333	3.6721	3.7039	11.9996	0.0337
23	11.5000	3.4999	3.7039	11.5073	-0.0073
24	10.9333	3.3215	3.7039	10.9974	-0.0641
25	10.2000	3.1762	3.7039	10.5820	-0.3820
Ave.	10.8920			10.8920	0.0000

$$X1 = 1/2$$

$$X2 = \text{Stax}$$

Table 9

1x1 RIB 85 Greige Stitches/cm² AWa = 1.63488, b = 16.33577, c = 0.441921, R² = 0.98772

Id	Meas.	X1	X2	Calc.	M - C
1	212.6667	12.3570	28.7647	216.2071	-3.5405
2	188.5050	10.7674	28.7647	190.2411	-1.7361
3	169.1056	9.4145	28.7647	168.1400	0.9656
4	144.4628	8.1557	28.7647	147.5761	-3.1133
5	131.4667	7.3782	28.7647	134.8752	-3.4085
6	244.1783	13.9333	22.0321	238.9828	5.1955
7	217.1633	12.3570	22.0321	213.2319	3.9315
8	189.2222	10.7674	22.0321	187.2658	1.9564
9	166.0222	9.4145	22.0321	165.1647	0.8575
10	149.8333	8.1557	22.0321	144.6008	5.2325
11	227.6000	13.4842	17.7860	229.7696	-2.1696
12	218.6933	12.2491	17.7860	209.5930	9.1003
13	189.6089	11.0325	17.7860	189.7195	-0.1107
14	177.6200	10.0882	17.7860	174.2941	3.3259
15	154.3833	9.1329	17.7860	158.6871	-4.3037
16	224.9733	13.4842	15.4151	228.7218	-3.7485
17	209.0122	12.2491	15.4151	208.5453	0.4669
18	190.5500	11.0325	15.4151	188.6718	1.8782
19	175.9600	10.0882	15.4151	173.2464	2.7136
20	154.2489	9.1329	15.4151	157.6393	-3.3904
21	250.4956	15.1226	13.7188	254.7371	-4.2415
22	225.8256	13.4842	13.7188	227.9722	-2.1466
23	204.7000	12.2491	13.7188	207.7957	-3.0957
24	188.7822	11.0325	13.7188	187.9222	0.8600
25	171.0200	10.0882	13.7188	172.4967	-1.4767
Ave.	191.0440			191.0439	0.0001

$$X_1 = 1/e^2$$

$$X_2 = tex$$

Table 10

1x1 RIB 85 Greige Weight(gsm) AW

a = -21.9275, b = 3.59633, R² = 0.99738

Id	Meas.	X1	Calc.	M - C
1	335.4860	101.1150	341.7154	-6.2294
2	315.5640	94.3878	317.5222	-1.9582
3	296.7430	88.2589	295.4807	1.2623
4	272.5070	82.1467	273.4991	-0.9921
5	260.9010	78.1331	259.0648	1.8362
6	276.3990	82.2400	273.8347	2.5643
7	260.2250	77.4483	256.6021	3.6229
8	241.5470	72.2956	238.0715	3.4755
9	225.8850	67.6013	221.1890	4.6960
10	207.7320	62.9196	204.3523	3.3797
11	211.9560	65.3115	212.9543	-0.9983
12	199.5280	62.2485	201.9388	-2.4108
13	190.9440	59.0765	190.5311	0.4129
14	178.8440	56.4918	181.2355	-2.3915
15	165.9450	53.7503	171.3762	-5.4312
16	180.4640	56.6056	181.6448	-1.1808
17	172.5940	53.9589	172.0976	0.4964
18	162.2130	51.2016	162.2105	0.0025
19	155.7950	48.9615	154.1541	1.6409
20	139.8480	46.5854	145.6090	-5.7610
21	171.4840	53.3493	169.9342	1.5498
22	161.2760	50.3765	159.2430	2.0330
23	153.3160	48.0139	150.7464	2.5696
24	142.6670	45.5672	141.9473	0.7197
25	131.8760	43.5736	134.7774	-2.9014
Ave.	208.4696		208.4693	0.0003

$$X_1 = \text{tex/l}$$

Table 11

1x1 RIB 85 Bleached Courses(cm) AW

a = -7.92716, b = 5.98165, c = 1.05404, $R^2 = 0.986945$

Id	Meas.	X1	X2	Calc.	M - C
1	19.2000	3.5343	5.3253	18.8272	0.3728
2	17.4000	3.2897	5.3253	17.3641	0.0359
3	16.1000	3.0808	5.3253	16.1144	-0.0144
4	14.5333	2.8699	5.3253	14.8524	-0.3191
5	13.8333	2.7189	5.3253	13.9493	-0.1160
6	19.7000	3.7594	4.6620	19.4741	0.2259
7	18.2000	3.5343	4.6620	18.1280	0.0720
8	16.7000	3.2897	4.6620	16.6648	0.0352
9	15.3667	3.0808	4.6620	15.4152	-0.0485
10	14.4000	2.8699	4.6620	14.1532	0.2468
11	18.3333	3.6695	4.1926	18.4417	-0.1084
12	17.2111	3.5080	4.1926	17.4754	-0.2643
13	16.2667	3.3359	4.1926	16.4464	-0.1797
14	15.4222	3.1856	4.1926	15.5470	-0.1247
15	14.5556	3.0305	4.1926	14.6196	-0.0641
16	17.9000	3.6695	3.8944	18.1274	-0.2274
17	16.9778	3.5080	3.8944	17.1611	-0.1833
18	16.1000	3.3359	3.8944	16.1321	-0.0321
19	15.2111	3.1856	3.8944	15.2326	-0.0215
20	14.4222	3.0305	3.8944	14.3053	0.1169
21	19.1333	3.8983	3.6799	19.2696	-0.1363
22	17.9167	3.6695	3.6799	17.9013	0.0154
23	17.0333	3.5080	3.6799	16.9350	0.0984
24	16.1000	3.3359	3.6799	15.9060	0.1940
25	15.4333	3.1856	3.6799	15.0065	0.4268
Ave.	16.5380			16.5380	0.0000

$$x_1 = 1/c$$

$$x_2 = \int \text{tex}$$

Table 12

1x1 RIB 85 Bleached Wales(cm) AW

a = 5.174659, b = 2.574358, c = -0.646553, $R^2 = 0.97118$

Id	Meas.	X1	X2	Calc.	M - C
1	10.6333	3.5343	5.3253	10.8302	-0.1969
2	10.3000	3.2897	5.3253	10.2005	0.0995
3	9.6333	3.0808	5.3253	9.6627	-0.0294
4	9.3889	2.8699	5.3253	9.1196	0.2693
5	8.8667	2.7189	5.3253	8.7309	0.1358
6	11.4667	3.7594	4.6620	11.8385	-0.3718
7	11.1000	3.5343	4.6620	11.2591	-0.1591
8	10.5667	3.2897	4.6620	10.6294	-0.0628
9	10.1000	3.0808	4.6620	10.0916	0.0084
10	9.3667	2.8699	4.6620	9.5485	-0.1818
11	12.2000	3.6695	4.1926	11.9105	0.2895
12	11.6667	3.5080	4.1926	11.4946	0.1721
13	11.0333	3.3359	4.1926	11.0518	-0.0184
14	10.6889	3.1856	4.1926	10.6647	0.0242
15	10.2889	3.0305	4.1926	10.2656	0.0233
16	12.3000	3.6695	3.8944	12.1033	0.1967
17	11.9000	3.5080	3.8944	11.6874	0.2126
18	11.1667	3.3359	3.8944	11.2446	-0.0779
19	10.8556	3.1856	3.8944	10.8575	-0.0019
20	10.3333	3.0305	3.8944	10.4584	-0.1251
21	12.9000	3.8983	3.6799	12.8309	0.0691
22	12.2833	3.6695	3.6799	12.2420	0.0413
23	11.9667	3.5080	3.6799	11.8261	0.1406
24	11.0333	3.3359	3.6799	11.3833	-0.3499
25	10.8889	3.1856	3.6799	10.9962	-0.1073
Ave.	10.9171			10.9171	0.0000

$$X_1 = 1/l$$

$$X_2 = \sqrt{\text{tex}}$$

Table 13

1x1 RIB 85 Bleached Stitches/cm AW

$$a = 0.94424, b = 16.1557, c = 0.04803, R^2 = 0.99624$$

Id	Meas.	X1	X2	Calc.	M - C
1	204.1600	12.4916	28.3593	204.1173	0.0427
2	179.2200	10.8224	28.3593	177.1501	2.0699
3	155.0967	9.4915	28.3593	155.6487	-0.5521
4	136.4519	8.2361	28.3593	135.3655	1.0863
5	122.6556	7.3922	28.3593	121.7333	0.9223
6	225.8933	14.1331	21.7339	230.3179	-4.4245
7	202.0200	12.4916	21.7339	203.7991	-1.7791
8	176.4633	10.8224	21.7339	176.8318	-0.3685
9	155.2033	9.4915	21.7339	155.3305	-0.1272
10	134.8800	8.2361	21.7339	135.0473	-0.1673
11	223.6667	13.4652	17.5783	219.3288	4.3379
12	200.7963	12.3057	17.5783	200.5961	0.2002
13	179.4756	11.1284	17.5783	181.5759	-2.1003
14	164.8464	10.1478	17.5783	165.7331	-0.8867
15	149.7605	9.1841	17.5783	150.1645	-0.4040
16	220.1700	13.4652	15.1665	219.2129	0.9571
17	202.0356	12.3057	15.1665	200.4803	1.5553
18	179.7833	11.1284	15.1665	181.4600	-1.6767
19	165.1251	10.1478	15.1665	165.6173	-0.4922
20	149.0296	9.1841	15.1665	150.0487	-1.0191
21	246.8200	15.1964	13.5419	247.1031	-0.2831
22	220.0764	13.4652	13.5419	219.1349	0.9415
23	203.8322	12.3057	13.5419	200.4022	3.4300
24	177.6367	11.1284	13.5419	181.3820	-3.7453
25	168.0519	10.1478	13.5419	165.5392	2.5126
Ave.	181.7260			181.7248	0.0012

$$X_1 = 1/e^2$$

$$X_2 = tex$$

Table 14

1x1 RIB 85 Bleached Weight(gsm) AW
 $a = -9.74729$, $b = 3.28584$, $R^2 = 0.99652$

Id	Meas.	X1	Calc.	M - C
1	317.5380	100.2318	319.5982	-2.0602
2	295.9760	93.2949	296.8049	-0.8289
3	277.5180	87.3703	277.3377	0.1803
4	253.3760	81.3871	257.6776	-4.3016
5	240.1440	77.1053	243.6083	-3.4643
6	261.2740	81.7064	258.7269	2.5471
7	247.6860	76.8152	242.6552	5.0308
8	229.7160	71.4990	225.1869	4.5291
9	213.3980	66.9585	210.2678	3.1302
10	196.5540	62.3731	195.2007	1.3533
11	202.2960	64.5035	202.2010	0.0950
12	192.4540	61.6638	192.8701	-0.4161
13	182.8660	58.6399	182.9341	-0.0681
14	170.3400	55.9967	174.2488	-3.9088
15	159.2030	53.2716	165.2946	-6.0916
16	174.8420	55.6535	173.1212	1.7208
17	166.4410	53.2034	165.0705	1.3705
18	154.2960	50.5944	156.4978	-2.2018
19	148.6950	48.3138	149.0042	-0.3092
20	135.5510	45.9626	141.2785	-5.7275
21	165.6780	52.7897	163.7114	1.9666
22	155.1670	49.6920	153.5326	1.6344
23	152.2260	47.5043	146.3442	5.8818
24	138.3040	45.1748	138.6898	-0.3858
25	132.3340	43.1385	131.9989	0.3351
Ave.	198.5549		198.5545	0.0004

$x_1 = \text{tex}/e$

Table 15

1x1 RIB 14 GAUGE Regression Data Base

GREIGE

Measured in the Reference State

Sample	avSL 1	1/avSL 2	1/aSL 3	avTex 4	aTx/aSL 5	ravTex 6	C/cm 7	W/cm 8	Wtgsm 9	S 10
R26/350	0.351	2.8490	8.1168	22.19	63.21	4.7	15.04	9.58	194.8	144
R26/326	0.326	3.0674	9.4094	22.19	68.06	4.7	16.06	10.13	218	163
R26/306	0.306	3.2679	10.679	22.19	72.5	4.7	17.27	10.76	241.8	186
R26/285	0.283	3.5335	12.486	22.19	78.4	4.7	18.85	11.23	250.8	212
R26/267	0.267	3.7453	14.027	22.19	83.09	4.7	20.45	11.6	274	237
R30/350	0.351	2.8490	8.1168	18.98	54.08	4.4	14.65	9.37	173	137
R30/326	0.326	3.0674	9.4094	18.98	58.23	4.4	15.93	10	191.6	159
R30/306	0.306	3.2679	10.679	18.98	62.03	4.4	16.9	10.55	198.8	178
R30/285	0.283	3.5335	12.486	18.98	67.07	4.4	18.71	11.39	216	213
R30/267	0.267	3.7453	14.027	18.98	71.09	4.4	19.79	11.81	229.3	234
R34/350	0.351	2.8490	8.1168	16.85	46	4.1	14.7	9	143.4	132
R34/326	0.326	3.0674	9.4094	16.85	51.68	4.1	15.85	9.76	152	155
R34/306	0.306	3.2679	10.679	16.85	55.05	4.1	16.67	10.58	172.8	176
R34/285	0.283	3.5335	12.486	16.85	59.53	4.1	18.53	11.5	185.4	213
R34/267	0.267	3.7453	14.027	16.85	63.1	4.1	20.03	11.76	194	236
R34/246	0.247	4.0485	16.391	16.85	68.21	4.1	21.61	12.31	220.2	268
MCS FQ1018	0.2756	3.6283	13.164	19.218	69.729	4.3839	19.401	11.667	235.09	226.36
MCS FQ1007	0.2766	3.6149	13.067	19.067	68.928	4.3667	19.07	11.519	228.31	219.67
KDCS 7/514	0.276	3.6232	13.127	18.95	68.659	4.3532	18.991	11.725	228.01	222.82
Martins CS2	0.2786	3.5894	12.883	19.313	69.322	4.3947	19.119	11.638	230	222.37

* MCS - Meridian Case Study Average Results
 * KDCS - Klynton Davis Case Study Average Results
 * Martins CS2 - Martins Case Study No 2 Average Results

Table 16

1x1 RIB 14 GAUGE Regression Data Base

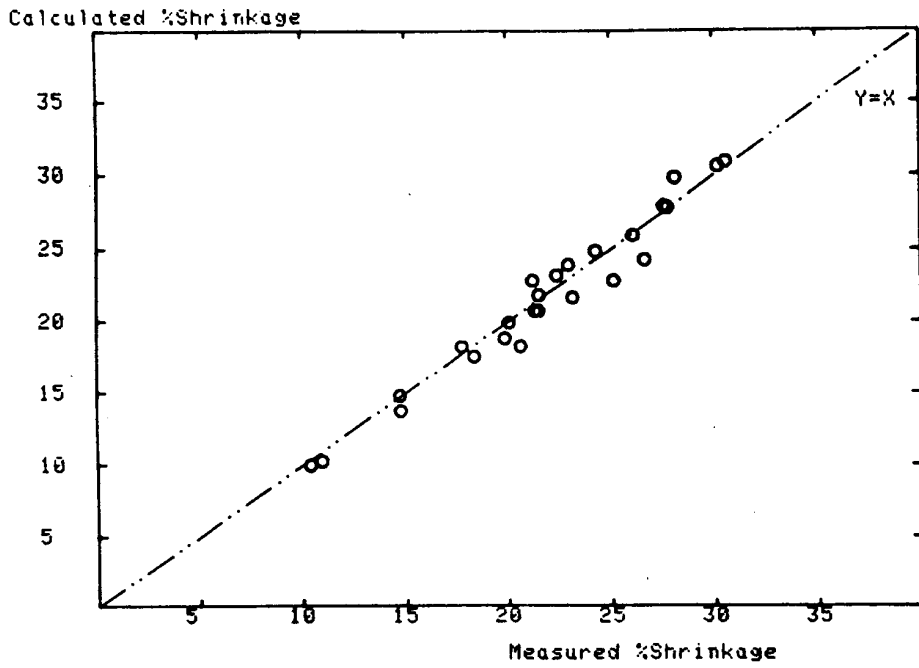
AVERAGE WINCH BLEACHED (OPTIC WHITE)
 Measured in the Reference State

Sample	avSL WB/T	1/avSL WB/T	1/aSL WB/T	avTex WB/T	aTx/aSL WB/T	ravTex WB/T	C/cm WB/T	W/cm WB/T	Wtgs WB/T	S WB/T
R26/350	0.3465	2.8860	8.3290	21.89	63.185	4.7	13.985	9.095	190	127
R26/306	0.304	3.2894	10.820	21.89	72.015	4.7	16.33	10.215	213.1	166.5
R30/326	0.324	3.0864	9.5259	18.715	57.765	4.3	14.92	9.685	170	144.5
R30/285	0.28	3.5714	12.755	18.715	66.855	4.3	17.715	10.935	197.7	194
R34/306	0.304	3.2894	10.820	16.435	54.08	4.05	15.665	10.245	154.6	160.5
R34/267	0.2665	3.7523	14.080	16.435	61.685	4.05	18.655	11.275	175	210
Martins CS2	0.2798	3.574	12.773	19.167	68.502	4.378	17.989	11.344	207.85	204.07
Martins CS1	0.276	3.6232	13.127	18.959	68.694	4.3543	17.948	11.346	207.26	203.65

=====
 * Martins CS1 - Martins Case Study No 1 Average Results
 * Martins CS2 - Martins Case Study No 2 Average Results

FIGURE 1

1x1 RIB 85 Greige Length Shrinkage - All Fabrics



1x1 RIB 85 Greige Width Shrinkage - All Fabrics

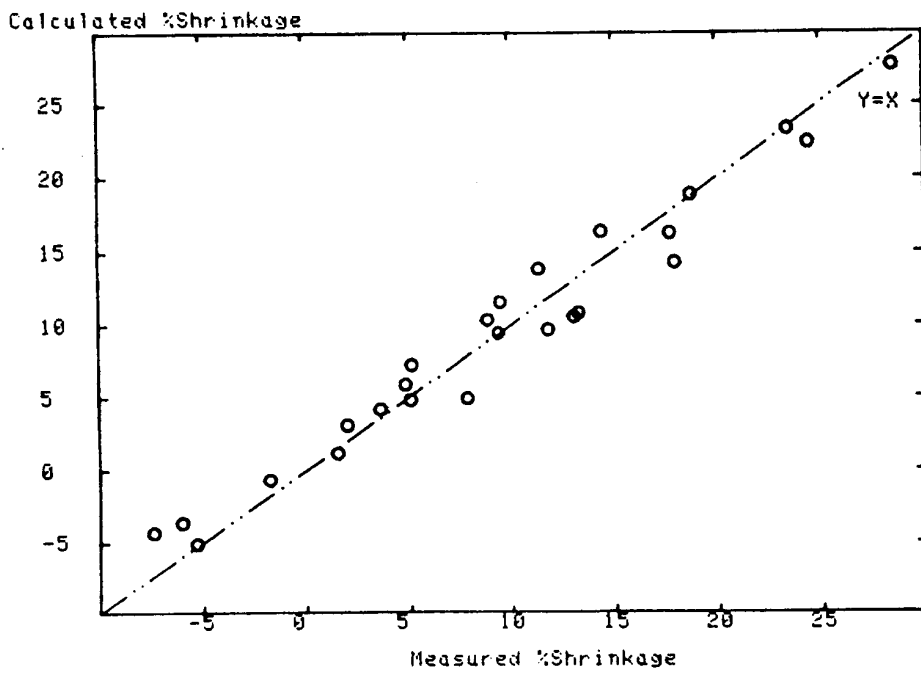
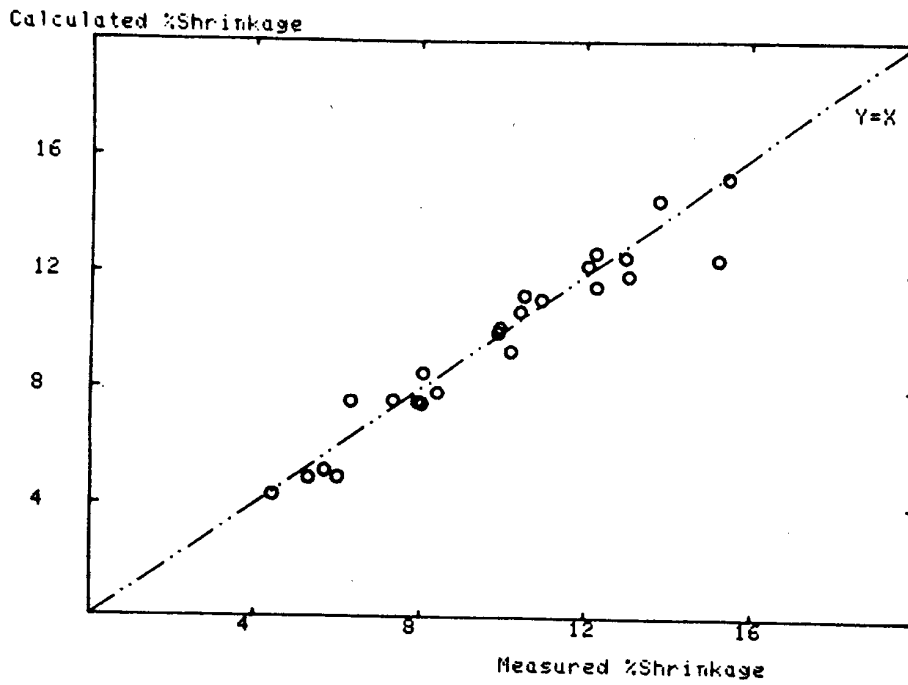


FIGURE 2

1x1 RIB 85 Bleached Length Shrinkage - All Fabrics



1x1 RIB 85 Bleached Width Shrinkage - All Fabrics

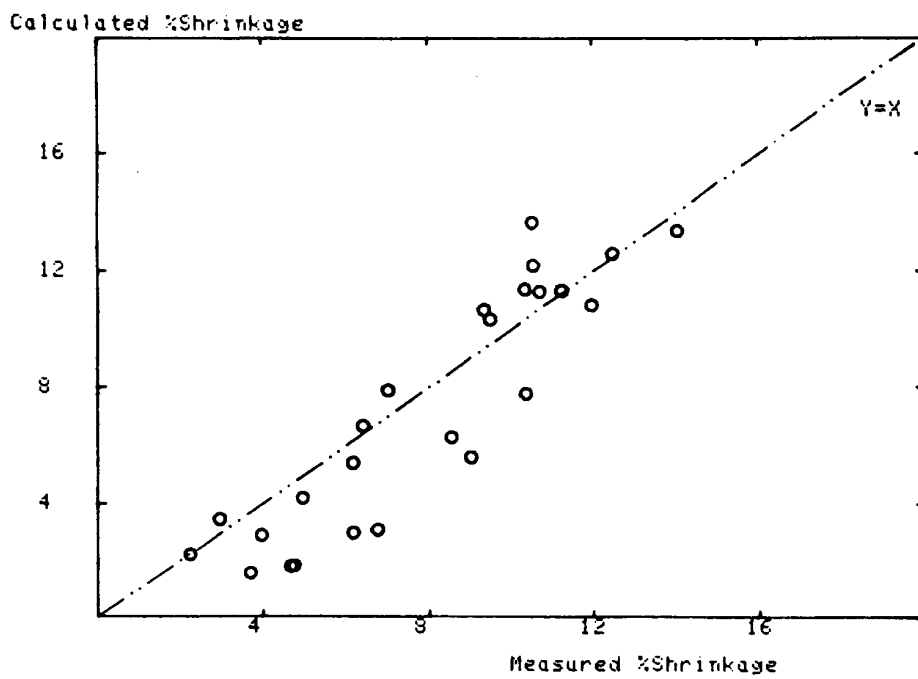
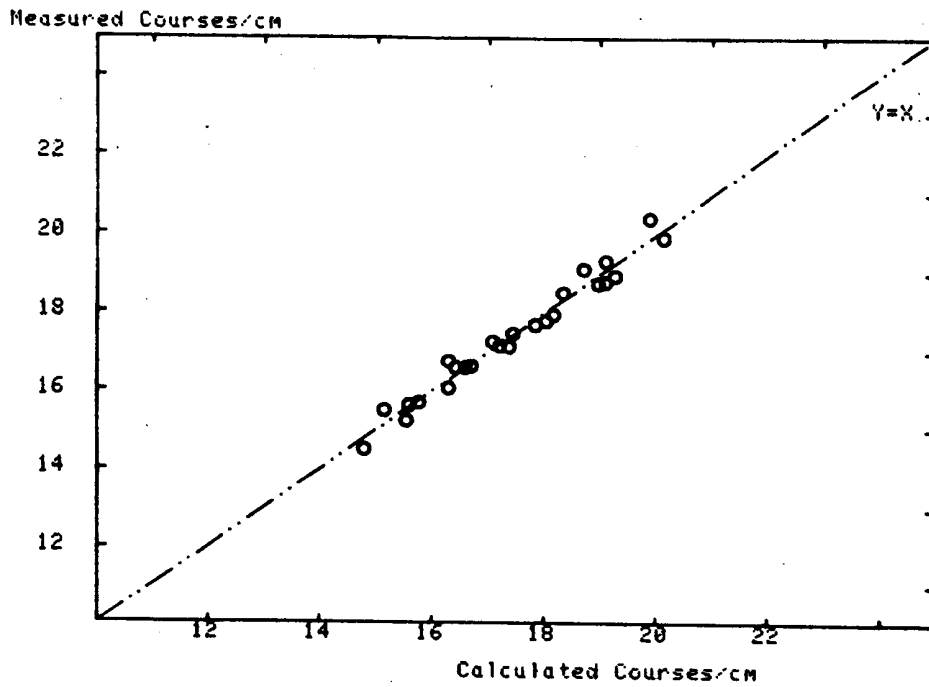


FIGURE 3

1x1 RIB 85 Measured vs Calculated Courses(AW) - Greige



1x1 RIB 85 Measured vs Calculated Courses(AW) - Bleached

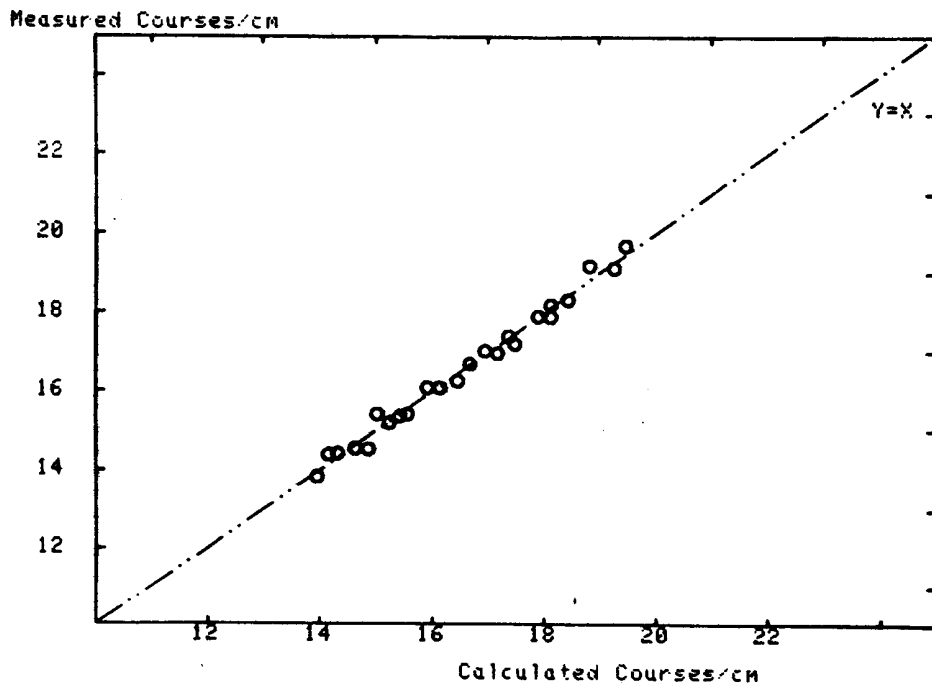
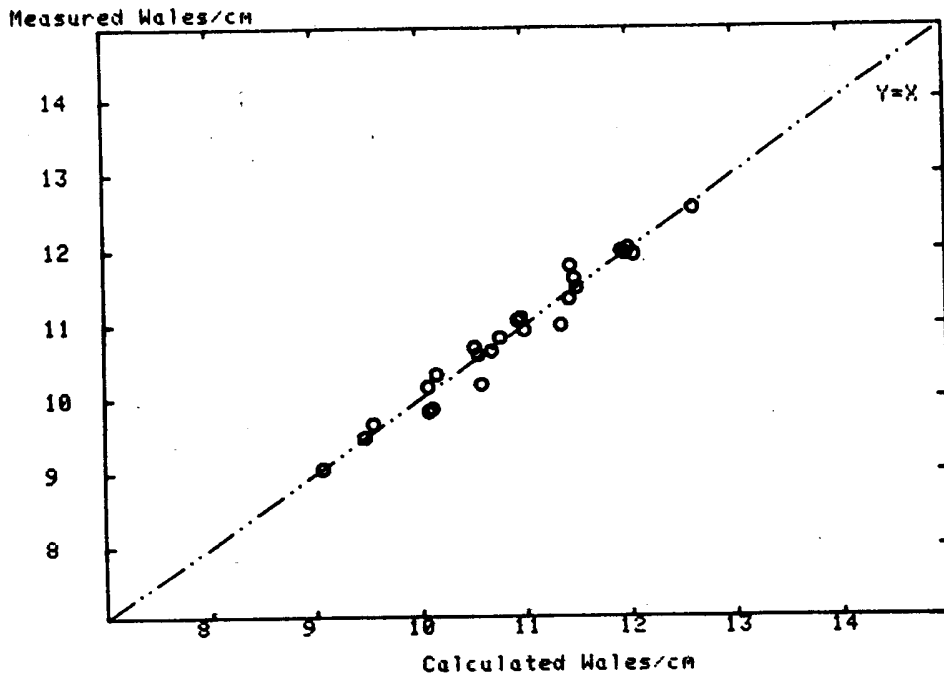


FIGURE 4

1x1 RIB 85 Measured vs Calculated Wales(AW) - Greige



1x1 RIB 85 Measured vs Calculated Wales(AW) - Bleached

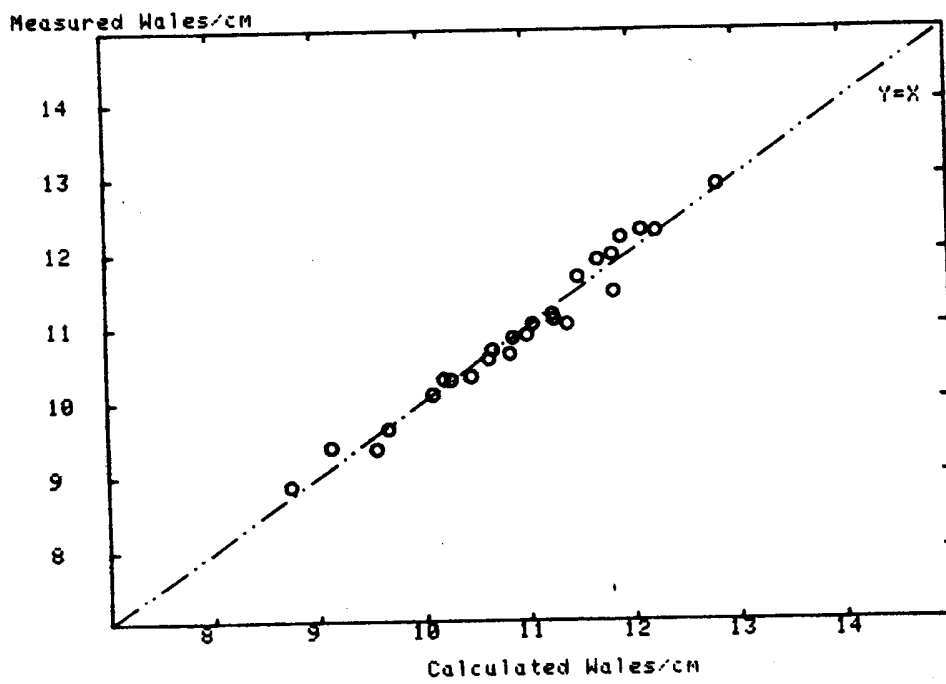
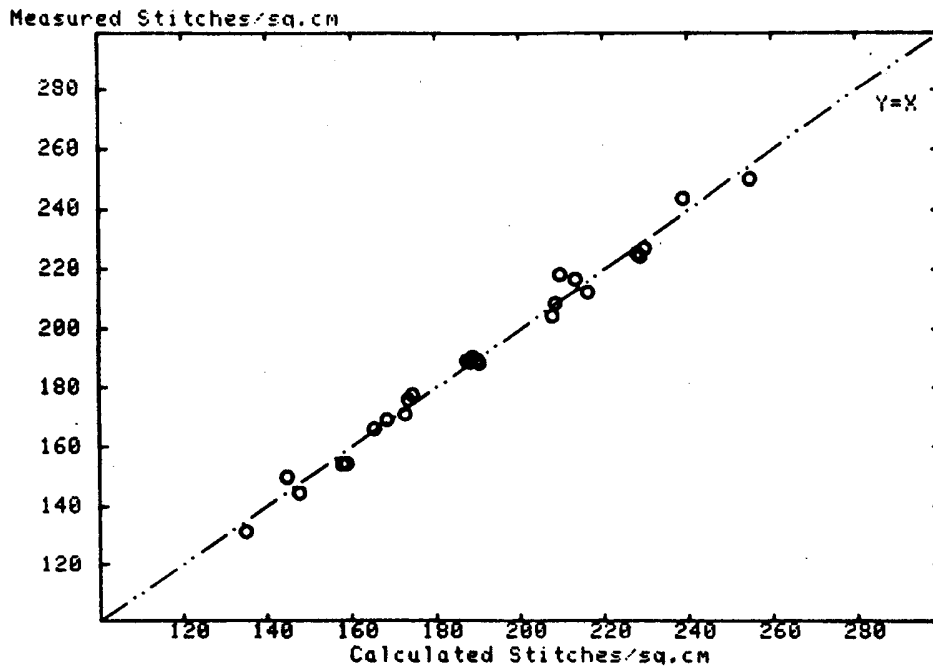


FIGURE 5

1x1 RIB 85 Measured vs Calculated Stitches/sq.cm(AW)- Greige



1x1 RIB 85 Measured vs Calculated Stitches/sq.cm(AW)- Bleached

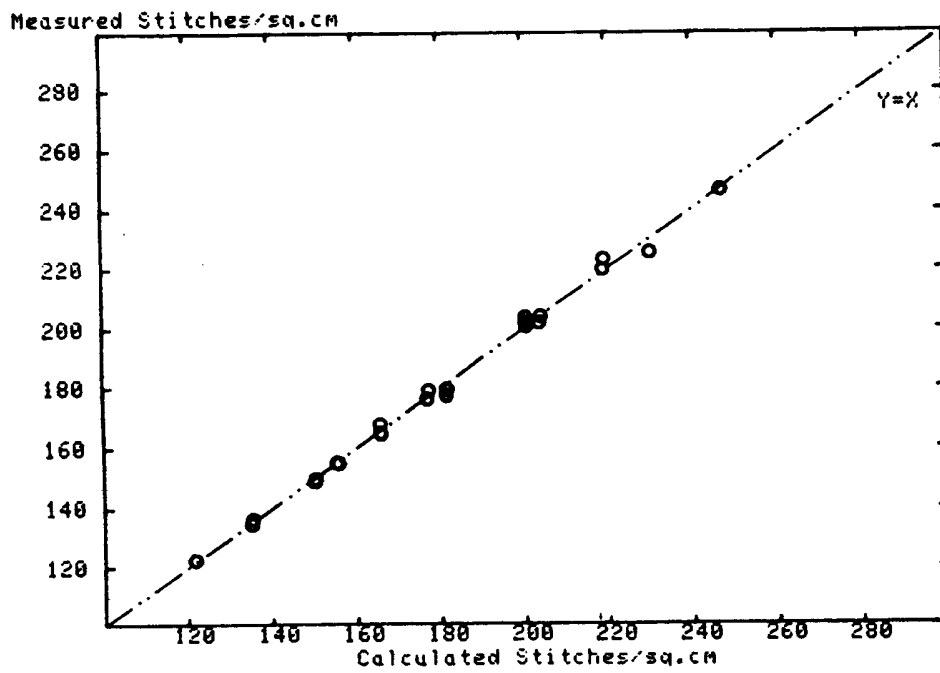
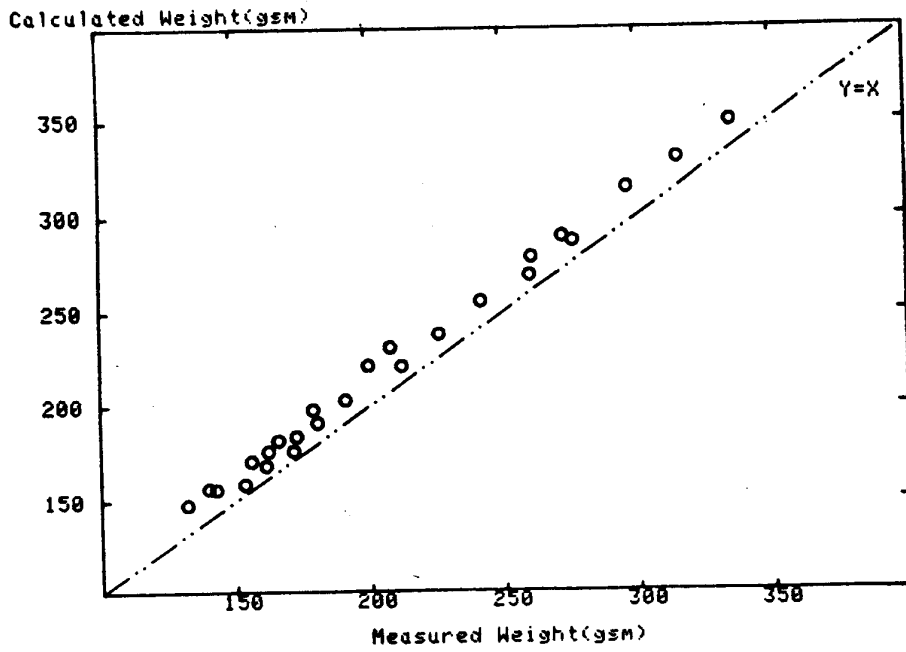


FIGURE 6

1x1 RIB 85 Greige Weight(AW) - All Fabrics



1x1 RIB 85 Bleached Weight(AW) - All Fabrics

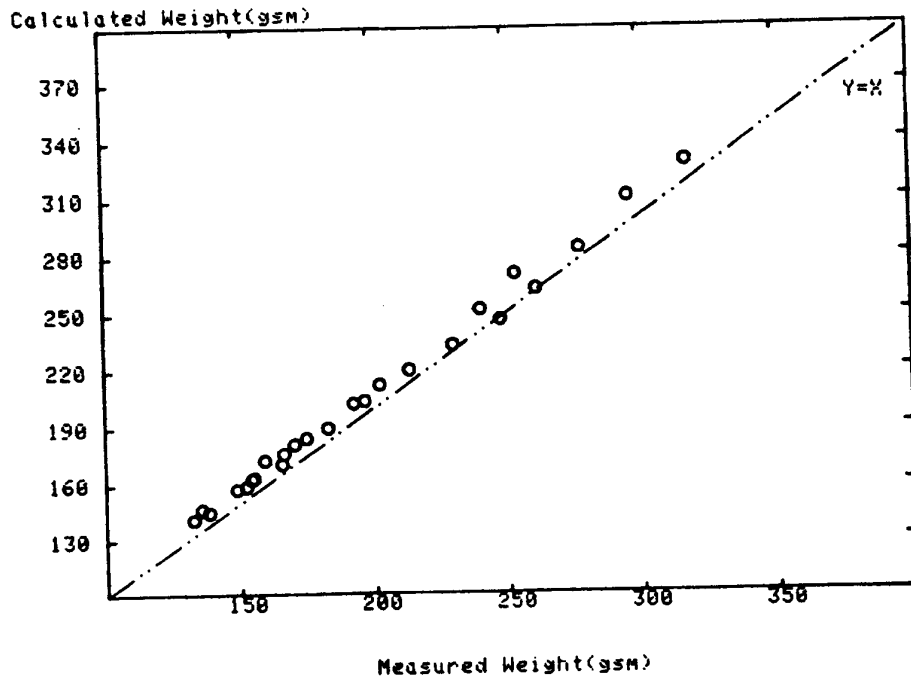
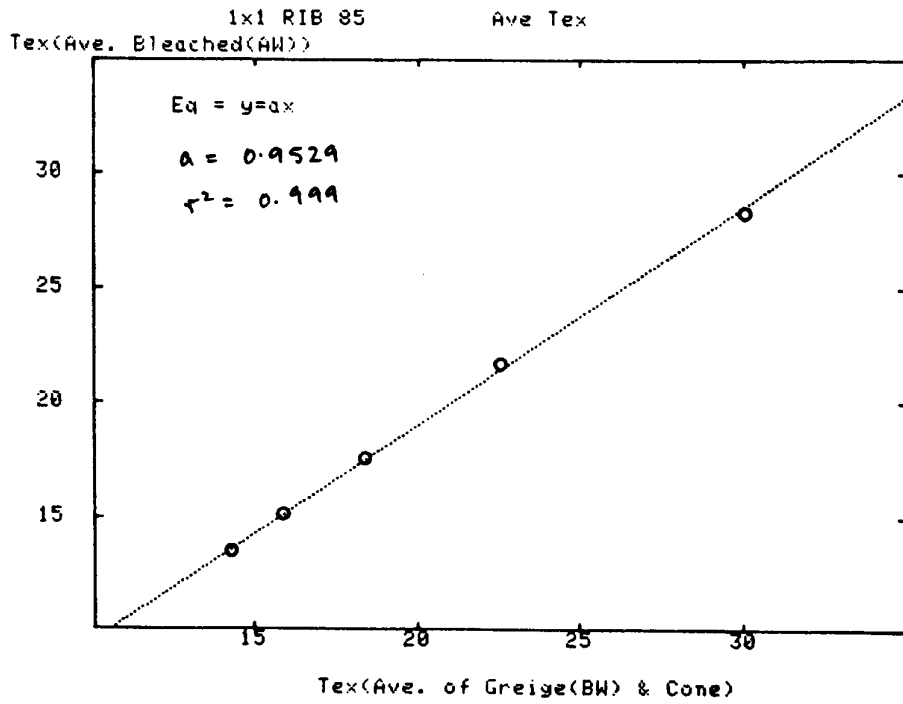
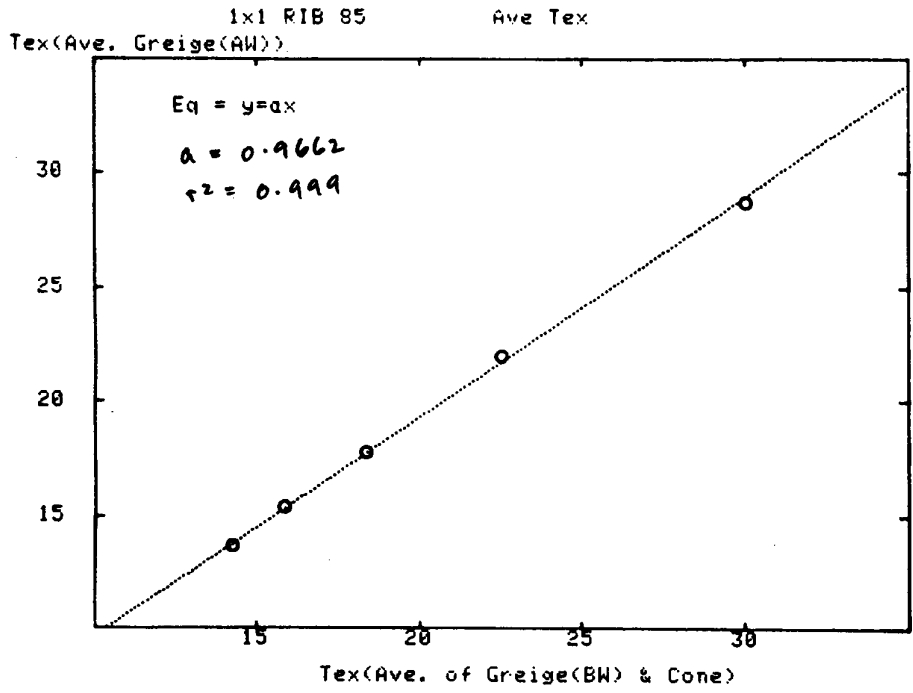
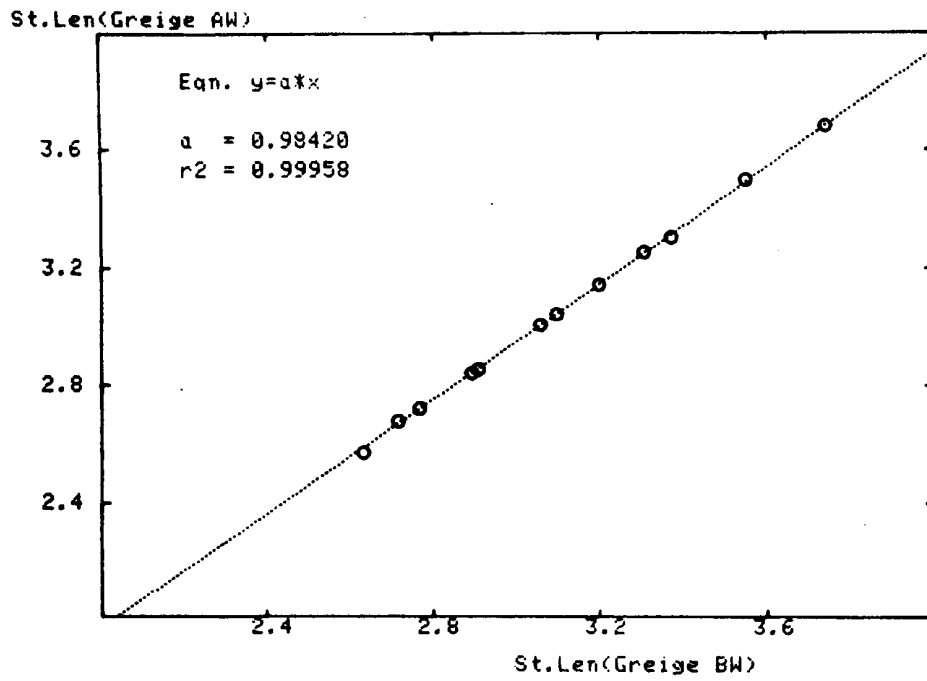


FIGURE 7



1x1 RIB 85 Ave Stitch Length (mm)

FIGURE 8



1x1 RIB 85 Ave Stitch Length (mm)

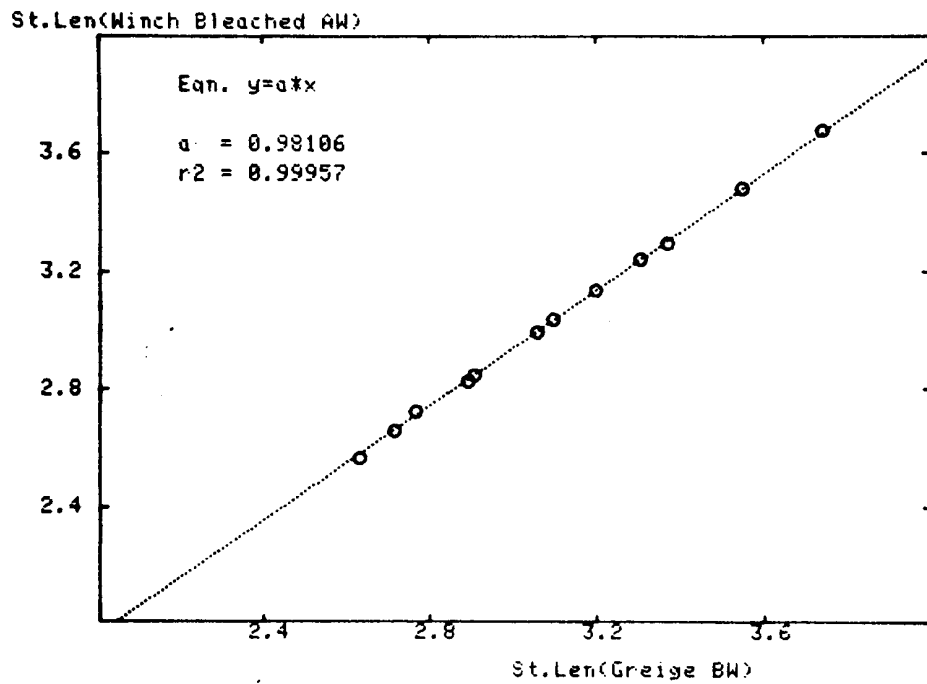
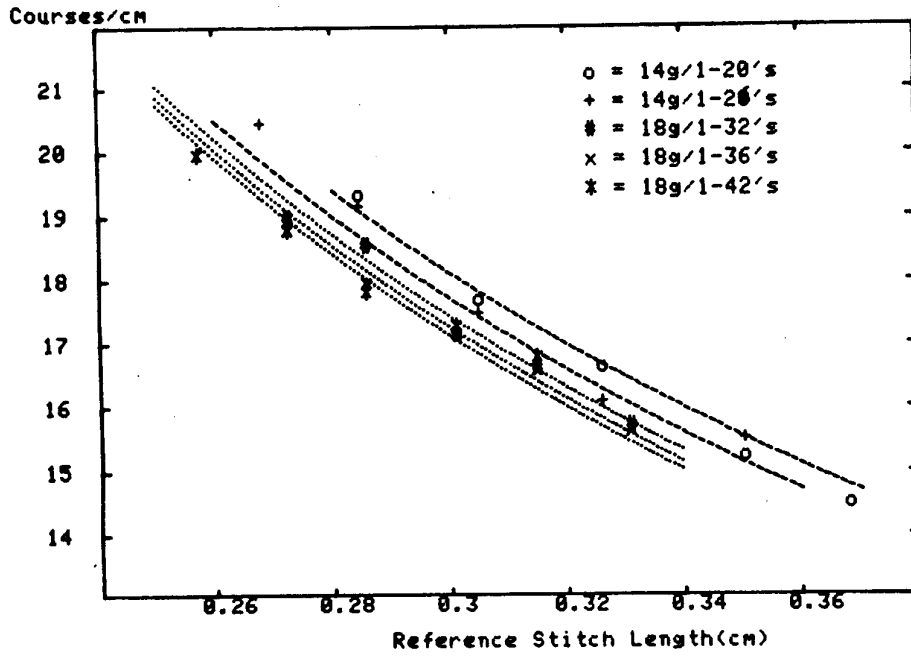


FIGURE 9

PREDICTION OF REFERENCE STATE : GREIGE COURSES/CM



PREDICTION OF REFERENCE STATE : BLEACHED COURSES/CM

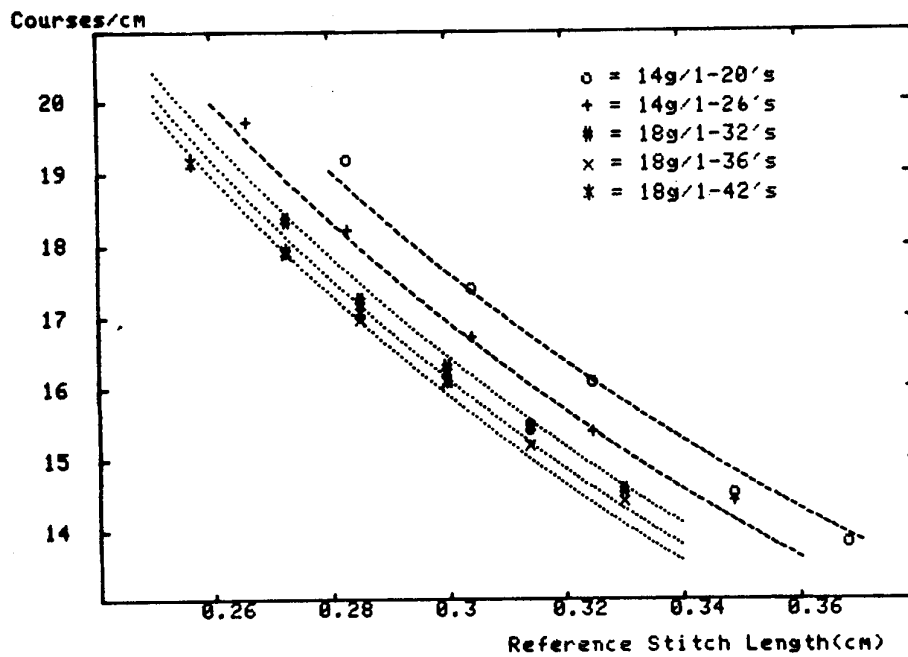
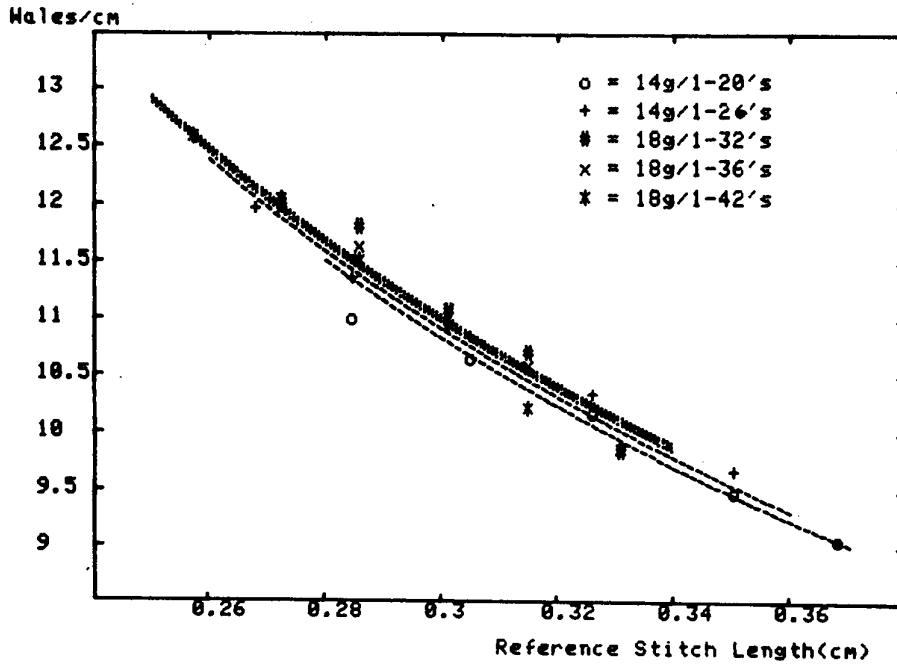


FIGURE 10

PREDICTION OF REFERENCE STATE : GREIGE WALES/CM



PREDICTION OF REFERENCE STATE : BLEACHED WALES/CM

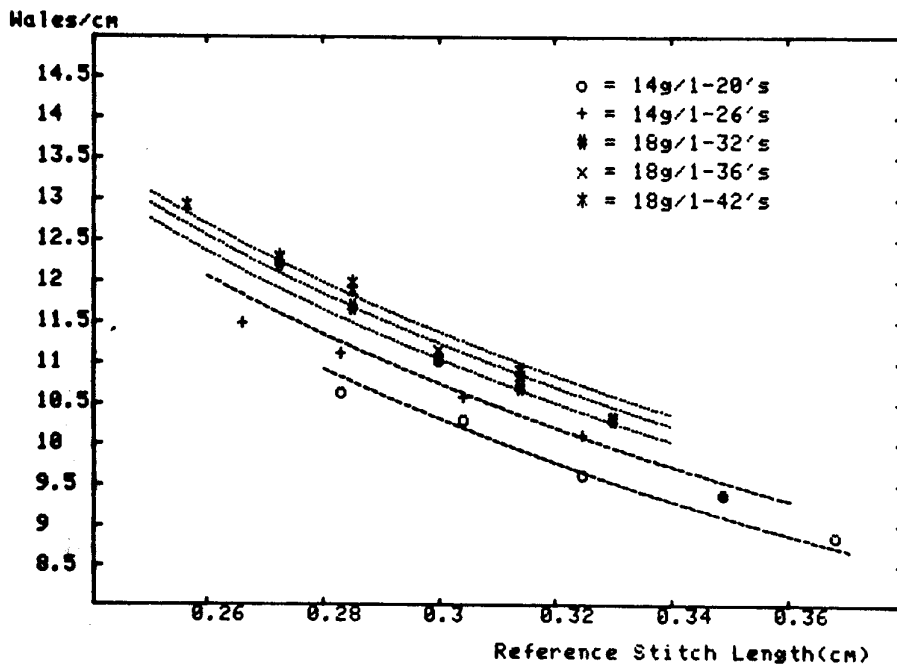
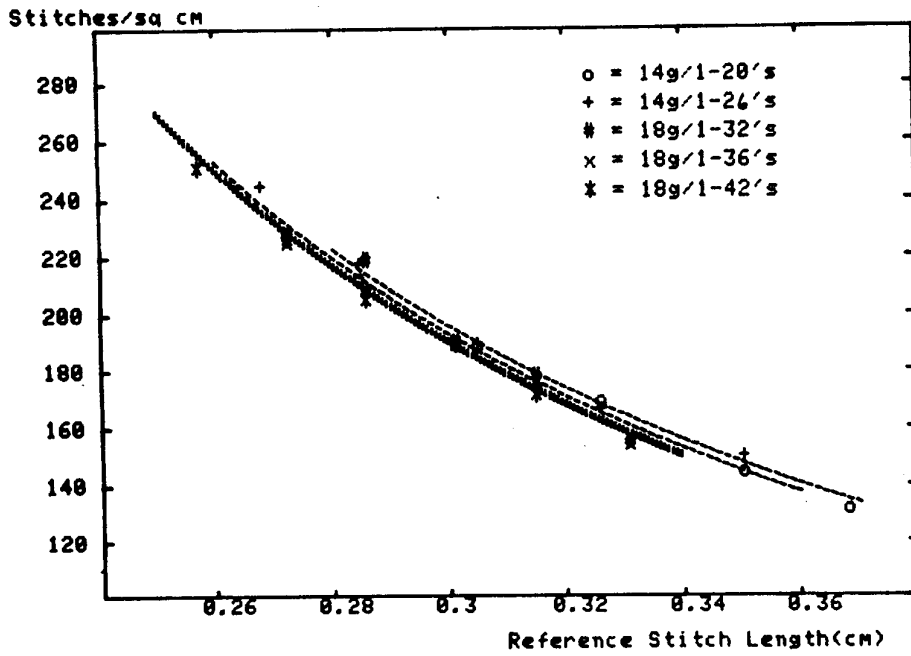


FIGURE 11

PREDICTION OF REFERENCE STATE : GREIGE STITCHES/SQ CM



PREDICTION OF REFERENCE STATE : BLEACHED STITCHES/SQ CM

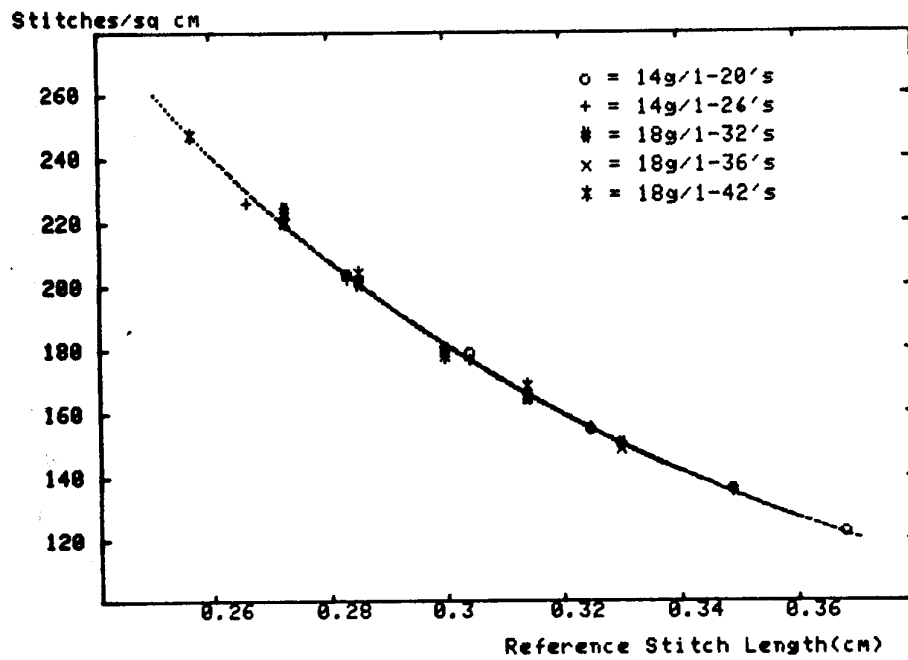
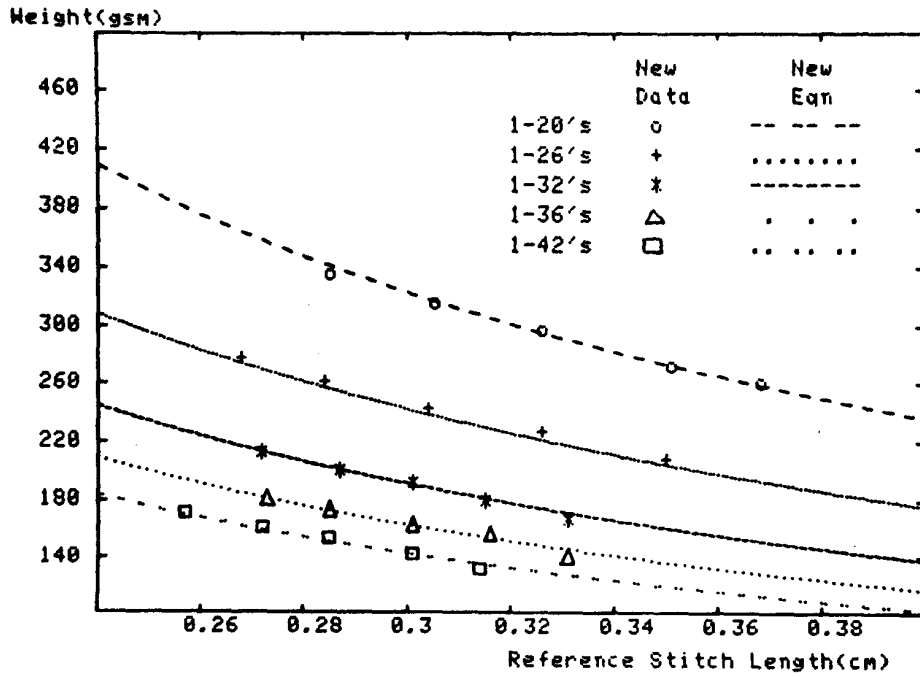


FIGURE 12

PREDICTION OF REFERENCE STATE : GREIGE WEIGHT/SQ M



PREDICTION OF REFERENCE STATE : BLEACHED WEIGHT/SQ M

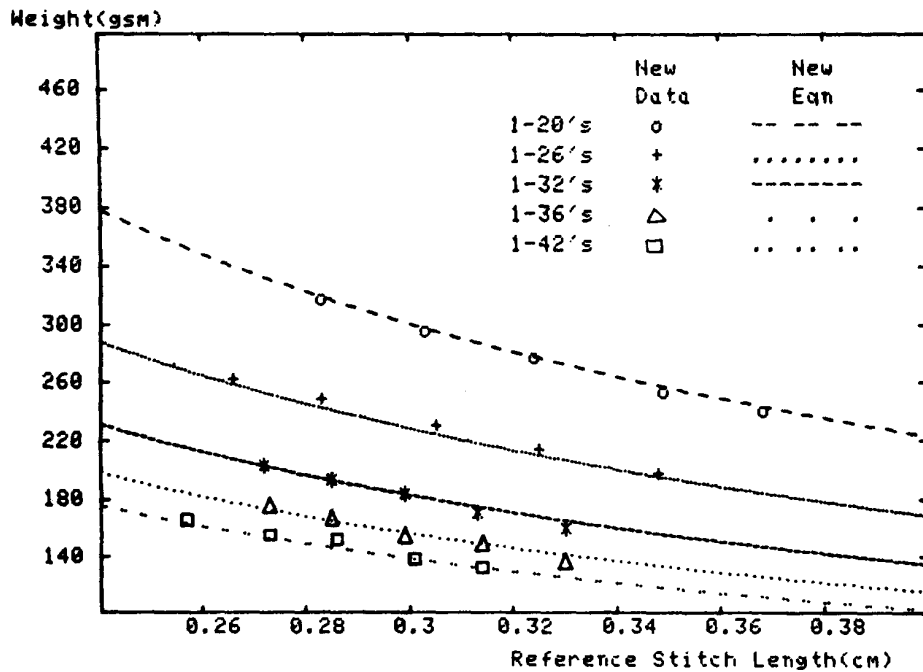
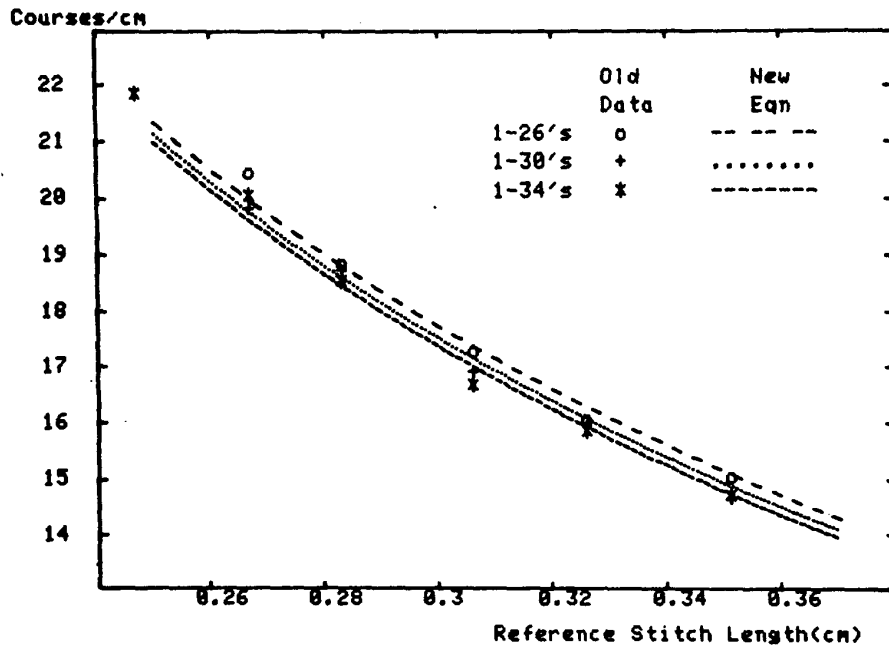


FIGURE 13

PREDICTION OF REFERENCE STATE : GREIGE COURSES/CM



PREDICTION OF REFERENCE STATE : BLEACHED COURSES/CM

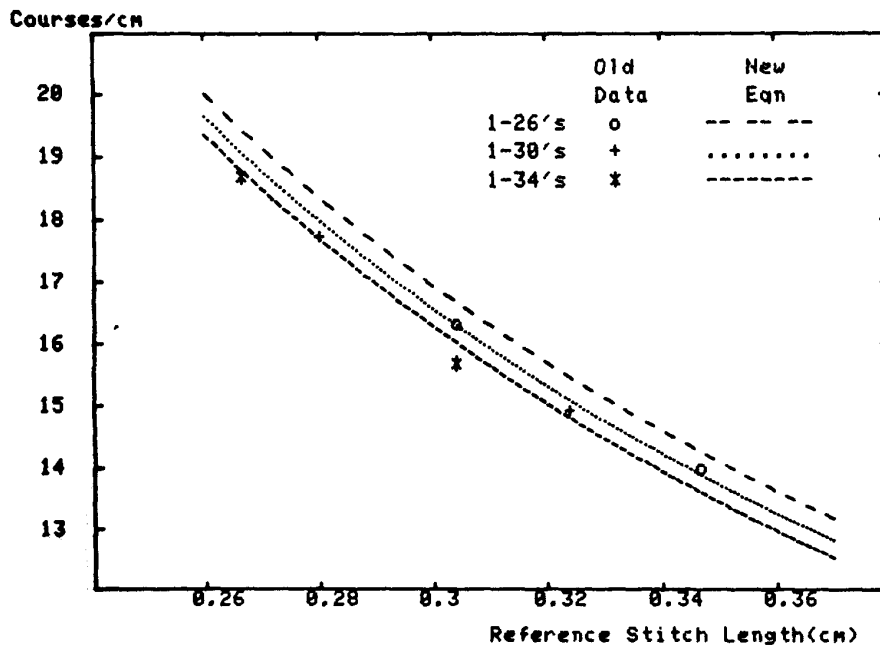
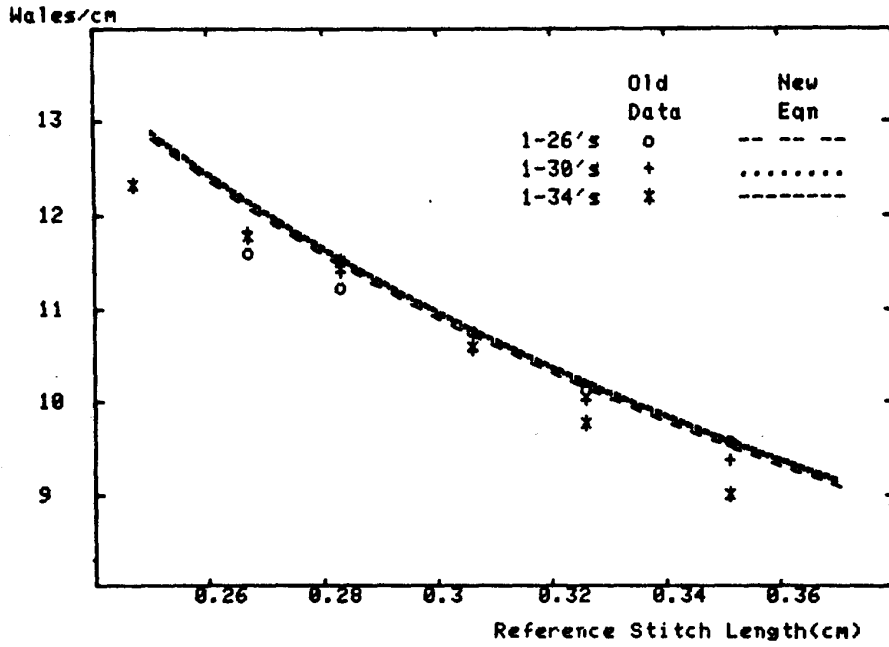


FIGURE 14

PREDICTION OF REFERENCE STATE : GREIGE WALES/CM



PREDICTION OF REFERENCE STATE : BLEACHED WALES/CM

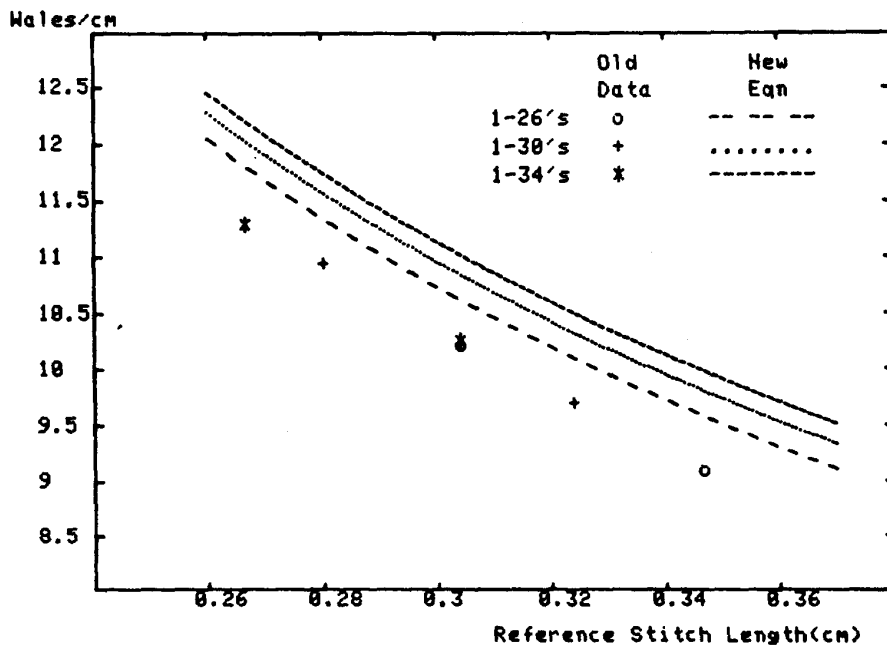
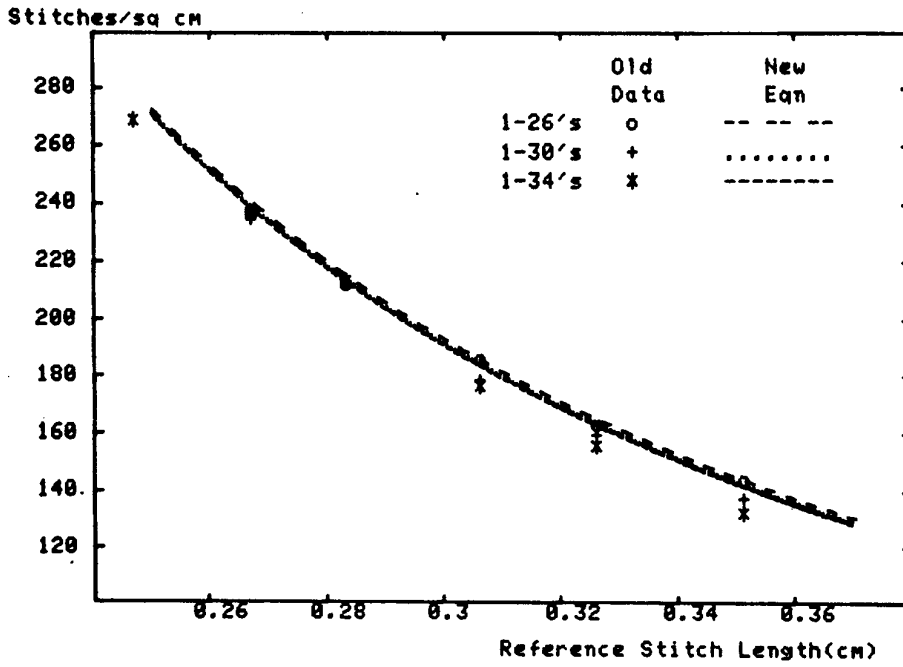


FIGURE 15

PREDICTION OF REFERENCE STATE : GREIGE STITCHES/SQ CM



PREDICTION OF REFERENCE STATE : BLEACHED STITCHES/SQ CM

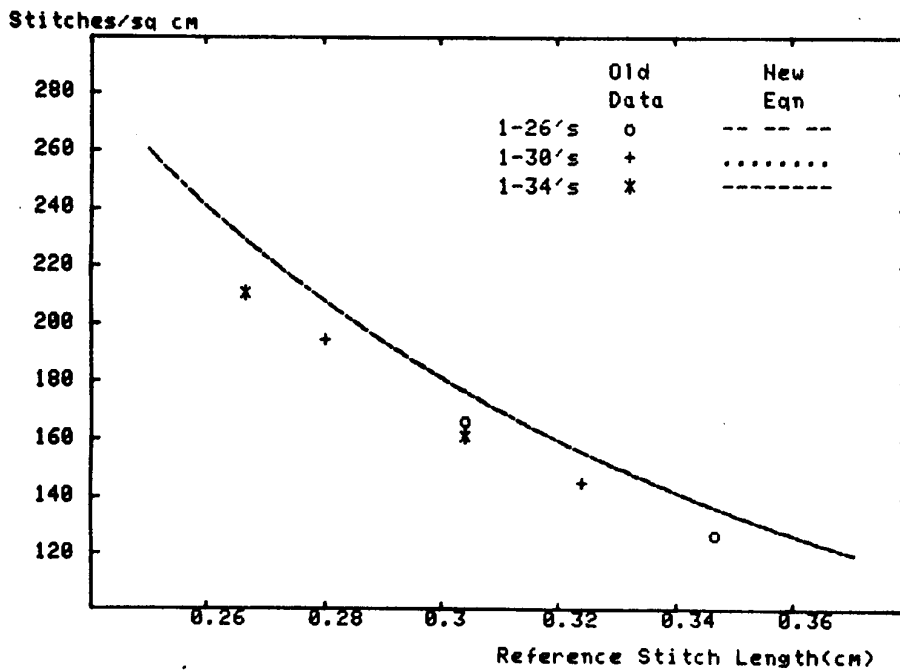
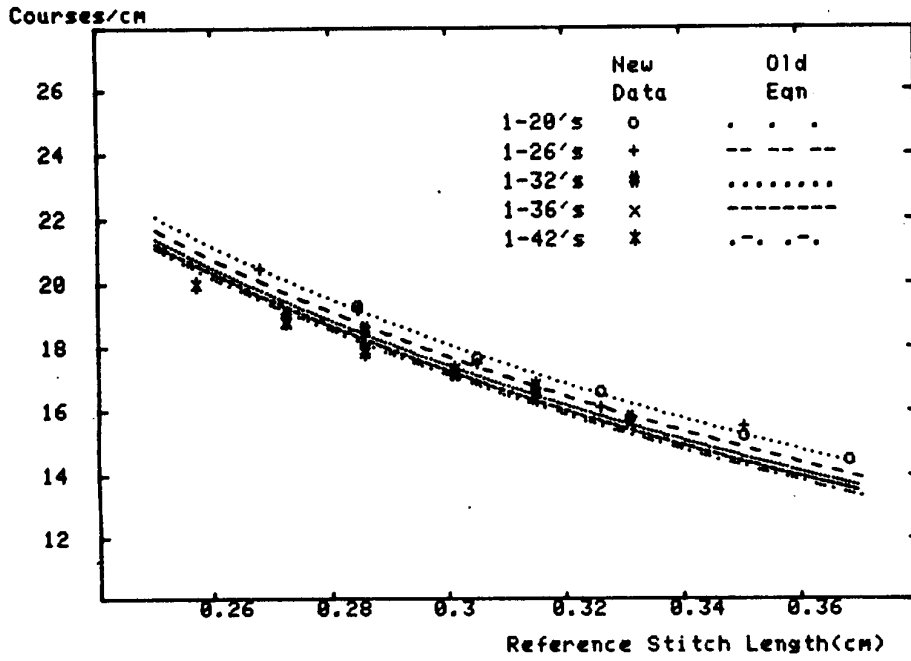


FIGURE 16

PREDICTION OF REFERENCE STATE : GREIGE COURSES/CM



PREDICTION OF REFERENCE STATE : BLEACHED COURSES/CM

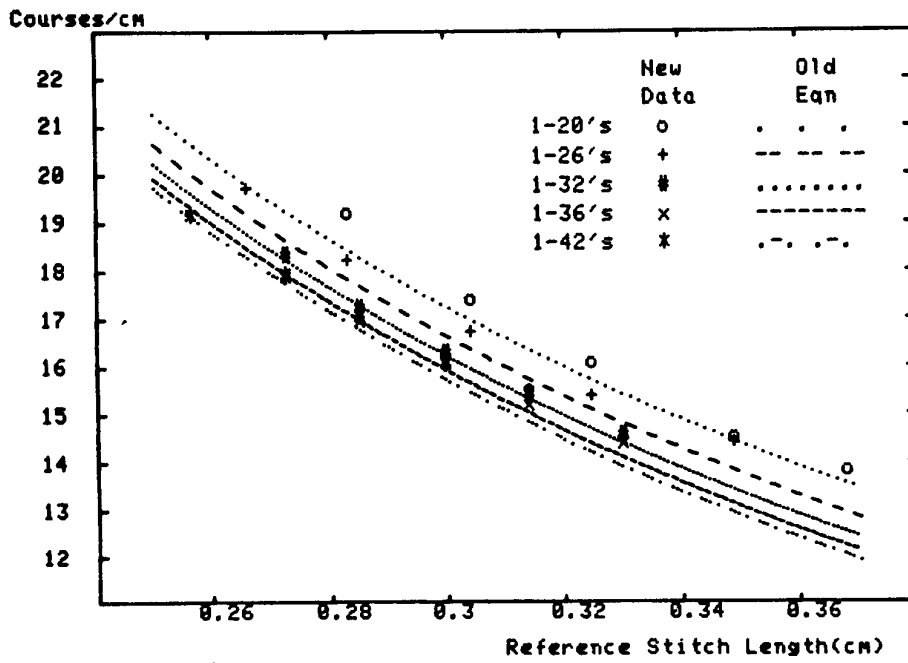
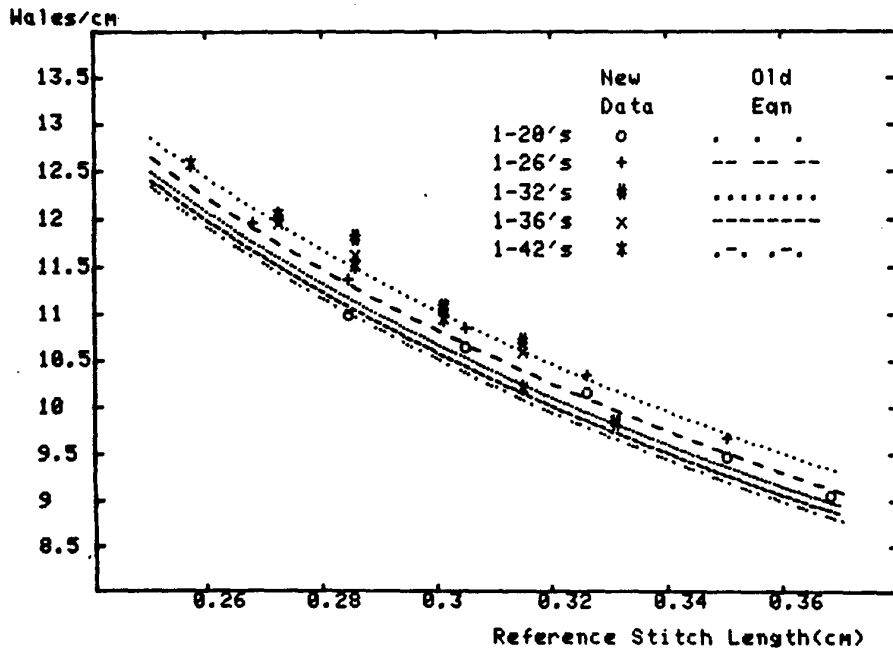


FIGURE 17

PREDICTION OF REFERENCE STATE : GREIGE WALES/CM



PREDICTION OF REFERENCE STATE : BLEACHED WALES/CM

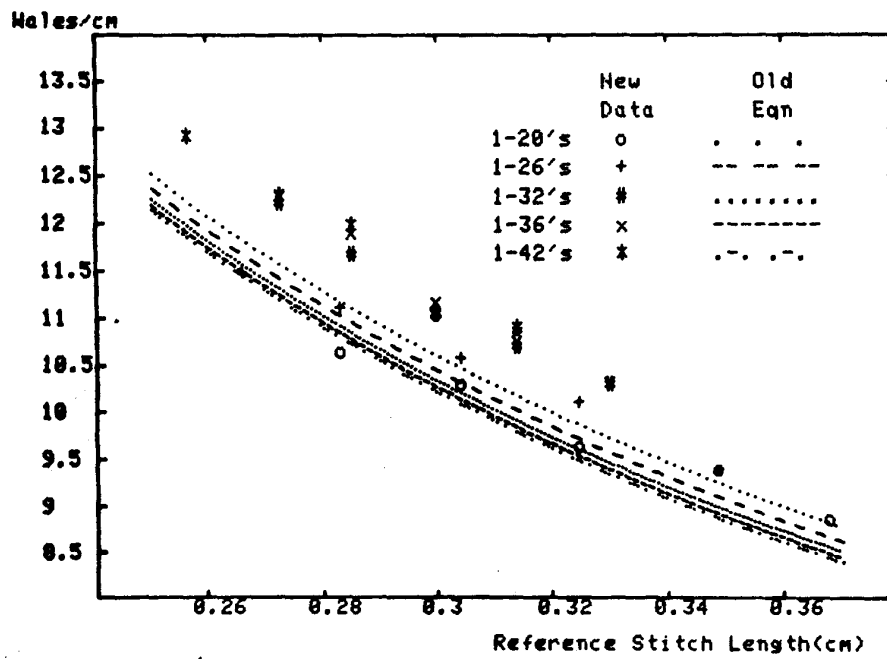
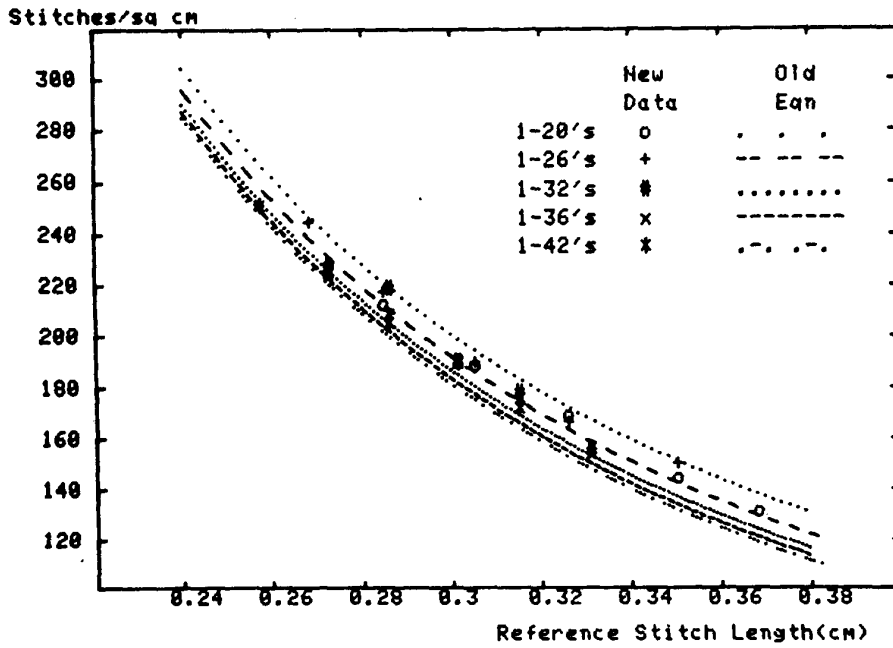


FIGURE 18

PREDICTION OF REFERENCE STATE : GREIGE STITCHES/SQ CM



PREDICTION OF REFERENCE STATE : BLEACHED STITCHES/SQ CM

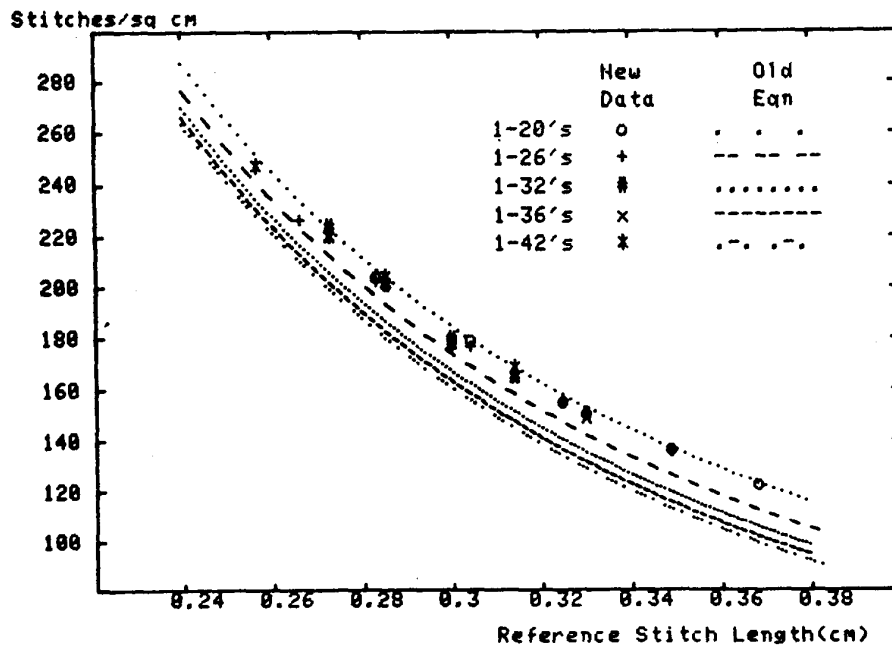
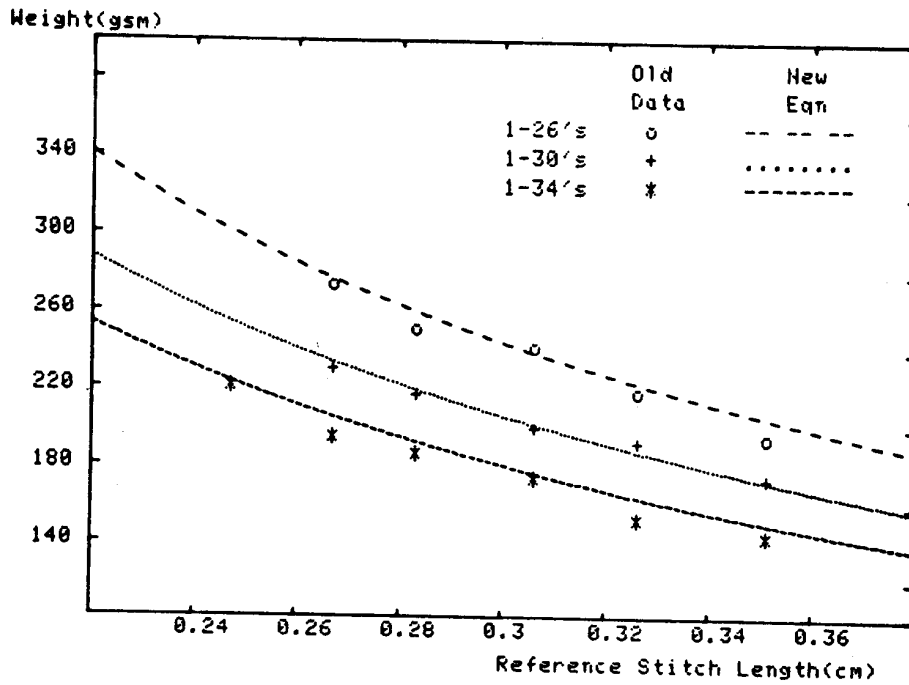


FIGURE 19

PREDICTION OF REFERENCE STATE : GREIGE WEIGHT/SQ M



PREDICTION OF REFERENCE STATE : BLEACHED WEIGHT/SQ M

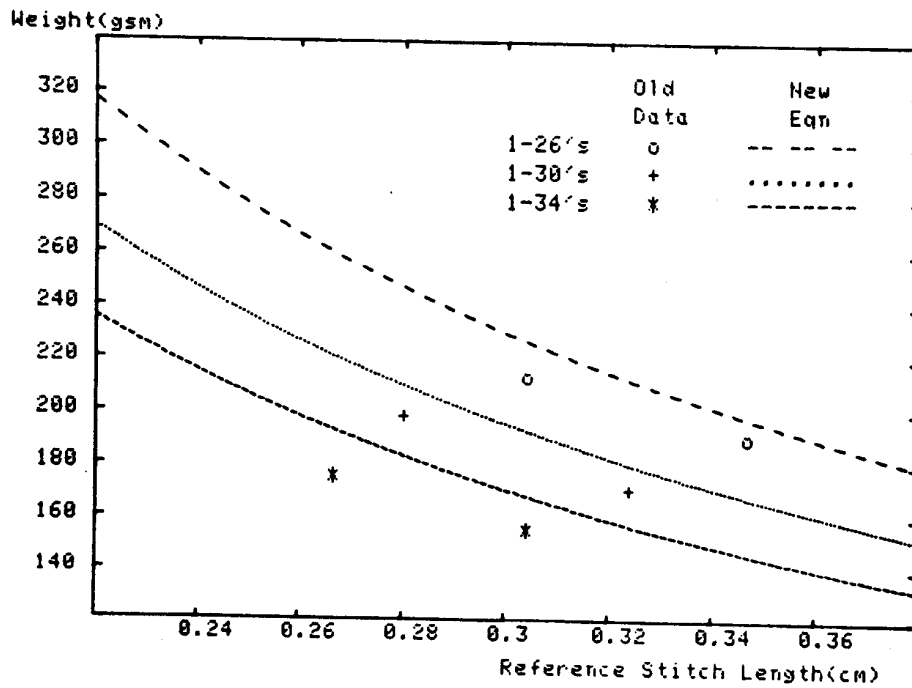
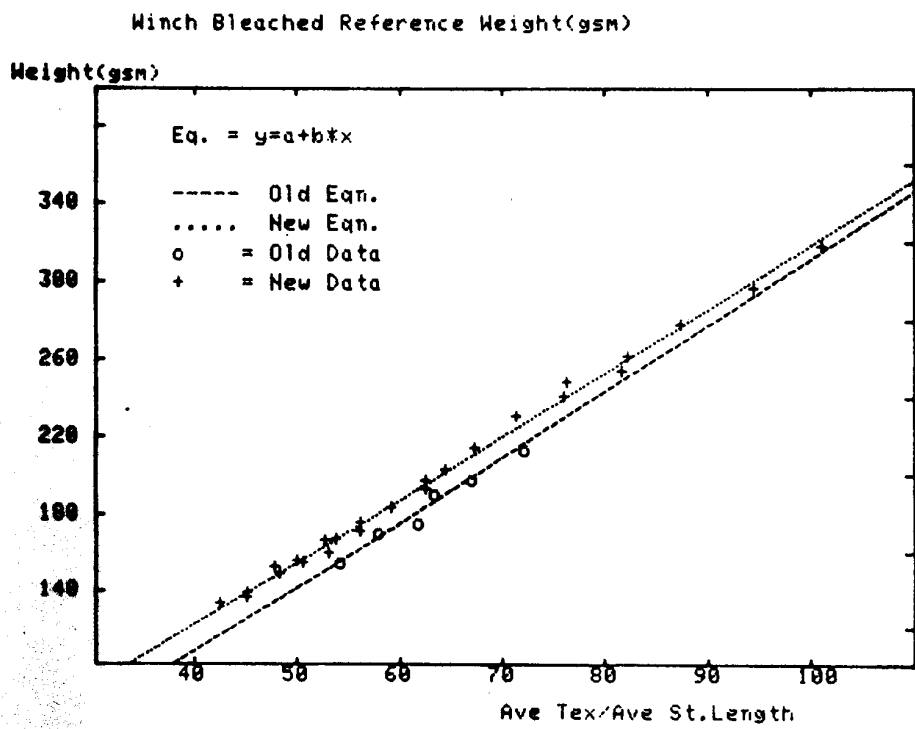
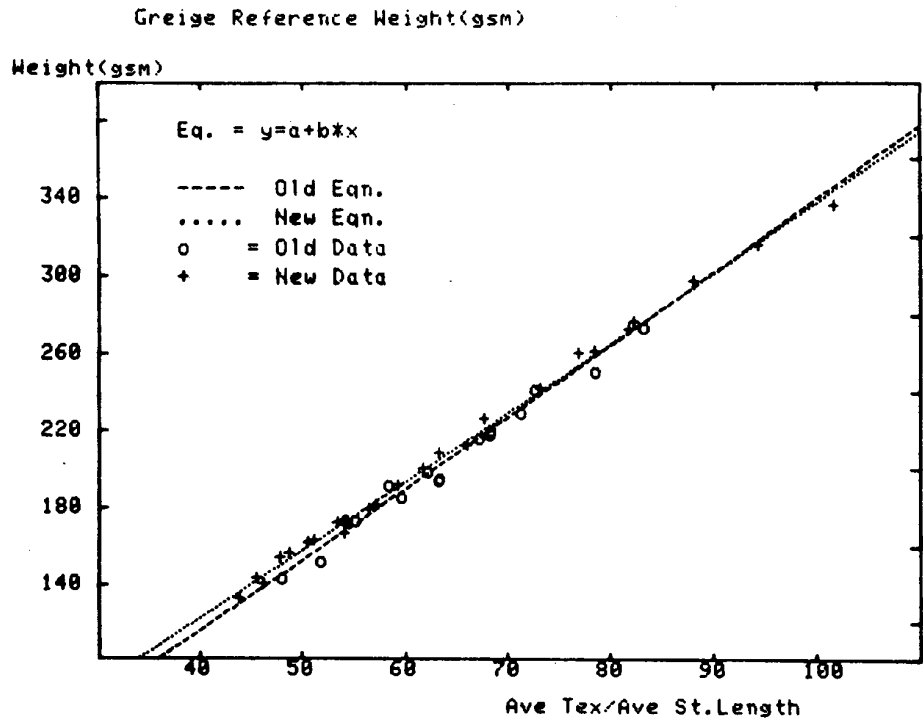


FIGURE 20



Appendix

RIB 85

YARN DATA

Test Method	Sample Identification				
	Kent Mill 1/20s	Carr Viy 1/26s	Mars Mill 1/32s	Mars Mill 1/36s	Carr Viy 1/42s
	1	2	3	4	5
1 Yarn count (Tex)	30.21	22.51	18.44	15.87	14.36
2 Twist (turns per metre)	611.00	725.50	797.50	796.00	889.50
3 Single end strength (g)	382.34	273.34	243.45	216.57	164.24
4 Extension at break (%)	6.68	6.83	6.57	6.64	6.05
5 Coefficient of friction (μ)	0.09	0.09	0.08	0.08	0.09
6 Twist liveliness (tpm)	38.30	54.10	55.25	59.45	70.70
7 Yarn Count (Ne)	19.55	26.23	32.02	37.22	41.11
8 Turns per inch	15.52	18.43	20.26	20.22	22.59
9 Twist Factor - alpha Tex	33.58	34.42	34.25	31.71	33.71
10 Twist Factor - English	3.51	3.60	3.58	3.31	3.52
11 Tenacity (g./Tex)	12.66	12.14	13.20	13.65	11.43

RIB 85

GREIGE DATA

Test Method	Sample Identification				
	Rb 14	Rb 14	Rb 14	Rb 14	Rb 14
	1-20	1-20	1-20	1-20	1-20
	285	306	326	350	368
	1	2	3	4	5
1 Length shrinkage, 5x	10.37	14.72	17.71	20.05	21.50
2 Width shrinkage, 5x	24.46	18.75	14.43	8.84	4.80
3 Weight (gsm)BW	240.37	238.60	228.93	215.64	206.36
4 Weight (gsm)AW	335.49	315.56	296.74	272.51	260.90
5 Courses per 3cm BW	52.20	45.80	40.80	36.60	34.00
6 Courses per 3cm AW	58.00	53.10	49.90	45.70	43.50
7 Wales per 3cm BW	25.60	25.90	25.50	25.50	25.60
8 Wales per 3cm AW	33.00	31.95	30.50	28.45	27.20
9 Stitch length (mm) BW	2.89	3.10	3.30	3.55	3.74
10 Stitch length (mm) AW	2.85	3.05	3.26	3.51	3.68
11 Burst strength, BW	940.90	912.60	813.50	793.00	727.70
12 Burst strength, AW	940.10	886.60	809.80	765.30	726.90
13 Distension at burst, BW	19.25	18.69	20.90	19.31	19.24
14 Distension at burst, AW	23.09	23.21	24.19	24.26	23.98
15 Angle of spirality, BW	-3.03	-3.03	-0.93	-1.09	-2.66
16 Angle of spirality, AW	-1.02	-1.08	-0.01	0.23	0.38
17 Width, BW	67.13	65.67	66.07	66.57	65.83
18 Yarn strength, BW	364.69	374.29	373.35	344.91	361.51
19 Yarn strength, AW	354.76	333.09	341.12	345.23	330.73
20 Yarn extension at break, BW	7.82	7.56	7.90	7.19	7.69
21 Yarn extension at break, AW	8.98	8.93	8.97	8.48	8.00
-22 Yarn count (tex), BW	29.16	29.66	30.08	29.57	29.43
-23 Yarn count (tex), AW	28.92	28.76	28.65	28.64	28.86
24 Thickness, BW	957.40	997.10	1030.90	1065.50	1097.80
25 Thickness, AW	1352.20	1348.40	1366.00	1418.90	1421.50
26 Turns per metre	655.50	678.50	630.00	648.00	666.50

RIB 85

GREIGE DATA

Sample Identification

Test Method	Rb 14	Rb 14	Rb 14	Rb 14	Rb 14
	1-26	1-26	1-26	1-26	1-26
	267	285	306	326	350
	6	7	8	9	10
1 Length shrinkage, 5x	10.91	14.68	18.31	20.60	22.38
2 Width shrinkage, 5x	28.58	23.44	17.74	11.37	5.12
3 Weight (gsm)BW	190.31	186.69	180.43	169.46	168.83
4 Weight (gsm)AW	276.40	260.23	241.55	225.89	207.73
5 Courses per 3cm BW	55.80	48.90	43.20	39.40	35.70
6 Courses per 3cm AW	61.30	57.40	52.40	48.20	46.50
7 Wales per 3cm BW	25.90	26.10	27.20	26.70	26.90
8 Wales per 3cm AW	35.85	34.05	32.50	31.00	29.80
9 Stitch length (mm) BW	2.71	2.89	3.09	3.31	3.55
10 Stitch length (mm) AW	2.68	2.84	3.04	3.26	3.50
11 Burst strength, BW	714.80	689.30	641.40	603.60	571.60
12 Burst strength, AW	727.40	634.30	598.20	557.60	527.50
13 Distension at burst, BW	19.59	19.12	18.60	19.85	19.32
14 Distension at burst, AW	23.43	23.31	23.18	23.93	24.57
15 Angle of spirality, BW	-3.82	-4.55	-4.29	-1.85	-2.40
16 Angle of spirality, AW	-0.97	-1.08	-2.53	-0.13	-0.86
17 Width, BW	65.90	64.23	62.50	61.37	61.73
18 Yarn strength, BW	298.76	300.80	296.11	291.17	290.95
19 Yarn strength, AW	270.17	261.76	267.69	272.05	265.01
20 Yarn extension at break, BW	7.86	8.12	7.96	8.33	8.17
21 Yarn extension at break, AW	9.16	8.74	9.45	9.06	8.91
22 Yarn count (tex), BW	22.55	22.50	22.76	22.46	22.62
23 Yarn count (tex), AW	22.80	21.83	22.22	22.82	22.88
24 Thickness, BW	849.20	881.30	932.20	951.20	997.90
25 Thickness, AW	1206.80	1249.60	1266.20	1236.10	1264.80
26 Turns per metre	742.00	755.00	761.50	801.00	756.00

RIB 85

GREIGE DATA

Test Method	Sample Identification				
	Rb 18	Rb 18	Rb 18	Rb 18	Rb 18
	1-32	1-32	1-32	1-32	1-32
	275	289	303	318	334
	11	12	13	14	15
1 Length shrinkage, 5x	19.84	21.21	24.28	27.78	27.60
2 Width shrinkage, 5x	13.32	9.49	5.85	1.99	-5.30
3 Weight (gsm)BW	165.11	156.70	152.34	139.34	141.65
4 Weight (gsm)AW	211.96	199.53	190.94	178.84	165.95
5 Courses per 3cm BW	46.20	42.90	38.60	35.90	33.90
6 Courses per 3cm AW	56.90	55.60	51.40	49.80	47.10
7 Wales per 3cm BW	32.10	31.30	31.60	31.10	31.00
8 Wales per 3cm AW	36.00	35.40	33.20	32.10	29.50
9 Stitch length (mm) BW	2.77	2.90	3.06	3.19	3.37
10 Stitch length (mm) AW	2.72	2.87	3.01	3.15	3.31
11 Burst strength, BW	624.20	579.10	558.30	587.80	565.20
12 Burst strength, AW	575.30	579.30	527.10	520.00	478.20
13 Distension at burst, BW	18.72	18.33	17.50	17.16	17.99
14 Distension at burst, AW	23.85	23.85	23.95	23.51	23.35
15 Angle of spirality, BW	-3.37	-2.44	-3.57	-4.09	-4.48
16 Angle of spirality, AW	0.68	0.97	-0.34	1.56	-3.18
17 Width, BW	78.23	80.50	79.63	80.00	80.75
18 Yarn strength, BW	204.76	251.01	232.15	238.72	235.59
19 Yarn strength, AW	233.35	215.83	229.69	221.13	228.58
20 Yarn extension at break, BW	7.55	8.82	7.16	6.93	6.44
21 Yarn extension at break, AW	10.03	7.73	9.11	7.57	7.51
22 Yarn count (tex), BW	18.27	18.18	18.19	18.07	17.94
23 Yarn count (tex), AW	17.89	17.67	17.81	17.71	17.84
24 Thickness, BW	818.00	818.90	828.80	828.50	872.10
25 Thickness, AW	1139.90	1088.20	1086.00	1115.50	1124.80
26 Turns per metre	886.00	917.50	904.00	851.00	851.00

RIB 05

GREIGE DATA

Test Method	Sample Identification				
	Rb 10	Rb 18	Rb 18	Rb 18	Rb 18
	1-36	1-36	1-36	1-36	1-36
	275	289	303	318	334
	16	17	18	19	20
1 Length shrinkage, 5x	21.31	22.95	26.10	28.15	30.21
2 Width shrinkage, 5x	13.00	9.38	3.59	-1.74	-7.38
3 Weight (gsm)BW	138.73	132.25	129.10	121.23	116.82
4 Weight (gsm)AW	180.46	172.59	162.21	155.80	139.85
5 Courses per 3cm BW	44.70	41.00	38.10	34.90	32.50
6 Courses per 3cm AW	56.40	53.90	51.50	49.80	46.90
7 Wales per 3cm BW	32.10	31.60	31.90	32.00	30.87
8 Wales per 3cm AW	35.90	34.90	33.30	31.80	29.60
9 Stitch length (mm) BW	2.77	2.91	3.07	3.21	3.37
10 Stitch length (mm) AW	2.73	2.85	3.01	3.16	3.31
11 Burst strength, BW	539.20	511.30	515.10	492.40	524.10
12 Burst strength, AW	477.30	446.70	451.10	408.50	387.30
13 Distension at burst, BW	17.62	18.35	17.66	17.47	18.02
14 Distension at burst, AW	22.90	22.75	23.29	23.63	22.82
15 Angle of spirality, BW	-3.25	-2.39	-2.89	-2.98	-5.02
16 Angle of spirality, AW	0.44	0.26	0.23	1.00	-2.61
17 Width, BW	78.67	78.60	78.77	78.83	82.03
18 Yarn strength, BW	200.24	208.65	200.39	189.03	209.47
19 Yarn strength, AW	193.79	177.03	181.48	184.35	174.43
20 Yarn extension at break, BW	7.35	7.42	7.33	6.20	6.79
21 Yarn extension at break, AW	9.92	7.34	8.33	7.25	6.92
22 Yarn count (tex), BW	15.84	15.86	15.78	15.77	15.94
23 Yarn count (tex), AW	15.57	15.43	15.36	15.39	15.32
24 Thickness, BW	798.50	769.60	791.40	797.20	804.90
25 Thickness, AW	1080.70	1029.90	1042.90	1043.90	1040.00
26 Turns per metre	923.00	999.50	957.00	889.50	985.00

RIB 85

GREIGE DATA

Test Method	Sample Identification				
	Rb 18	Rb 18	Rb 18	Rb 18	Rb 18
	1-42	1-42	1-42	1-42	1-42
	260	275	289	303	318
	21	22	23	24	25
1 Length shrinkage, 5x	21.48	23.14	25.14	26.66	30.68
2 Width shrinkage, 5x	17.97	11.81	7.82	1.54	-6.88
3 Weight (gsm)BW	124.75	123.12	115.68	112.69	105.81
4 Weight (gsm)AW	171.48	161.28	153.32	142.67	131.88
5 Courses per 3cm BW	47.48	44.18	41.20	39.28	34.78
6 Courses per 3cm AW	59.88	56.38	53.48	51.88	50.38
7 Wales per 3cm BW	32.38	32.68	32.88	32.48	31.78
8 Wales per 3cm AW	37.78	36.18	34.58	32.88	38.68
9 Stitch length (mm) BW	2.63	2.76	2.91	3.04	3.19
10 Stitch length (mm) AW	2.57	2.72	2.85	3.01	3.14
11 Burst strength, BW	455.20	444.50	399.40	414.80	411.60
12 Burst strength, AW	436.40	392.70	384.50	365.10	373.10
13 Distension at burst, BW	17.54	17.88	18.84	17.35	18.38
14 Distension at burst, AW	22.94	22.77	22.85	23.65	23.88
15 Angle of spirality, BW	-3.35	-3.64	-4.10	-4.83	-3.24
16 Angle of spirality, AW	0.65	0.23	0.52	1.15	1.33
17 Width, BW	79.38	78.33	78.48	77.43	77.25
18 Yarn strength, BW	182.68	172.71	188.38	172.87	176.88
19 Yarn strength, AW	166.51	188.48	158.43	164.69	167.85
20 Yarn extension at break, BW	7.82	7.37	7.46	7.83	7.81
21 Yarn extension at break, AW	8.55	9.36	8.38	8.91	7.38
22 Yarn count (tex), BW	13.91	14.81	14.84	14.18	14.83
23 Yarn count (tex), AW	13.71	13.74	13.63	13.73	13.79
24 Thickness, BW	719.88	745.98	763.78	758.58	765.98
25 Thickness, AW	1888.88	1834.28	1819.98	946.38	985.58
26 Turns per metre	994.88	942.58	967.88	1876.88	987.58

RIB'85

WINCH BLEACHED DATA

Test Method	Sample Identification				
	Rb 14	Rb 14	Rb 14	Rb 14	Rb 14
	1-20	1-20	1-20	1-20	1-20
	285	306	326	350	368
	1	2	3	4	5
1 Length shrinkage, Sx	4.42	5.67	6.30	8.01	8.40
2 Width shrinkage, Sx	9.48	9.34	9.01	10.37	11.96
3 Weight (gsm)BW	279.16	263.59	238.51	216.22	198.80
4 Weight (gsm)AW	317.54	295.98	277.52	253.38	240.14
5 Courses per 3cm BW	55.10	49.50	44.65	40.33	38.23
6 Courses per 3cm AW	57.60	52.20	48.30	43.60	41.50
7 Wales per 3cm BW	28.60	27.60	27.28	25.97	23.71
8 Wales per 3cm AW	31.90	30.90	28.90	28.17	26.60
9 Stitch length (mm) BW	2.85	3.05	3.27	3.51	3.70
10 Stitch length (mm) AW	2.83	3.03	3.24	3.49	3.68
11 Burst strength, BW	897.10	825.60	810.50	734.60	712.30
12 Burst strength, AW	879.60	797.70	735.50	705.80	689.90
13 Distension at burst, BW	22.30	22.48	22.26	21.61	21.55
14 Distension at burst, AW	23.77	23.30	23.36	22.57	22.95
15 Angle of spirality, BW	-0.02	-0.63	0.08	-0.25	-2.85
16 Angle of spirality, AW	0.51	0.41	0.39	-0.15	-1.37
17 Width, BW	59.30	62.17	63.60	68.20	75.10
18 Yarn strength, BW	354.20	319.56	334.08	323.78	324.77
19 Yarn strength, AW	385.72	389.09	363.52	367.44	361.12
20 Yarn extension at break, BW	8.04	7.82	8.10	8.26	8.09
21 Yarn extension at break, AW	8.36	8.81	8.24	7.98	7.85
22 Yarn count (tex), BW	27.89	28.43	28.36	28.49	28.57
23 Yarn count (tex), AW	28.54	28.62	28.26	28.44	27.93
24 Thickness, BW	1080.50	1031.00	1069.00	1052.80	1057.20
25 Thickness, AW	1133.40	1175.40	1220.00	1239.80	1255.50

RIB'85

WINCH BLEACHED DATA

Test Method	Sample Identification				
	Rb 14	Rb 14	Rb 14	Rb 14	Rb 14
	1-26	1-26	1-26	1-26	1-26
	267	285	306	326	350
	6	7	8	9	10
1 Length shrinkage, 5x	5.28	5.99	7.32	9.87	9.88
2 Width shrinkage, 5x	11.24	10.70	12.47	10.54	14.03
3 Weight (gsm)BW	220.04	209.62	191.30	172.45	157.86
4 Weight (gsm)AW	261.27	247.69	229.72	213.40	196.55
5 Courses per 3cm BW	56.20	51.90	46.30	41.50	38.90
6 Courses per 3cm AW	59.10	54.60	50.10	46.10	43.20
7 Wales per 3cm BW	30.50	29.53	27.70	26.60	24.33
8 Wales per 3cm AW	34.40	33.30	31.70	30.30	28.10
9 Stitch length (mm) BW	2.68	2.86	3.06	3.28	3.52
10 Stitch length (mm) AW	2.66	2.83	3.05	3.25	3.48
11 Burst strength, BW	722.20	647.00	605.50	569.00	511.80
12 Burst strength, AW	697.50	647.30	589.80	546.50	502.70
13 Distension at burst, BW	22.49	22.26	21.78	21.40	21.22
14 Distension at burst, AW	22.65	22.96	23.26	22.86	22.37
15 Angle of spirality, BW	-0.12	0.24	2.48	0.20	4.18
16 Angle of spirality, AW	2.12	1.57	2.45	0.97	1.52
17 Width, BW	55.77	56.80	60.63	62.70	70.83
18 Yarn strength, BW	278.73	270.49	264.71	248.92	262.65
19 Yarn strength, AW	293.07	300.03	283.47	267.61	281.60
20 Yarn extension at break, BW	8.83	8.79	8.65	8.13	8.01
21 Yarn extension at break, AW	8.56	8.65	8.76	8.62	8.78
22 Yarn count (tex), BW	21.86	21.68	21.54	21.76	21.49
23 Yarn count (tex), AW	21.85	21.56	21.70	21.83	21.72
24 Thickness, BW	893.80	934.50	950.20	951.30	980.90
25 Thickness, AW	1055.80	1089.50	1123.10	1147.70	1178.00

RIB'85

WINCH BLEACHED DATA

Test Method	Sample Identification				
	Rb 18	Rb 18	Rb 18	Rb 18	Rb 18
	1-32	1-32	1-32	1-32	1-32
	275	289	303	318	334
	11	12	13	14	15
1 Length shrinkage, 5x	7.91	9.92	10.51	12.26	13.76
2 Width shrinkage, 5x	10.34	8.54	4.66	6.17	3.96
3 Weight (gsm)BW	170.33	164.42	156.17	150.28	137.69
4 Weight (gsm)AW	202.30	192.45	182.87	170.34	159.20
5 Courses per 3cm BW	50.85	46.40	43.30	40.90	37.30
6 Courses per 3cm AW	55.00	51.63	48.80	46.27	43.67
7 Wales per 3cm BW	32.43	32.80	32.50	31.10	29.97
8 Wales per 3cm AW	36.60	35.00	33.10	32.07	30.87
9 Stitch length (mm) BW	2.74	2.86	3.02	3.16	3.31
10 Stitch length (mm) AW	2.72	2.85	2.99	3.13	3.30
11 Burst strength, BW	558.10	547.10	516.90	510.50	477.20
12 Burst strength, AW	578.10	544.40	501.00	494.80	470.50
13 Distension at burst, BW	20.74	20.24	20.24	19.56	19.40
14 Distension at burst, AW	22.73	22.43	22.41	22.29	22.40
15 Angle of spirality, BW	-6.26	-3.54	-6.59	-2.29	-1.06
16 Angle of spirality, AW	-3.70	-1.93	-3.90	-1.58	-1.56
17 Width, BW	78.10	75.10	77.67	79.73	82.27
18 Yarn strength, BW	227.53	220.13	223.53	209.67	202.28
19 Yarn strength, AW	231.27	228.69	221.85	219.37	229.45
20 Yarn extension at break, BW	8.10	8.16	7.98	8.17	7.24
21 Yarn extension at break, AW	7.78	7.96	7.50	7.65	7.90
22 Yarn count (tex), BW	17.88	17.46	17.41	17.32	17.64
23 Yarn count (tex), AW	17.48	17.74	17.66	17.54	17.48
24 Thickness, BW	895.00	816.70	820.70	836.80	853.00
25 Thickness, AW	1032.60	1049.20	1053.40	1045.30	1060.00

RIB'85

WINCH BLEACHED DATA

Test Method	Sample Identification				
	Rb 18	Rb 18	Rb 18	Rb 18	Rb 18
	1-36	1-36	1-36	1-36	1-36
	275	289	303	318	334
	16	17	18	19	20
1 Length shrinkage, 5x	10.18	10.92	12.24	13.03	15.20
2 Width shrinkage, 5x	6.16	4.95	3.69	4.74	6.76
3 Weight (gsm)BW	149.76	141.01	134.93	128.29	121.78
4 Weight (gsm)AW	174.84	166.44	154.38	148.70	135.55
5 Courses per 3cm BW	48.70	45.27	42.13	40.17	37.83
6 Courses per 3cm AW	53.78	50.93	48.30	45.63	43.27
7 Wales per 3cm BW	34.90	34.20	32.97	31.97	30.83
8 Wales per 3cm AW	36.90	35.70	33.50	32.57	31.00
9 Stitch length (mm) BW	2.74	2.87	3.02	3.16	3.32
10 Stitch length (mm) AW	2.73	2.85	2.99	3.14	3.30
11 Burst strength, BW	499.60	514.60	479.00	446.20	424.50
12 Burst strength, AW	465.20	460.60	432.00	415.00	402.00
13 Distension at burst, BW	20.46	21.09	19.36	20.02	20.08
14 Distension at burst, AW	23.81	22.60	21.86	22.61	23.28
15 Angle of spirality, BW	-0.25	0.81	9.89	4.84	1.84
16 Angle of spirality, AW	-0.86	-0.52	3.55	4.17	-0.14
17 Width, BW	72.28	75.37	78.80	80.13	84.32
18 Yarn strength, BW	177.26	177.47	164.15	167.15	170.11
19 Yarn strength, AW	200.06	193.03	188.79	190.77	179.82
20 Yarn extension at break, BW	7.54	7.46	6.96	7.12	7.09
21 Yarn extension at break, AW	7.71	7.56	7.26	7.50	7.02
22 Yarn count (tex), BW	15.16	15.15	15.15	15.30	15.20
23 Yarn count (tex), AW	15.31	15.30	15.12	15.18	14.92
24 Thickness, BW	768.90	759.60	754.80	768.80	776.70
25 Thickness, AW	925.20	934.70	937.00	941.60	953.50

RIB'85

WINCH BLEACHED DATA

Test Method	Sample Identification				
	Rb 18	Rb 18	Rb 18	Rb 18	Rb 18
	1-42	1-42	1-42	1-42	1-42
	260	275	289	303	318
	21	22	23	24	25
1 Length shrinkage, 5x	8.05	10.41	12.05	12.95	15.45
2 Width shrinkage, 5x	10.52	7.00	6.40	2.23	2.95
3 Weight (gsm)BW	136.65	134.15	129.48	118.76	114.68
4 Weight (gsm)AW	165.68	155.17	152.23	138.30	132.33
5 Courses per 3cm BW	52.50	48.00	44.80	42.20	39.20
6 Courses per 3cm AW	57.40	53.75	51.10	48.30	46.30
7 Wales per 3cm BW	33.40	33.93	33.50	32.36	31.53
8 Wales per 3cm AW	38.70	36.85	35.90	33.10	32.67
9 Stitch length (mm) BW	2.59	2.74	2.87	3.03	3.16
10 Stitch length (mm) AW	2.57	2.73	2.86	3.01	3.14
11 Burst strength, BW	422.10	388.80	383.70	361.40	343.30
12 Burst strength, AW	432.20	420.00	381.20	355.80	362.20
13 Distension at burst, BW	20.94	20.36	19.97	20.40	20.48
14 Distension at burst, AW	22.62	22.25	22.32	22.96	22.63
15 Angle of spirality, BW	0.92	-4.01	-2.71	2.86	-0.18
16 Angle of spirality, AW	1.26	-0.74	-0.14	3.24	1.83
17 Width, BW	75.63	73.13	76.23	77.07	78.23
18 Yarn strength, BW	164.23	150.28	150.03	153.40	162.07
19 Yarn strength, AW	174.92	158.71	161.88	164.88	155.97
20 Yarn extension at break, BW	6.97	6.58	7.03	6.65	7.72
21 Yarn extension at break, AW	6.44	6.66	6.74	6.77	6.54
22 Yarn count (tex), BW	13.77	13.54	13.52	13.40	13.52
23 Yarn count (tex), AW	13.48	13.61	13.64	13.59	13.38
24 Thickness, BW	712.70	708.50	705.00	704.30	707.20
25 Thickness, AW	895.80	901.20	904.30	913.70	927.90

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GREIGE DATA (14 GAUGE)

Column Statistics

No.	Test Method	N	Mean	Std.Dev	%C.V.
1	Length shrinkage, 5x	10	17.1222	4.2844	25.02
2	Width shrinkage, 5x	10	15.7524	8.2628	52.45
3	Weight (gsm)BW	10	202.5639	27.3534	13.50
4	Weight (gsm)AW	10	269.2989	39.3465	14.61
5	Courses per 3cm BW	10	43.1600	7.1812	16.64
6	Courses per 3cm AW	10	51.6000	5.8922	11.42
7	Wales per 3cm BW	10	26.0900	0.6244	2.39
8	Wales per 3cm AW	10	31.3500	2.6655	8.50
9	Stitch length (mm) BW	10	3.2137	0.3344	10.41
10	Stitch length (mm) AW	10	3.1667	0.3300	10.42
11	Burst strength, BW	10	740.8400	124.0063	16.74
12	Burst strength, AW	10	717.3700	138.2263	19.27
13	Distension at burst, BW	10	19.3866	0.6484	3.34
14	Distension at burst, AW	10	23.7139	0.5322	2.24
15	Angle of spirality, BW	10	-2.7650	1.2436	-44.98
16	Angle of spirality, AW	10	-0.6270	0.8820	-140.67
17	Width, BW	10	64.7800	2.1056	3.25
18	Yarn strength, BW	10	329.6533	36.9206	11.20
19	Yarn strength, AW	10	304.1620	39.4442	12.97
20	Yarn extension at break, BW	10	7.8684	0.3263	4.15
21	Yarn extension at break, AW	10	8.8669	0.3951	4.46
22	Yarn count (tex), BW	10	26.0788	3.6977	14.18
23	Yarn count (tex), AW	10	25.3984	3.5506	13.98
24	Thickness, BW	10	976.0500	77.9673	7.99
25	Thickness, AW	10	1313.0500	77.6823	5.92
26	Turns per metre	10	709.4000	59.8084	8.43

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GREIBE DATA (10 GAUGE)

Column Statistics

No.	Test Method	N	Mean	Std.Dev	%C.V.
1	Length shrinkage, 5x	15	25.0979	3.4016	13.55
2	Width shrinkage, 5x	15	4.9740	7.7692	156.17
3	Weight (gsm)BW	15	131.6884	17.1597	13.03
4	Weight (gsm)AW	15	167.9167	22.2733	13.26
5	Courses per 3cm BW	15	39.6867	4.7212	11.90
6	Courses per 3cm AW	15	52.7267	3.7469	7.11
7	Wales per 3cm BW	15	31.8244	0.5863	1.84
8	Wales per 3cm AW	15	33.5600	2.5074	7.47
9	Stitch length (mm) BW	15	3.0100	0.2284	7.59
10	Stitch length (mm) AW	15	2.9605	0.2251	7.60
11	Burst strength, BW	15	508.1467	70.1314	13.80
12	Burst strength, AW	15	453.5867	71.2966	15.72
13	Distension at burst, BW	15	17.8612	0.5483	3.07
14	Distension at burst, AW	15	23.2252	0.4897	1.76
15	Angle of spirality, BW	15	-3.5227	0.7292	-20.70
16	Angle of spirality, AW	15	0.1927	1.3488	700.09
17	Width, BW	15	79.1156	1.2836	1.62
18	Yarn strength, BW	15	203.5888	25.7749	12.66
19	Yarn strength, AW	15	191.7869	26.5486	13.84
20	Yarn extension at break, BW	15	7.2445	0.6071	8.38
21	Yarn extension at break, AW	15	8.2749	1.0087	12.19
22	Yarn count (tex), BW	15	15.9954	1.7427	10.89
23	Yarn count (tex), AW	15	15.6399	1.7283	11.05
24	Thickness, BW	15	792.1133	38.8974	4.91
25	Thickness, AW	15	1052.3800	53.4558	5.08
26	Turns per metre	15	931.3667	60.0828	6.45

RIB'85

WINCH BLEACHED DATA (14 GAUGE)

Column Statistics

No.	Test Method	N	Mean	Std.Dev	%C.V.
1	Length shrinkage, 5x	10	7.1138	1.8967	26.66
2	Width shrinkage, 5x	10	10.9144	1.5614	14.31
3	Weight (gsm)BW	10	214.7545	37.9840	17.69
4	Weight (gsm)AW	10	253.3180	36.7740	14.52
5	Courses per 3cm BW	10	46.2617	6.6519	14.38
6	Courses per 3cm AW	10	49.6300	6.1713	12.43
7	Wales per 3cm BW	10	27.1832	2.1330	7.85
8	Wales per 3cm AW	10	30.4267	2.4849	8.17
9	Stitch length (mm) BW	10	3.1775	0.3317	10.44
10	Stitch length (mm) AW	10	3.1537	0.3318	10.52
11	Burst strength, BW	10	703.5600	121.5036	17.27
12	Burst strength, AW	10	679.2300	113.6762	16.74
13	Distension at burst, BW	10	21.9339	0.4751	2.17
14	Distension at burst, AW	10	23.0055	0.4240	1.84
15	Angle of spirality, BW	10	0.3310	1.8627	562.76
16	Angle of spirality, AW	10	0.8420	1.1354	134.85
17	Width, BW	10	63.5100	6.1771	9.73
18	Yarn strength, BW	10	298.1900	36.8188	12.35
19	Yarn strength, AW	10	329.2667	48.0135	14.58
20	Yarn extension at break, BW	10	8.2716	0.3551	4.29
21	Yarn extension at break, AW	10	8.4608	0.3417	4.04
22	Yarn count (tex), BW	10	25.0061	3.5267	14.10
23	Yarn count (tex), AW	10	25.0466	3.4975	13.96
24	Thickness, BW	10	992.1200	59.5783	6.01
25	Thickness, AW	10	1161.8200	64.6913	5.57

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WINCH BLEACHED DATA (18 GAUGE)

Column Statistics

No.	Test Method	N	Mean	Std.Dev	%C.V.
1	Length shrinkage, 5x	15	11.6563	2.2597	19.39
2	Width shrinkage, 5x	15	5.9399	2.4622	41.45
3	Weight (gsm)BW	15	139.2258	16.3000	11.71
4	Weight (gsm)AW	15	162.0462	20.3221	12.54
5	Courses per 3cm BW	15	43.9700	4.6501	10.58
6	Courses per 3cm AW	15	49.6033	4.2196	8.51
7	Wales per 3cm BW	15	32.5065	1.4276	4.39
8	Wales per 3cm AW	15	34.3011	2.3072	6.96
9	Stitch length (mm) BW	15	2.9734	0.2223	7.48
10	Stitch length (mm) AW	15	2.9535	0.2217	7.51
11	Burst strength, BW	15	450.2000	60.2023	14.90
12	Burst strength, AW	15	447.6667	63.0059	14.25
13	Distension at burst, BW	15	20.2227	0.5137	2.54
14	Distension at burst, AW	15	22.6126	0.4657	2.06
15	Angle of spirality, BW	15	-0.3020	4.2050	-1121.93
16	Angle of spirality, AW	15	-0.0600	2.4569	-3613.06
17	Width, BW	15	77.6044	3.2230	4.15
18	Yarn strength, BW	15	101.2049	27.6521	15.25
19	Yarn strength, AW	15	193.2975	27.3512	14.15
20	Yarn extension at break, BW	15	7.3033	0.5395	7.31
21	Yarn extension at break, AW	15	7.2662	0.5240	7.21
22	Yarn count (tex), BW	15	15.4200	1.7020	11.03
23	Yarn count (tex), AW	15	15.4209	1.7206	11.15
24	Thickness, BW	15	772.5000	60.6097	7.06
25	Thickness, AW	15	965.0267	62.9425	6.52