

COMPARISON OF GARMENTS MADE FROM RESIN FINISHED
AND PURE FINISH SINGLE JERSEY FABRIC

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M & S FRAME

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1. INTRODUCTION

Research Record No. 207 reported the results of a variability trial on resin finished fabrics which studied samples taken at Corah from their quality 3169 during July and August 1985. This was a single jersey quality made from 30 Ne combed cotton knitted at 2.80mm stitch length.

Subsequent to that exercise some of the same type of cloth was finished to the same final dimensions but without the resin finish so that, after garments had been made, a direct comparison could be made of the influence of the resin finish upon dimensional stability and other properties of the garments.

Purely from the point of view of dimensional stability, of course, this is a somewhat unrealistic comparison because it would probably be easy enough to either finish the unresinated cloth so that shrinkages were equal (in which case the weight and width would be slightly different) or to reconstruct the grey cloth so that both resinated and unresinated materials had the same weight, width, and shrinkages. However, there are other properties of interest, such as spirality and general appearance after laundering for which a direct comparison is certainly adequate and the direct comparison is, of course, the most simple and inexpensive experiment to organise commercially.

2. WORK PLAN

Knitting, processing, and garment making was carried out at Corah. The nominal fabric specification was as follows:

Quality 3169 plain single jersey
30Ne combed cotton knitted at 2.80 mm TF = 15.8
Finished to: 54 c/3cm
 42.5 w/3cm
 140 gsm

Shrinkage: 5% in each direction to 1 WTD

Garment style: Basic T-shirt, size 14
 : Length 64cm
 : Width 51.5cm

Testing and analysis were carried out at IIC. Forty garments were available - 20 with resin finish, 20 without. Testing was according to the following scheme.

1. Resin finished garments were numbered 1 to 20.
2. Pure finish garments were numbered 21 to 40.
3. One garment from each set was retained for reference (Nos. 1 and 21).

4. Five garments from each set were cut up for physical testing (Nos. 2 to 6 and 22 to 26).
5. The remaining fourteen garments in each set were divided into two sets of seven for separate washing treatments.
 - a) 5 cycles wash & tumble dry (Nos 7 to 13 and 27 to 33)
 - b) 5 cycles wash & line dry (Nos 14 to 20 and 34 to 40)

After each cycle measurements were made of shrinkage, courses and wales, weight (β gauge), seam displacement, spirality, and length on the M & S frame.

6. One sample from each of the four sets was removed and retained for reference (Nos. 7, 27, 14, and 34).
7. The remaining six garments in each set were given a further five laundering cycles. However those garments which had previously been tumble dried were this time line dried, and vice versa. After each cycle the same physical measurements were made as in stage 5.
8. One sample from each of the four sets was removed and retained for reference (Nos. 8, 28, 15, and 35).
9. The remaining 20 garments, five in each set, were cut up for physical testing (Nos. 9 to 13, 16 to 20, 29 to 33, and 36 to 40).
10. The ten garments which had been retained for reference were given a subjective evaluation by the method of paired comparisons. Each of seven observers was asked to look at every possible pair of garments and to say which was the better in terms of:
 - seam pucker
 - shape retention
 - hairiness
 - general overall appearance

With ten samples there are $(9+8+7+\dots+1)$ possible pairs which makes 45 comparisons in all. The results of the seven observers were averaged to decide the better of each pair for each of the four criteria.

11. Again using the ten reference garments, some measurements were made on the M & S frame to check the effect of increasing "body" width upon length shrinkage.
12. Finally, the relationship between spirality and seam displacement was investigated.

3. RESULTS

All of the individual test data are given in the Appendix. Figure 1 is a diagram showing where measurements were made on the garments to obtain the shrinkage results.

3.1. Dimensions

Table 1 shows the average results and standard deviations, over the five garments measured as received. From this it can be seen that the finisher has delivered both fabrics at identical dimensions, almost exactly on specification for width and weight. The cloth was not perfectly straight, with a spirality of 6.5 degrees but in fact a spirality of this order is desirable in the as-delivered fabric to minimise twisting of the garment during laundering.

The garments were fractionally longer than the specification (again a desirable feature) but the garment width was exactly correct. Standard deviations are all acceptably low so we can conclude, if this limited sample is typical, that fabric production, finishing, and garment manufacture are all under close control. The length/width ratios are given so that changes in basic garment shape can be followed after washing.

Table 2 shows the results after 5 laundering cycles. Courses, wales, and weight in the Reference State (i.e. after 5 tumble cycles) were very similar to those recorded in the corresponding fabrics of the previous case study (Research Record No. 207). Spirality is higher (10.7 compared to 9.2) but the difference is probably not significant. Shrinkages are also about the same as found in the fabrics. Thus we can say that these resin finished garments are typical of normal production.

The data in Table 2 also confirm some other trends which were to be expected:

- resin finishing improves shrinkage after tumble drying significantly in the length and slightly in the width,
- resin finishing improves spirality and seam displacement slightly.
- the resin finished garment is longer and wider after laundering and thus the shape ratio is better preserved.
- shrinkages are better after line drying than after tumbling and the margin between line and tumble length shrinkages is better for the resin finished goods.

However, there were two small surprises in the data:

- spirality and seam displacement are worse after line drying than after tumbling; this may be purely a geometrical effect due to the change in shape, but may also be partly due to possible relaxation of stresses in the yarn during hot tumbling.

- the weight of the pure finished fabrics was only marginally greater than the resin finished ones. We would have expected about 4-5% difference but only about 1% was found.

Table 3 shows the results after ten laundering cycles. The most important conclusion is one that has been reached before on other garment testing series, namely that when garments which have been laundered with tumble drying are subsequently line-dried, then a part of the shrinkage is recovered. Conversely, when garments which have only ever been line dried are subsequently tumble dried, then the shrinkage rapidly approaches that of tumble dried materials. All the other dimensional properties of the garments follow these trends also.

Figures 2, 3 and 4 illustrate the changes in shrinkages over the first five, and over all ten cycles graphically. A point to notice is that shrinkage in the length direction appears to be less progressive for the resin finished samples, i.e. a bigger proportion of the final shrinkage occurs in the first wash (although the absolute level is still less than for the pure finish garments). In this particular series of garment there was no indication that the M & S frame was giving a better or a more reliable indication of shrinkage than the standard test.

Figures 5, 6, 7, 8, and 9 show similar plots for the other dimensional parameters, namely courses, wales, weight, spirality and seam displacement respectively. The conclusions are the same as those for shrinkage though there is more variability in some of the data.

3.2. Strength

Burst strength and yarn strength were also measured on the washed samples after 10 cycles with results as follows,

where L/T = 5 cycles line dry + 5 cycles Tumble; T/L is the reverse

	PURE FINISH			RESIN FINISH			% LOSS
	L/T	T/L	MEAN	L/T	T/L	MEAN	MEAN
YARN	278	276	277	212	229	221	20.2
FABRIC	588	576	582	462	480	471	19.1

These compare reasonably well with the losses in burst strength found in the previous fabric study where a loss of 18.5% was found for the Reference State materials.

3.3. Subjective Comparisons

Tables 4, 5, 6, and 7 show the results of the paired comparisons for the four subjective criteria chosen, namely seam pucker, hairiness, shape, and

general appearance. The tables may appear somewhat confusing at first glance and so their general layout will be explained before discussing the results.

There were ten samples involved. Every sample was compared with every other sample for a simple decision, i.e. better, worse, or equal. The ten samples are identified by number at the top of each column and by laundering treatment as well as by number at the start of each row.

Reading along a given row yields the results of the test for that sample against each of the other samples. If it was better, the score was 2, if worse, then zero, if equal then 1.

Thus the result of each test is actually recorded twice. For example in Table 4, the result of the comparison between samples 14 and 27 can be found by looking along the row allocated to sample 14 and finding the result under the column allocated to 27. The result was a 2, showing that 14 was better than 27 for seam pucker. The same answer can be found by looking along the row given to sample 27 and finding a zero under the 14 column, showing that 27 was worse than 14.

By adding across rows we can arrive at a score for each sample which lies between zero (worst) and 18 (best).

Furthermore, if we divide the table into quarters, then the top right quarter represents the scores of resin finished samples as a whole against non-resin samples as a whole. The bottom left quarter represents the converse and the sum of the scores in these two blocks should be 50.

In Table 4 each of these two blocks scores 25 so there is no advantage, in terms of seam pucker, for resin finishing.

Looking at the scores for individual samples we can see that seam pucker is affected by tumble drying. Line dried samples are always better, even if they have previously been tumbled.

Table 5 indicates surface hairiness, a property which was expected to be improved by resin. In fact the results confirm this expectation but the margin is rather small at 27:23. Presumably the small margin is due to the fact that the concentration of resin used is very low compared to that used for woven fabrics where big improvements in surface hairiness are often seen. The adverse effect expected from tumble drying is present but, again, the difference is not dramatic. Presumably these results are speaking well for the basic quality of the yarn that was used - a lower quality of yarn might have thrown up larger differences between line-dried and tumble-dried samples, and between resin/pure finish.

Table 6 shows the subjective evaluation of garment shape. In this case the resin finished fabrics obviously produce a superior product to the pure finish cloth since the score is 41:9.

Tumble drying produced a noticeable distortion which was already predicted by the L/W Ratios given in Tables 2 and 3. Notice that spirality and seam displacement have obviously not been large factors for the observers in arriving at these decisions, since these properties are actually better for tumble dried garments.

Table 7 shows the scores for best overall appearance and, once again the resin finished garments score heavily, 41:9, and the tumble dried garments are markedly inferior to those which have been line dried.

3.4. Body Width and Garment Fit

T-shirts are close fitting garments and, for a given size, they have to fit a range of body sizes. For example the nominal (and the actual) width of these garments is 51.5 cm which corresponds to a body size of 103 cm or 40½ inches. In the reference state (after 5 wash and tumble cycles) the average width was about 101 cm for the resin finished and 99 cm for the pure finished garments. If the garments were to be worn by a person with a body size greater than the reference width, then the garment would be stretched in the width. This would have two consequences.

Firstly, the width extension causes contraction in the length, i.e. additional shrinkage which must be added on to the laundering shrinkage to assess the true performance of the garment.

Secondly, there is a certain level of extension at which the garment becomes uncomfortable due to excessive pressure on the body. The comfort level of pressure has been established by TEFO, our STARFISH collaborators in Sweden. and we are currently attempting to define the corresponding levels of extension for single jersey fabrics. It is not yet possible to say exactly what this level is for these garments, but we believe that it is probably between 15 and 20% over reference width.

The ten garments which remained were measured on the M & S frame with the width set at the reference width. The frame width was then increased in intervals of 5% up to 20% for the resin-finished materials or 25% for the pure finish. At each frame width the length was recorded and converted to a shrinkage based on the unstretched length. Results are given in Table 8

The trends are similar for all samples; as the frame width (body width) increases, the garment becomes shorter. At the comfort level of extension we can expect a shortening of 2% to 4 percent in addition to any laundering shrinkage. There is not much difference between resin-finished and pure finish garments. A simplified graph is shown in Figure 10 which represents the averages of resin and pure finish samples, broken down into only two classes; as received and laundered. From this chart, the danger of incorrect sizing is obvious. For example, if we want to limit the length-shortening effect to say 2%, then the body width must not be more than 15% over reference width. For these garments that means 103cm (40½ inches) for the resin finished or 101 cm (39½ inches) for the pure finish. Thus, according

to this criterion, these garments have been delivered at maximum acceptable body width. In fact, the designated nominal body size was 91cm (36 inches) so the fit should be comfortable in any case. The resin finished garments will be comfortable on a slightly wider range of body sizes than the pure finish.

3.5. Spirality and Seam Displacement

IIC's standard evaluation of fabric twisting is the angle of spirality which is defined as the angle between the wales and a line drawn perpendicular to the courses. Seam displacement is often advocated as a better measure of twisting because it is quick and simple and it gives a direct indication of the size of the problem, independent from the length of the garment.

This latter point is important because, for a given angle of spirality, the amount of seam displacement depends on the length of the garment. For a short garment, a relatively higher spirality can be accepted than for a long one.

Figure 11 shows the relationship between seam displacement and angle of spirality. In a real garment the situation is more complicated because:-

- a) The line of courses is not quite horizontal - the extent of this discrepancy depends on the number of feeders and the diameter of the knitting machine as well as any distortions introduced deliberately or accidentally by the finisher.
- b) The spiral angle is not necessarily constant from top to bottom of the garment after laundering. At the bottom of the garment twisting is relatively easy but at the top it is prevented to some extent by the garment construction.

Neglecting the effect of the inclination of the courses, the theoretical relationship is as follows:-

$$SD = L (\tan A - \tan B)$$

where: SD = seam displacement
L = effective length of garment
B = spiral angle as delivered, before washing
A = spiral angle after washing

L, the effective length is almost certainly less than the total garment length. It probably corresponds roughly to the length from the hem to the armhole.

It was decided to check out this relationship for the present set of garments because some future version of the STARFISH model could include predictions of spirality in single jersey fabrics and seam displacement in garments.

The average results for spirality, seam displacement and total length are repeated in Table 9 where also are shown the hem-to-arm lengths of the five remaining reference garments. Also shown are the estimated values for seam displacement which result when the above equation is applied to both the total garment length and the hem/arm length. These results are also shown plotted in Figure 12. It is obvious from these that the total garment length is not the appropriate base for calculating seam displacement since the estimates are always too high. The hem/arm length, on the other hand gives a very good estimate, especially when it is remembered that the H/A measurements were taken from single garments whereas the total length, and the seam displacement were averages over at least five garments. Notwithstanding the poor absolute predictions from total length, the correlation with measured values is very good, so it may be possible to develop prediction equations based on this parameter also, by the application of appropriate correction coefficients. However there is no point in pursuing this analysis any further on such a limited data set.

4. CONCLUSIONS

1. The fabrics and garments had apparently been produced to high standards of quality control, and the resin finished materials were typical of normal bulk production.
2. Dimensional stability was significantly better for the garments made from resin finished cloth. This was to be expected since both pure finish and resin finish fabrics had been delivered at identical dimensions.
3. The resin finished garments had marginally better spirality and seam displacement values after laundering and the shape (length/width ratio) was better preserved due to the improved length shrinkage. This last factor seemed to weigh fairly heavily with the subjective observers.
4. The margin between line dried and tumble dried shrinkage is smaller for resin finished materials. This aspect is important for garment fit where a range of body sizes and a range of laundering habits has to be contended with.
5. When garments which had been tumble dried were subsequently line dried, a part of the shrinkage was recovered. This confirms observations on previous garment trials.
6. There was no indication that the M & S frame was giving more realistic or more reliable shrinkage figures than the standard test.
7. Losses in burst strength for the resin finished fabric were about 20% - similar to what had been found in the earlier fabric study.
8. Subjective evaluation by a panel of seven independent observers found no advantage for resin finishing in seam puckering, a slight advantage

in surface hairiness, a strong advantage in shape retention and a strong advantage in general overall appearance.

9. Measurements of change in length on the M & S frame at increasing width showed that additional "shrinkage" would be a problem if the garments were worn by persons having a body width in excess of about 101 cm (39½ inches) for pure finish garments or 103 cm (40½ inches) for the resin finish. Since the nominal body size was supposed to be 91 cm (36 inches) this would presumably not be a problem for these garments.
10. Seam displacement is directly related to spirality and garment length but the appropriate length to use in predicting seam displacement is the hem-to-arm length, not the total garment length. More work will be needed to develop a reliable prediction equation for future use in the STARFISH model.

TABLE 1

CORAH GARMENT TRIAL 1986

Garments Measured As Received

		PURE FINISH		RESIN FINISH	
		Mean	s.d.	Mean	s.d.
Yarn Count	Ne	30.6	0.2	30.1	0.2
St.Length	mm	2.76	0.003	2.76	0.002
Courses	3cm	53.3	0.3	53.4	0.4
Wales	3cm	42.8	0.2	42.8	0.3
Weight	gsm	134	2	136	1
Spirality	deg	6.5	0.6	6.7	0.2
Length	cm	65.5	0.2	65.7	0.2
Width	cm	51.5	0.1	51.8	0.1
L/W Ratio		1.27	n.a.	1.27	n.a.

TABLE 2

CORAH GARMENT TRIAL 1986

Garments Measured After 5 Cycles

		PURE	FINISH	RESIN	FINISH
		Line	Tumble	Line	Tumble
Courses	3cm	56.7	59.7	55.6	57.7
Wales	3cm	45.6	46	45.3	45.6
Weight	gsm	147	149	144	147
SHR : Len	%	4.4	10.2	3.2	7.5
: Wid	%	3.3	5.4	1.8	4.2
: M&S	%	6	10.4	4	7.6
Spirality	deg	12.6	11.3	11.9	10.7
Seam Disp	cm	4.3	3.3	3.6	2.8
Length	cm	62.9	58.8	64.6	61.8
Width	cm	50.2	49.9	50.3	50.6
L/W Ratio		1.25	1.18	1.28	1.22

* M&S frame set at nominal garment width

TABLE 3

CORAH GARMENT TRIAL 1986

Garments Measured After 10 Cycles

		PURE FINISH		RESINFINISH	
		L/T	T/L	L/T	T/L
Courses	3cm	59.6	57.3	57.7	55.8
Wales	3cm	45.7	45.4	45	45.2
Weight	gsm	152	151	150	145
SHR : Len	%	9.4	6.2	7.7	4.4
: Wid	%	4.7	2.3	3	2
: M&S	%	10.7	8	7.9	5.1
Spirality	deg	12.5	13.5	11.5	13.3
Seam Disp	cm	3.7	4.4	2.6	3.9
Length	cm	59.3	62	61.1	63.2
Width	cm	49.6	50.5	50.5	50.7
L/W Ratio		1.2	1.23	1.21	1.25

- * M&S Frame set at nominal garment width
- * L/T = 5 cycles Line dry then 5 cycles Tumble
- * T/L = 5 cycles Tumble dry then 5 cycles Line

TABLE 4

CORAH GARMENT TRIAL 1986

PAIRED COMPARISONS : Least Seam Pucker

Sample No	1	7	8	14	15	21	27	28	34	35	Total	
RESIN												
As Rec'd	1	n.a.	2	2	2	2	1	2	1	1	2	15
ST	7	0	n.a.	0	0	0	0	1	0	0	1	2
ST/SL	8	0	2	n.a.	1	1	0	1	1	2	2	10
SL	14	0	2	1	n.a.	1	0	2	1	2	2	11
SL/ST	15	0	2	1	1	n.a.	0	2	0	0	1	7
NO RESIN												
As Rec'd	21	1	2	2	2	2	n.a.	2	1	1	2	15
ST	27	0	1	1	0	0	0	n.a.	0	0	0	2
ST/SL	26	1	2	1	1	2	1	2	n.a.	1	2	13
SL	34	1	2	0	0	2	1	2	1	n.a.	2	11
SL/ST	35	0	1	0	0	1	0	2	0	0	n.a.	4

- * Read across Rows and compare with columns
 2 = Better 0 = Worse 1 = Equal
 e.g. Sample 1 better than 7, Sample 8 worse than 1
- * Resin vs No Resin = 25 : 25 ie no difference overall

TABLE 5

CORAH GARMENT TRIAL 1986

PAIRED COMPARISONS : Least Hairiness

Sample No	RESIN							NO RESIN					Total
	1	7	8	14	15	21	27	28	34	35			
RESIN													
As Rec'd	1	n.a.	2	2	2	2	2	2	1	1	2	16	
ST	7	0	n.a.	1	1	1	1	1	1	1	1	7	
ST/5L	8	0	1	n.a.	0	1	1	1	1	1	2	7	
5L	14	0	1	2	n.a.	2	0	1	1	2	1	11	
5L/ST	15	0	1	1	0	n.a.	0	1	1	1	1	6	
NO RESIN													
As Rec'd	21	0	2	2	1	2	n.a.	2	2	2	2	15	
ST	27	0	1	1	1	1	0	n.a.	1	1	1	7	
ST/5L	28	1	1	1	1	1	0	1	n.a.	1	1	8	
5L	34	1	1	1	0	1	0	1	1	n.a.	2	8	
5L/ST	35	0	1	0	1	1	0	1	1	0	n.a.	5	

* Read across Rows and compare with columns
 2 = Better 0 = Worse 1 = Equal
 e.g. Sample 1 better than 7, Sample 8 worse than 1

* Resin vs No Resin = 27 : 23 ie Resin slightly better ?

TABLE 6

CORAH GARMENT TRIAL 1986

PAIRED COMPARISONS : Best Shape

Sample No	RESIN					NO RESIN					Total	
	1	7	8	14	15	21	27	28	34	35		
RESIN												
As Rec'd	1	n.a.	2	2	2	2	1	2	2	2	2	18
ST	7	0	n.a.	0	0	1	0	2	2	2	2	9
ST/SL	8	0	2	n.a.	2	2	0	2	2	2	2	14
SL	14	0	2	0	n.a.	2	0	2	2	2	2	12
SL/ST	15	0	1	0	0	n.a.	0	2	2	2	2	9
NO RESIN												
As Rec'd	21	1	2	2	2	2	n.a.	2	2	2	2	17
ST	27	0	0	0	0	0	0	n.a.	0	0	1	1
ST/SL	28	0	0	0	0	0	0	2	n.a.	0	2	4
SL	34	0	0	0	0	0	0	2	2	n.a.	2	6
SL/ST	35	0	0	0	0	0	0	1	0	0	n.a.	1

* Read across Rows and compare with columns
 2 = Better 0 = Worse 1 = Equal
 e.g. Sample 1 better than 7, Sample 8 worse than 1

* Resin vs No Resin = 41 : 9 ie Resin is much better

TABLE 7

CORAH GARMENT TRIAL 1986

PAIRED COMPARISONS : Best Overall Appearance

Sample No	RESIN					NO RESIN					Total	
	1	7	8	14	15	21	27	28	34	35		
RESIN												
As Rec'd	1	n.a.	2	2	2	2	2	2	2	2	2	18
ST	7	0	n.a.	0	1	1	0	2	2	1	2	9
ST/SL	8	0	2	n.a.	2	2	0	2	2	2	2	14
SL	14	0	1	0	n.a.	2	0	2	2	2	2	11
SL/ST	15	0	1	0	0	n.a.	0	2	2	2	2	9
NO RESIN												
As Rec'd	21	0	2	2	2	2	n.a.	2	2	2	2	16
ST	27	0	0	0	0	0	0	n.a.	0	0	0	0
ST/SL	28	0	0	0	0	0	0	2	n.a.	0	2	4
SL	34	0	1	0	0	0	0	2	2	n.a.	2	7
SL/ST	35	0	0	0	0	0	0	2	0	0	n.a.	2

* Read across Rows and compare with columns
 2 = Better 0 = Worse 1 = Equal
 e.g. Sample 1 better than 7, Sample 8 worse than 1

* Resin vs No Resin = 41 : 9 ie Resin much better

CORAH GARMENT TRIAL 1986

Measurements on the M&S Frame at different Widths

% Difference in Garment Length

Sample Width	As Rec'vd	SL	ST	SL/ST	ST/SL	Washed mean
RESIN						
Ref + 5%	1.2	0.2	-0.5	0.3	-0.3	-0.1
Ref + 10%	0.6	-0.3	0.1	-1.4	-1.6	-1.2
Ref + 15%	-1.7	-1.8	0.2	-2.7	-3.2	-2.1
Ref + 20%	-2.7	-3.4	0.4	-3.8	-4.1	-3.8
NO RESIN						
Ref + 5%	0.2	0.3	-0.3	0.4	0.4	0.2
Ref + 10%	0.2	-0.5	-0.3	0.6	-1.6	-0.8
Ref + 15%	-2.1	-2.7	-2.4	-2.1	-2.6	-2.4
Ref + 20%	-4	-3.8	-3.4	-3	-4.1	-3.6
Ref + 25%	-5.9	-6.2	-5.6	-5.3	-5.6	-5.7

Av Resin	0.7	100.7	Av R	0.05	100.5
+NO Resin	0.4	100.4	+NO R	-1	99
As R	-1.9	98.1	Washed	-2.25	97.75
	-3.4	96.6		-3.7	96.3
	-5.9	94.1 (94.2)		-5.7	94.3 (94.2)

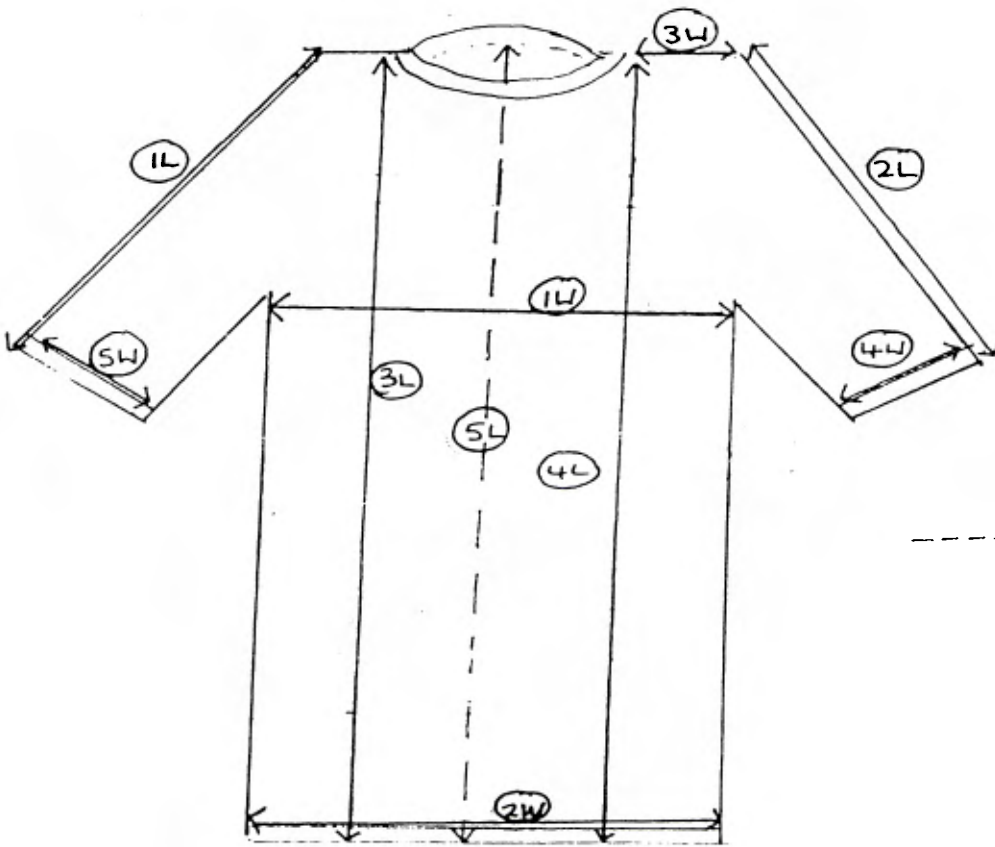
CORAH GARMENT TRIAL 1986

Spirality Angle and Seam Displacement

Sample state	Spiral angle	SD meas	Length Tot	Length H/A	SD Est Tot	SD Est H/A
RESIN						
As Rec'vd	6.7 ^{y2}	0 ^{y1}	65.7	40.4 ^{x3}	0	0
SL	11.9	3.6	64.6	39.8	6	3.7
ST	10.7	2.8	61.8	38.8	4.4	2.8
SL/ST	11.5	2.6	61.1	39	5.2	3.4
ST/SL	13.3	3.9	63.2	39.4	7.5	4.7
NO RESIN						
As Rec'vd	6.5 ^{x2}	0	65.5	41	0	0
SL	12.6	4.3	62.9	39.4	6.9	4.3
ST	11.3	3.3	59.0	36.9	5	3.2
SL/ST	12.5	3.7	59.3	38.7	6.4	4.2
ST/SL	13.5	4.4	62	38.2	7.8	4.8
				38.775		

- * Tot = Total garment length
H/A = Length from hem to arm
SD = Seam Displacement
meas = Measured
Est = Estimation of SD from length and spirality

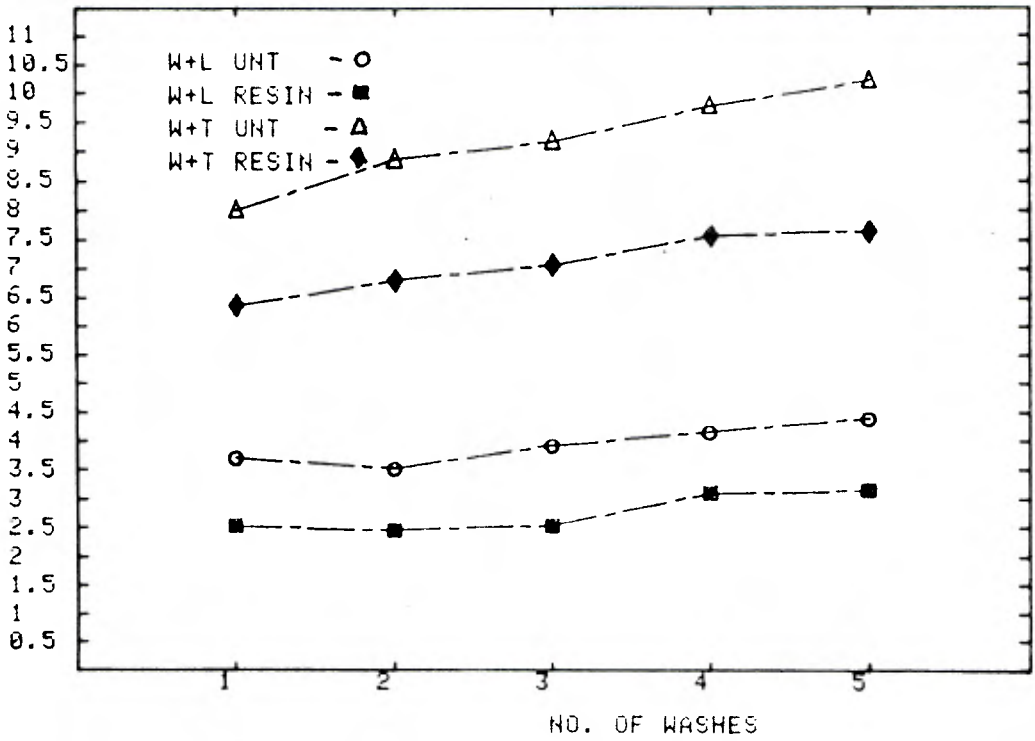
FIGURE 1



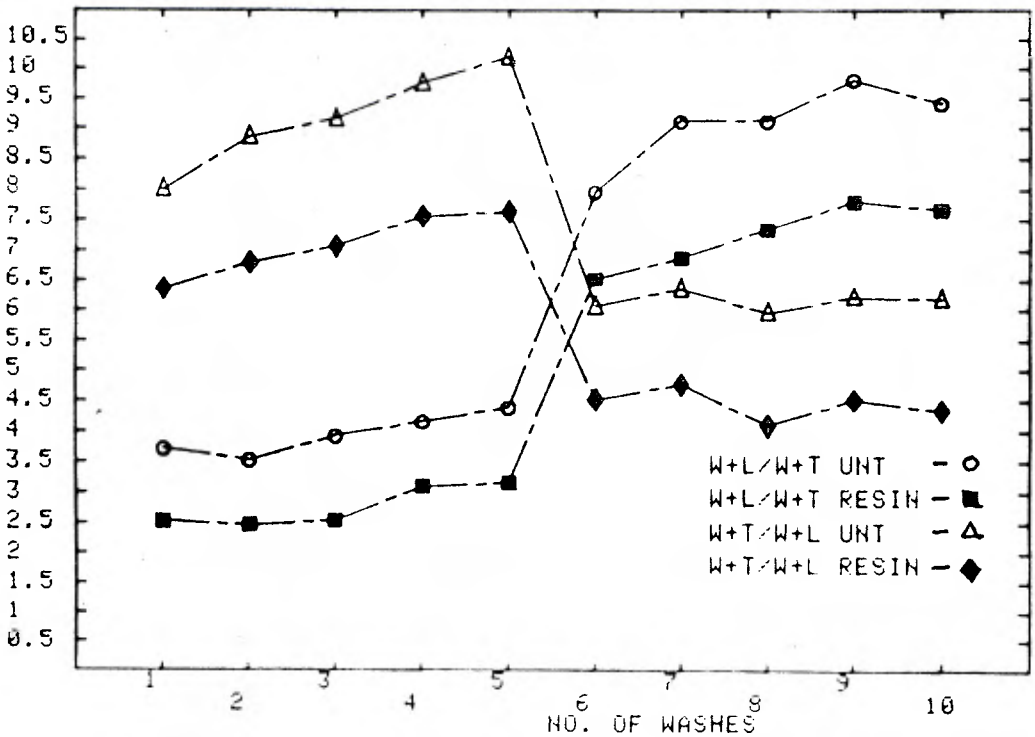
----- back measurements

MEAN LENGTH SHRINKAGE

FIGURE 2



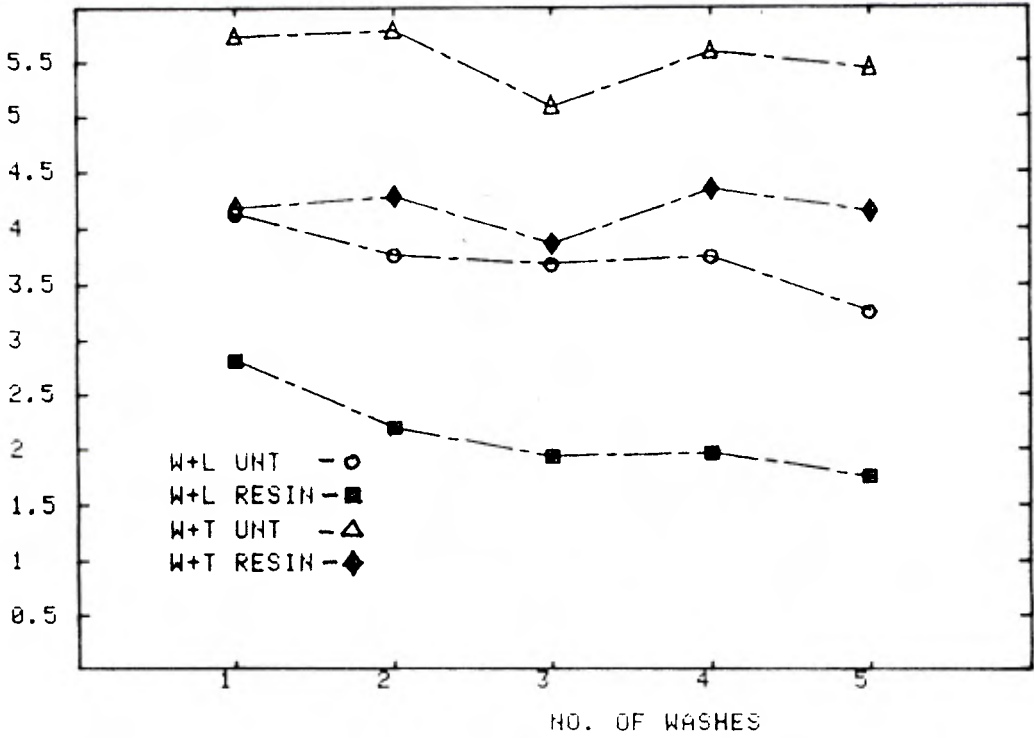
MEAN LENGTH SHRINKAGE



MEAN WIDTH SHRINKAGE

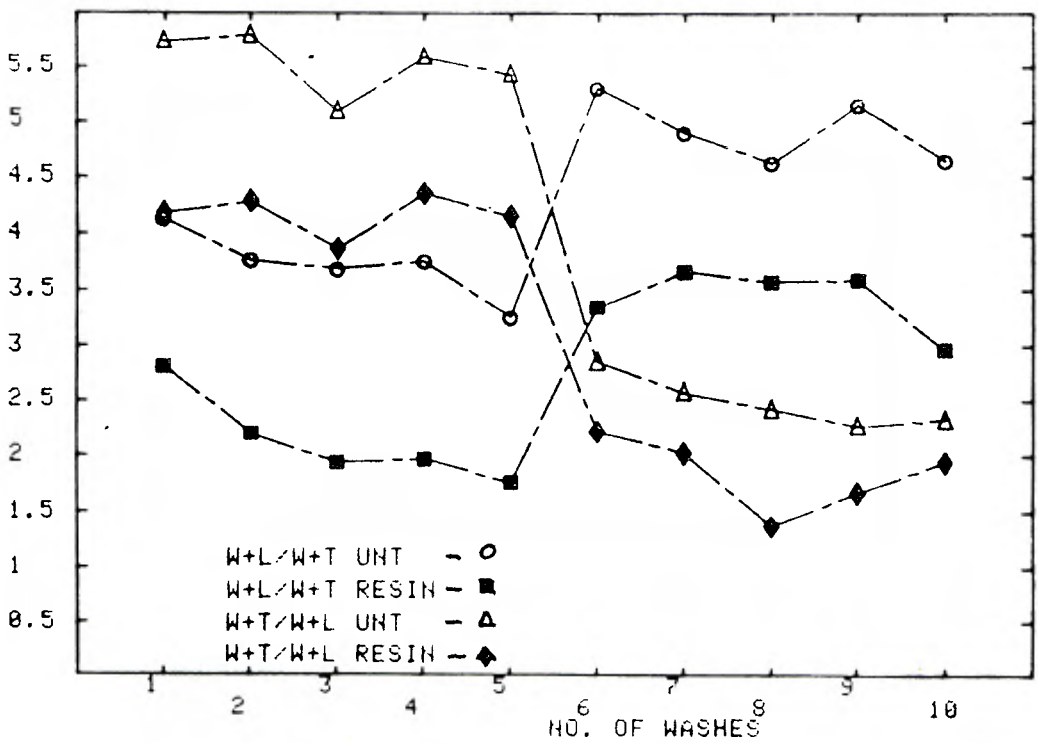
FIGURE 3

%



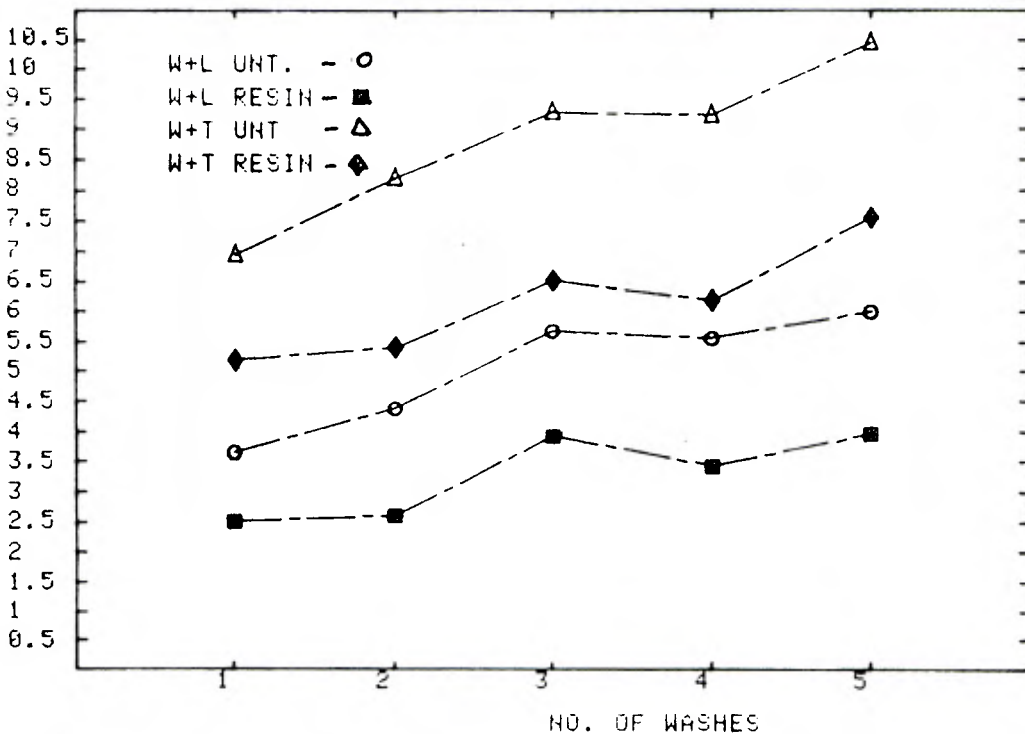
MEAN WIDTH SHRINKAGE

%

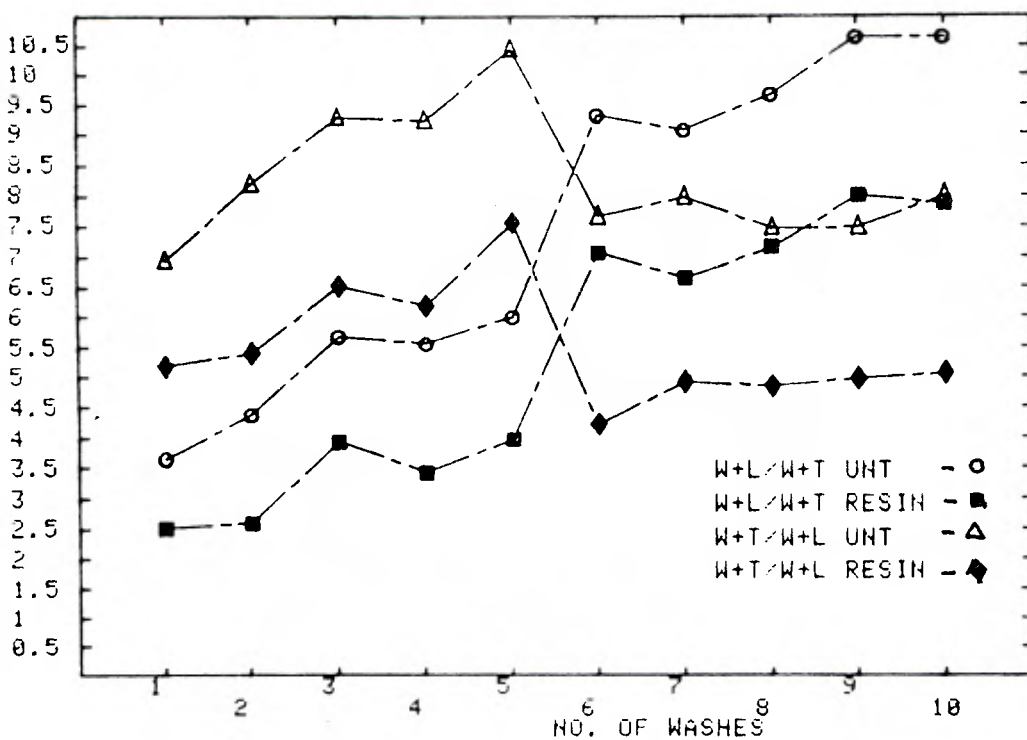


M&S MEASURING FRAME - MEAN % SHRINKAGE DATA

FIGURE 4



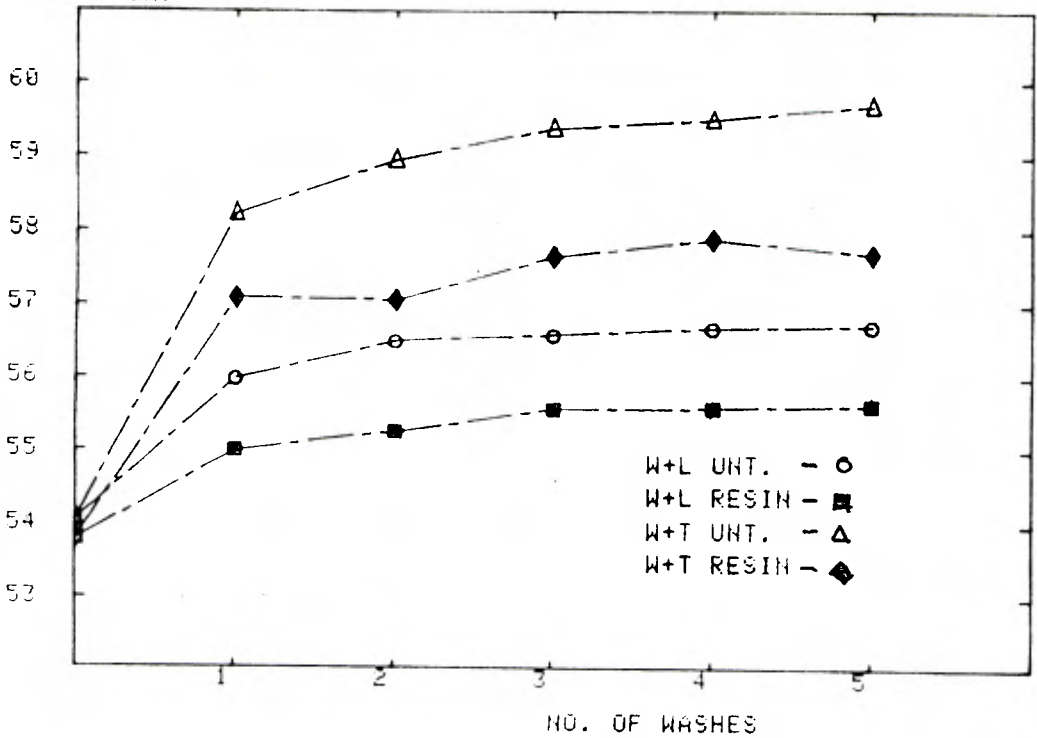
M&S MEASURING FRAME - MEAN % SHRINKAGE DATA



CORAH GARMENT TRIAL - COURSES/3CM.

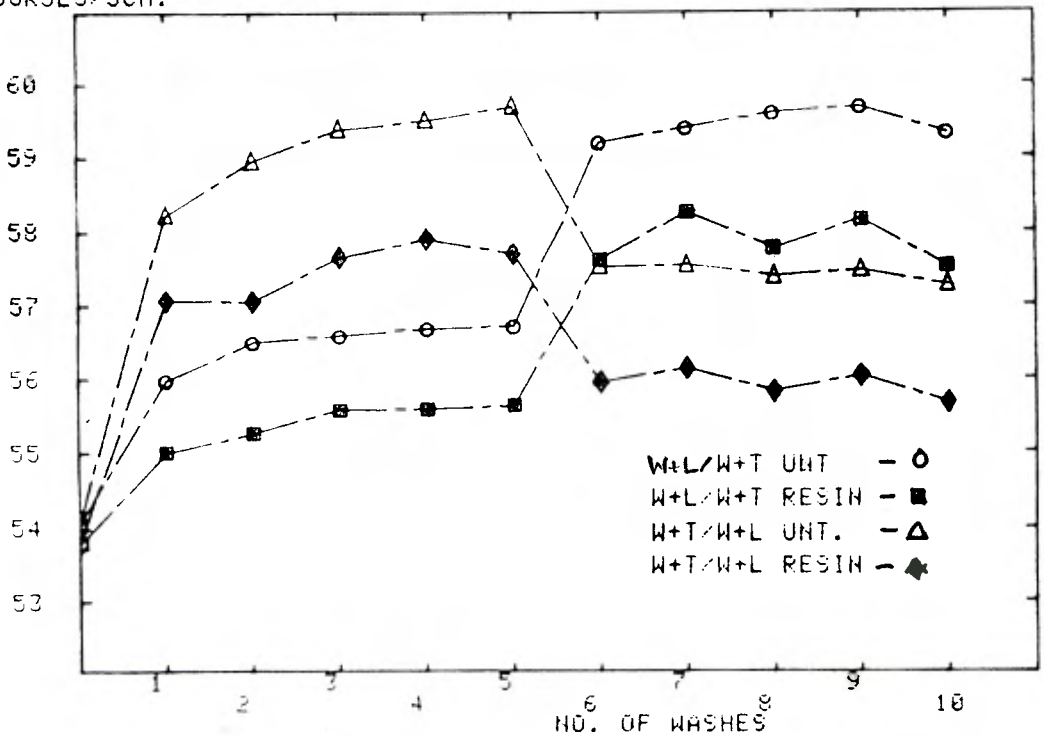
FIGURE 5

COURSES/3CM.



CORAH GARMENT TRIAL - COURSES/3CM.

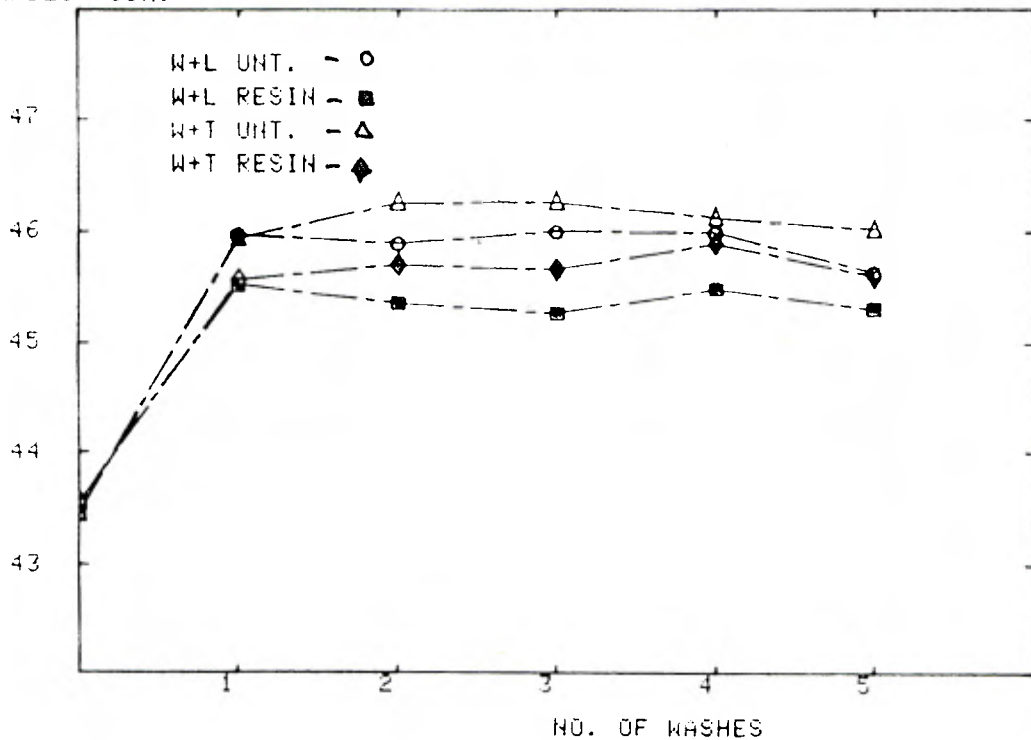
COURSES/3CM.



CORAH GARMENT TRIAL - WALES > 3CM.

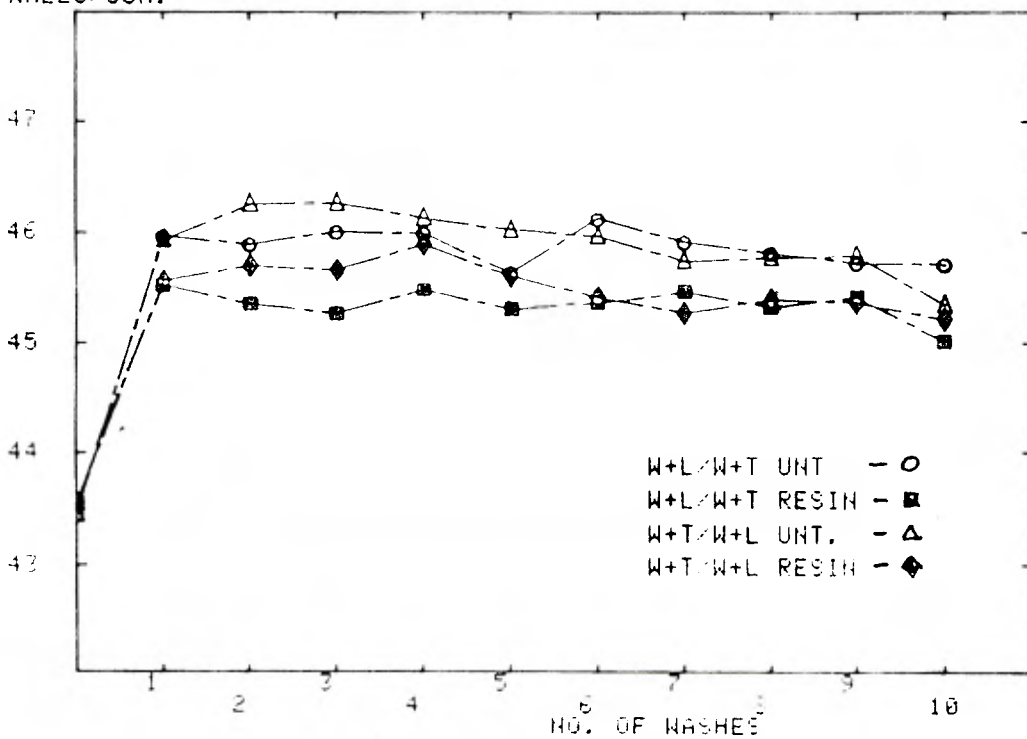
FIGURE 6

WALES > 3CM.



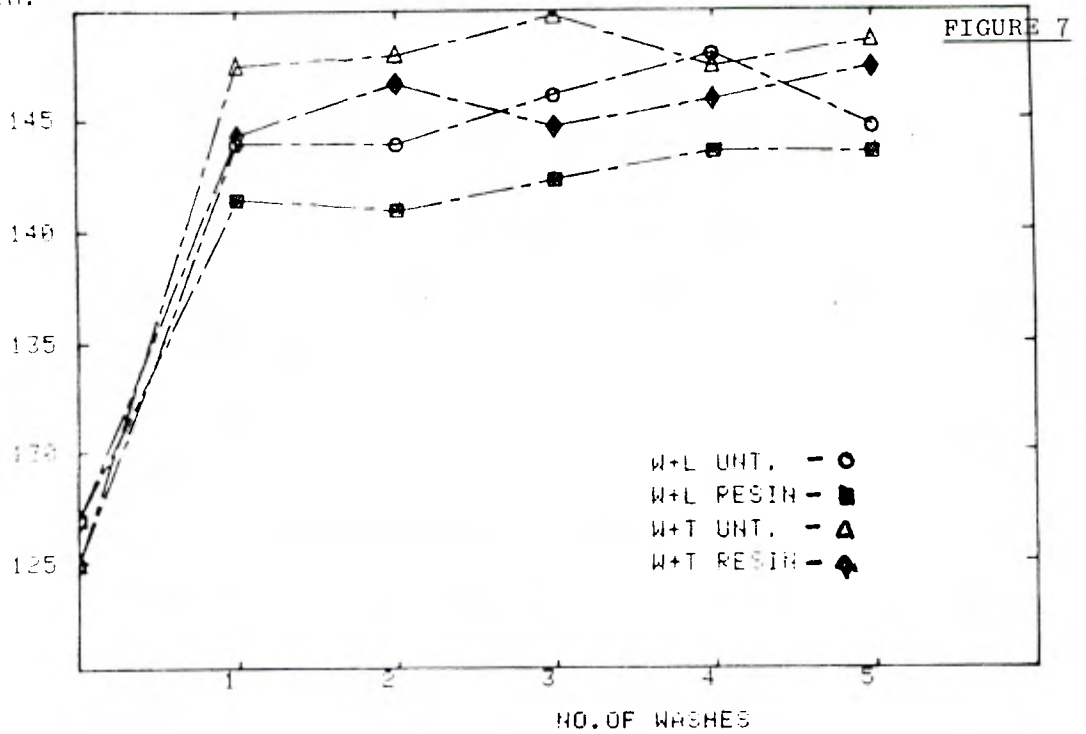
CORAH GARMENT TRIAL - WALES > 3CM.

WALES > 3CM.



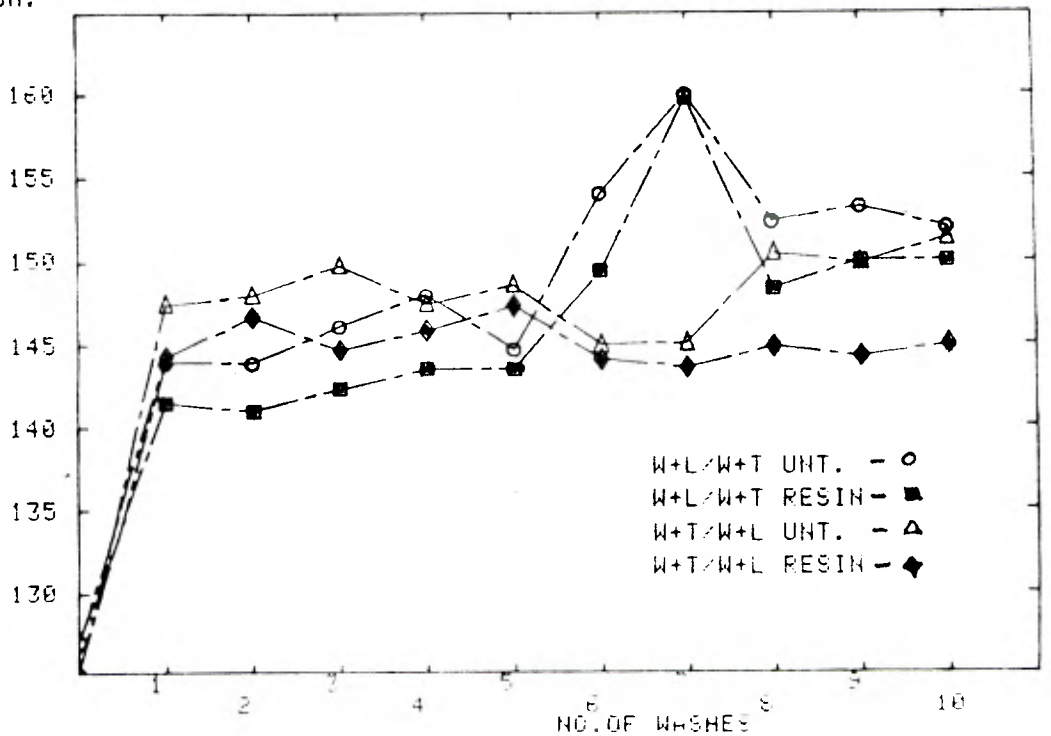
CORAH GARMENT TRIAL - WEIGHT

GSM.



CORAH GARMENT TRIAL - WEIGHT

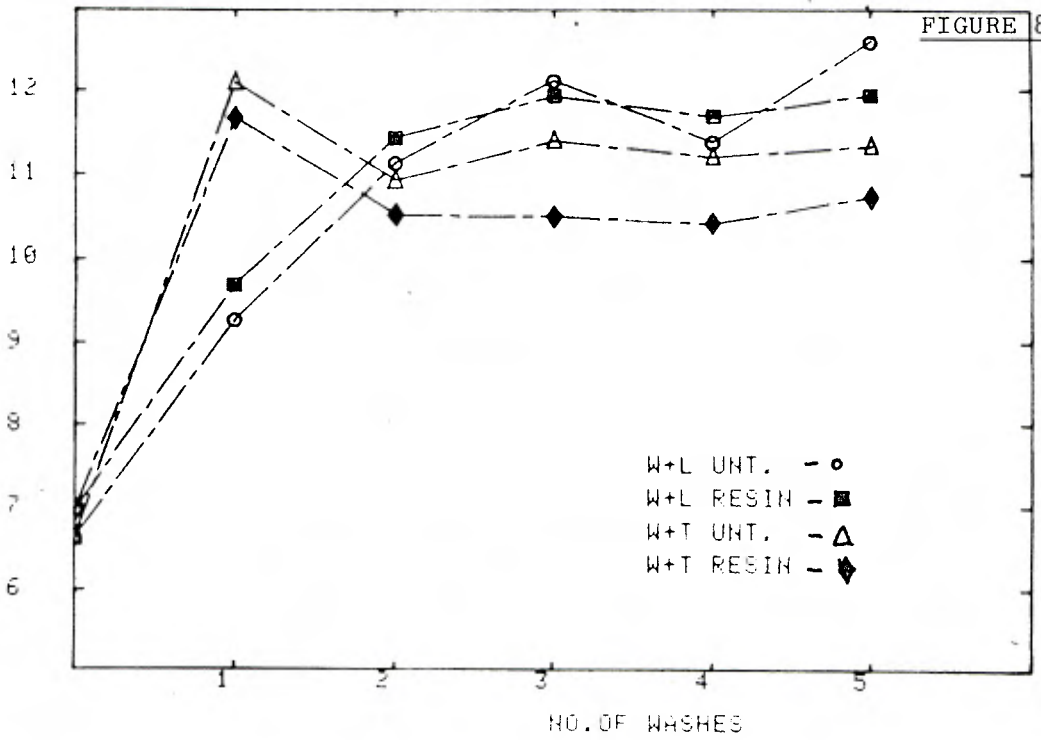
GSM.



CORAH GARMENT TRIAL - ANGLE OF SPIRALITY

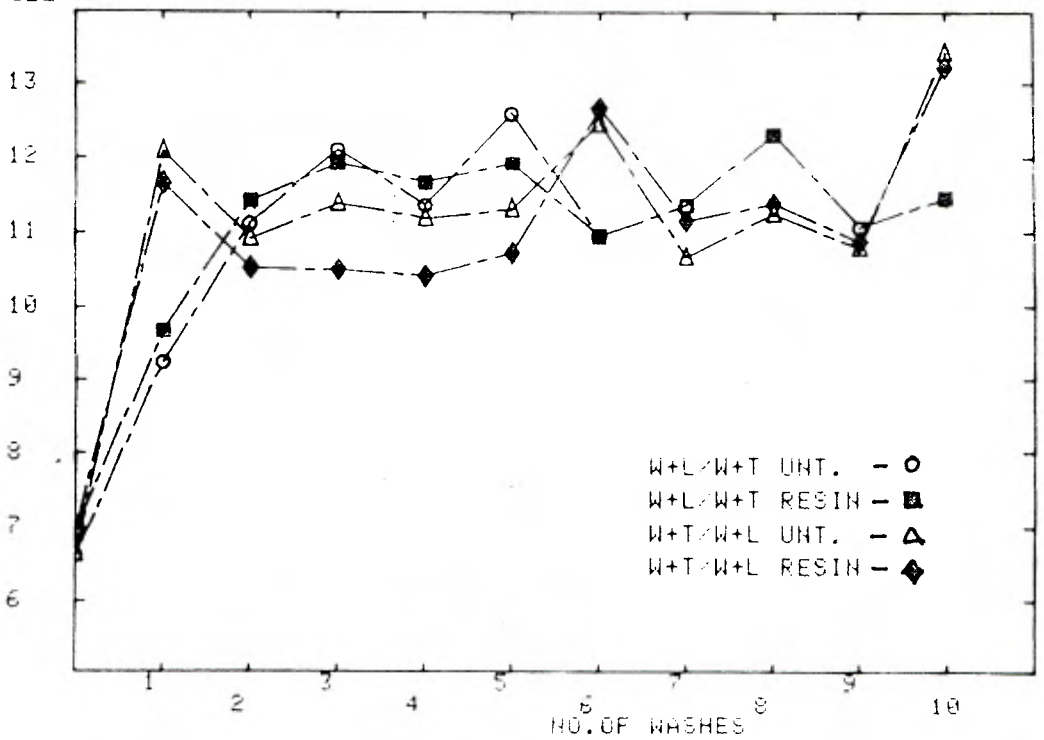
ANGLE

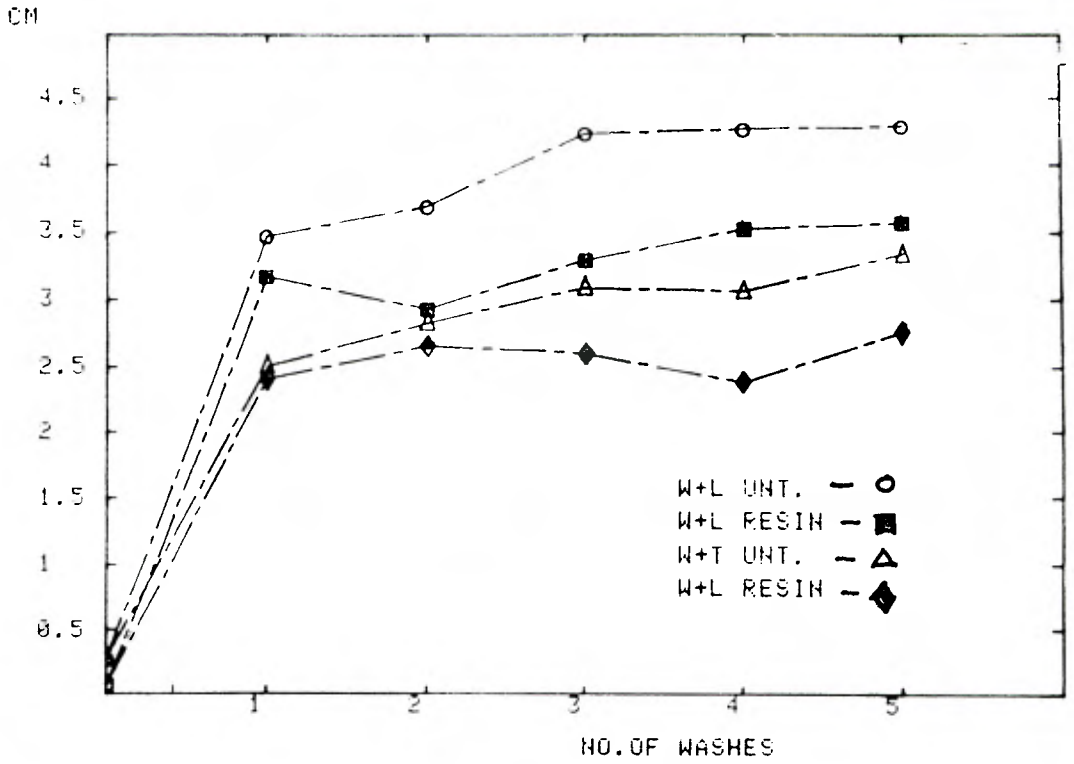
FIGURE 8



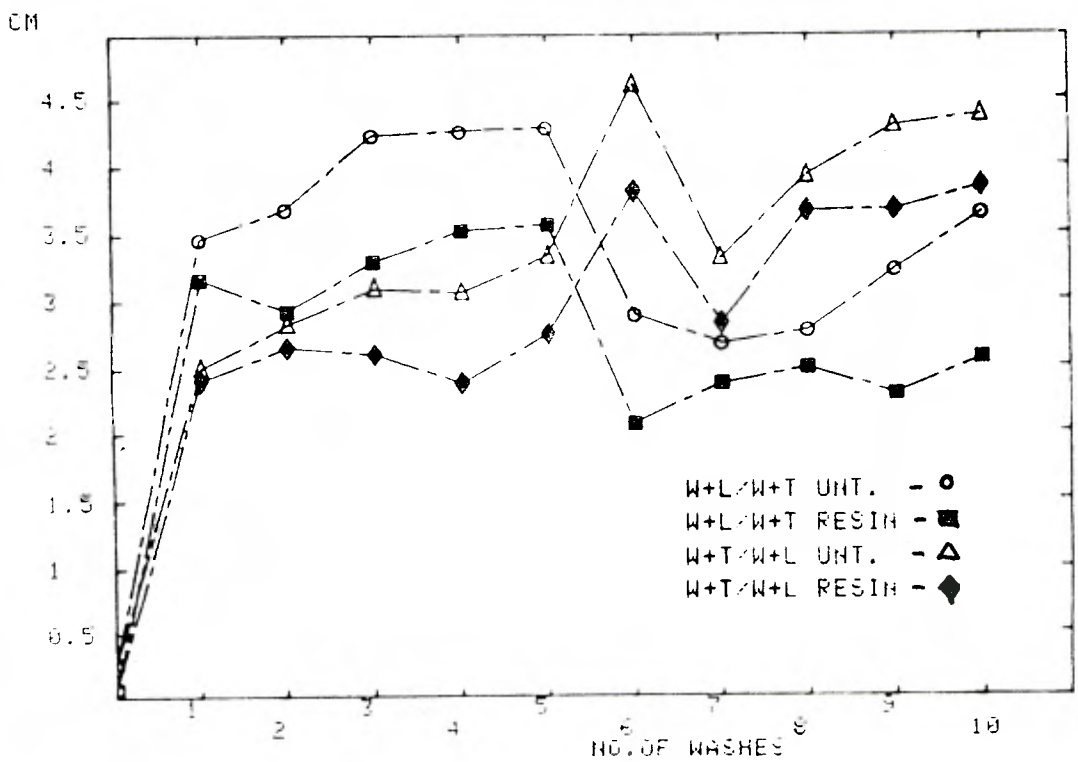
CORAH GARMENT TRIAL - ANGLE OF SPIRALITY

ANGLE





CORAH GARMENT TRIAL - SEAM DISPLACEMENT



GARMENT LENGTH AS A FUNCTION OF M&S FRAME WIDTH

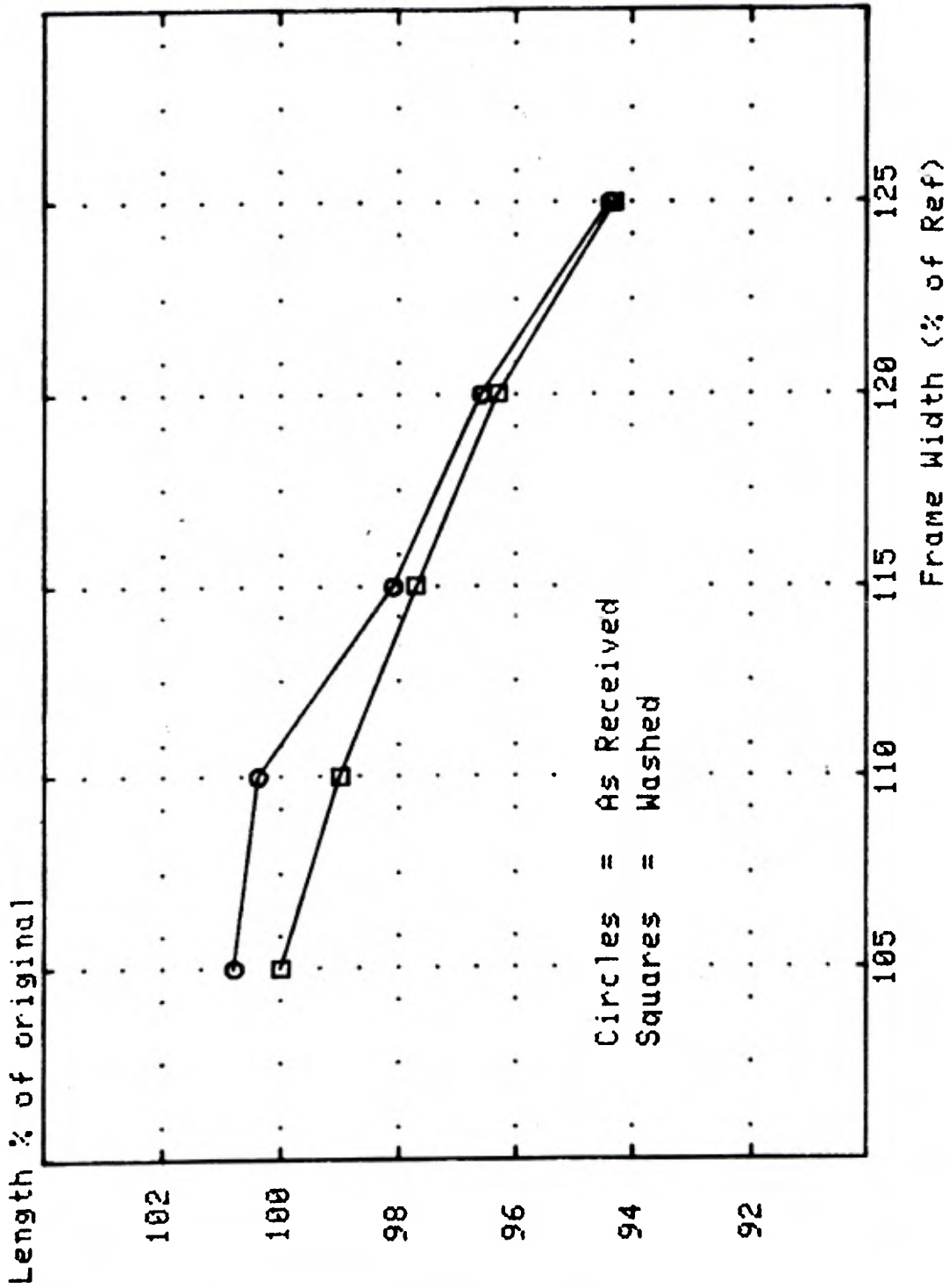
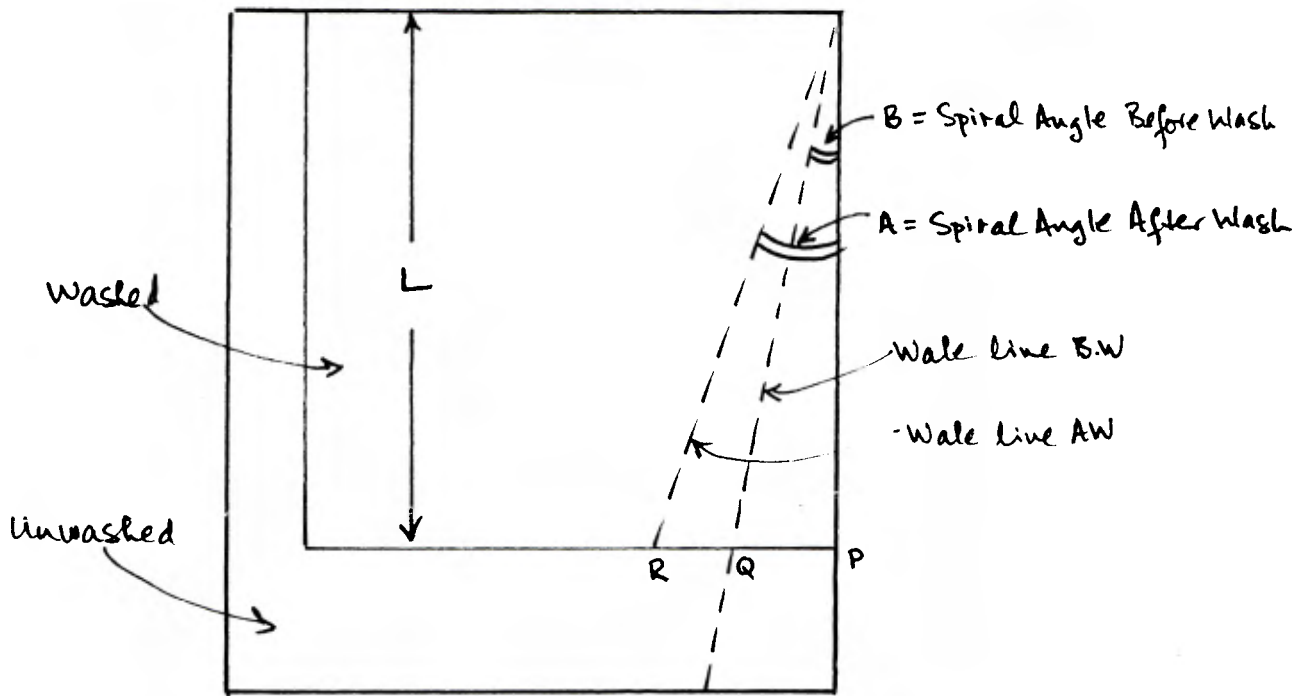


FIGURE 11

DEPENDENCE OF SEAM DISPLACEMENT ON GARMENT LENGTH AND SPIRALITY



$$\text{Seam Displacement} = QR = (PR - QP)$$

$$PR = L \cdot \tan A$$

$$QP = L \cdot \tan B$$

$$\therefore SD = L \cdot (\tan A - \tan B)$$

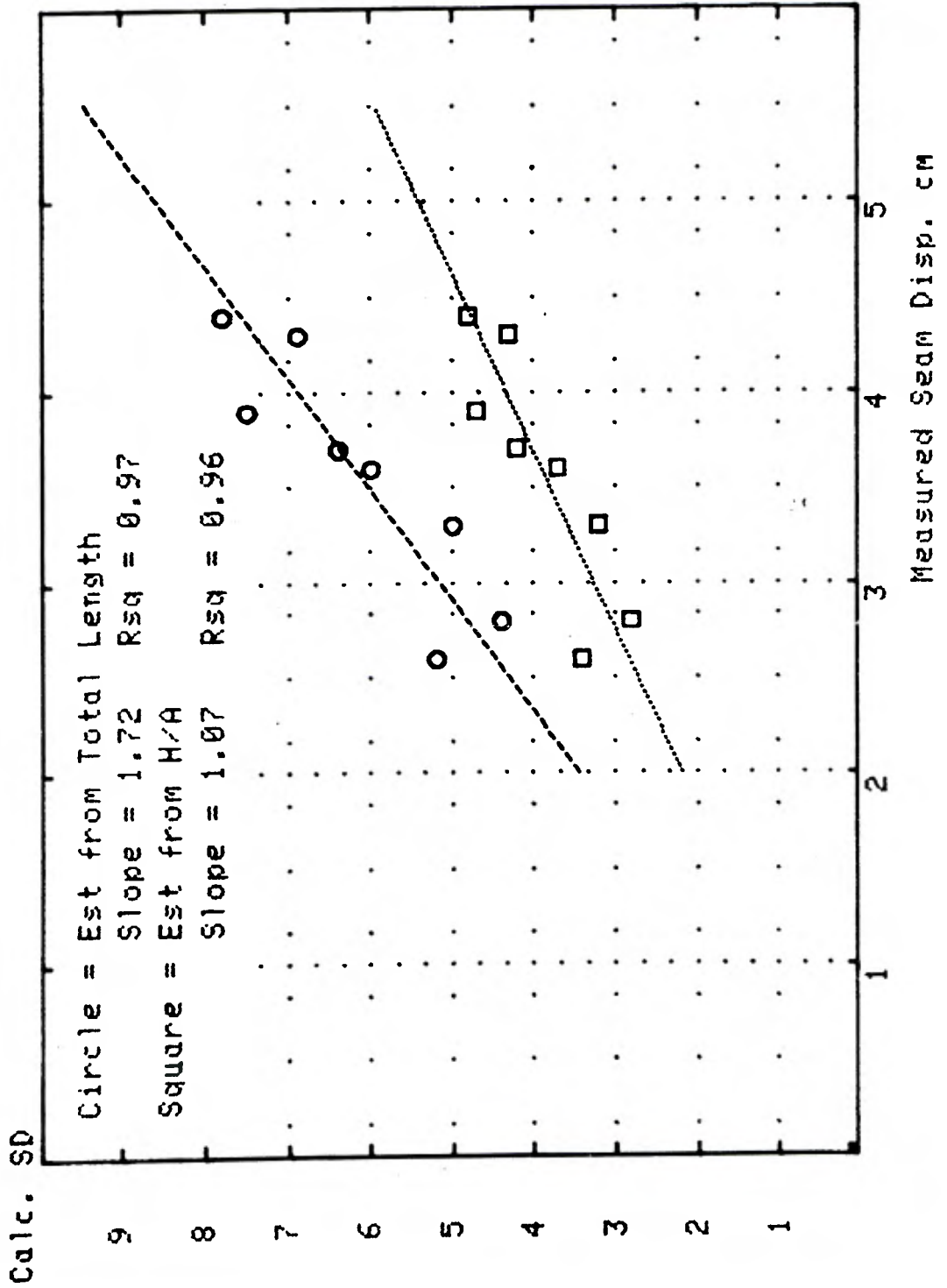
[approx.]

$$SD = 0.0176 \cdot L \cdot \tan A \cdot (A - B)$$

↓
A

0.0176

SEAM DISPLACEMENT CALCULATED FROM SPIRALITY AND LENGTH



Appendix

CORAH GARMENT TRIAL AS RECEIVED - \bar{X}

Sample no.	resin finished					untreated				
	2	3	4	5	6	22	23	24	25	26
Weight (gsm)BW	136.81	135.09	135.39	135.05	136.60	135.21	134.92	131.80	135.53	133.52
Courses per 3cm BW	53.10	53.50	53.00	53.60	53.90	53.20	53.40	53.50	53.60	52.90
Wales per 3cm BW	42.90	42.90	43.10	42.40	42.60	43.00	43.00	42.50	42.90	42.70
Stitch length (mm) BW	2.76	2.77	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Angle of spirality. BW	6.83	6.49	6.74	6.60	7.05	6.27	5.54	6.65	6.90	7.19
Width. BW	51.90	51.70	51.70	51.70	51.90	51.50	51.40	51.40	51.70	51.40
Yarn count (tex). BW	19.66	19.43	19.64	19.68	19.66	19.40	19.26	19.25	19.38	19.16
Thickness. BW	589.70	583.90	580.30	585.20	580.10	580.80	580.70	578.70	578.10	581.30
Colour - R value	33.30	32.75	32.81	32.43	33.22	32.63	33.31	32.79	33.10	32.80
Colour - G value	14.05	13.83	13.83	13.56	13.95	13.58	13.94	13.72	13.79	13.74
Colour - B value	12.45	12.26	12.26	12.03	12.37	11.91	12.40	12.08	12.17	12.14

CORAH GARMENT TRIAL - AFTER LAUNDERING - \bar{X}

Sample no.	Resin finished									
	Tumble + Line					Line + Tumble				
	9	10	11	12	13	16	17	18	19	20
Weight (gsm)AW	147.96	147.85	146.87	148.10	146.19	150.84	153.15	151.29	151.68	151.74
Stitch length (mm) AW	2.75	2.74	2.74	2.75	2.75	2.74	2.74	2.74	2.74	2.73
Burst strength. AW	474.60	494.70	453.60	435.70	451.60	447.30	507.30	459.60	501.80	483.40
Distension at burst. AW	16.52	16.99	17.76	16.43	16.82	17.21	17.98	17.19	18.29	18.44
Yarn strength. AW	227.83	215.44	208.55	209.76	198.72	213.91	231.76	230.03	229.64	240.29
Yarn extension at break. AW	6.32	5.70	5.65	5.44	5.21	5.72	5.69	6.09	6.17	6.39
Yarn count (tex). AW	19.57	19.85	19.67	19.76	19.54	19.58	19.62	19.25	19.56	19.49
Thickness. AW	713.50	684.90	688.90	703.10	672.70	746.50	771.50	762.80	757.60	770.30
Colour - R value	35.74	35.78	35.31	35.39	35.60	35.35	35.30	35.37	35.51	35.55
Colour - G value	14.95	14.96	14.76	14.73	14.81	14.99	14.91	14.90	14.94	14.97
Colour - B value	13.25	13.11	13.08	13.00	13.03	13.57	13.39	13.30	13.43	13.36

Sample no.	Untreated									
	Tumble + Line					Line + Tumble				
	29	30	31	32	33	36	37	38	39	40
Weight (gsm)AW	153.76	153.05	153.00	154.17	152.72	157.62	157.48	156.99	157.73	157.09
Stitch length (mm) AW	2.75	2.75	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74
Burst strength. AW	571.40	585.40	600.10	583.70	599.40	580.80	574.30	573.70	567.20	584.90
Distension at burst. AW	19.61	17.95	18.28	18.69	19.10	18.63	18.49	18.64	18.64	18.57
Yarn strength. AW	268.33	284.44	277.44	283.25	277.41	272.35	273.53	273.83	272.87	287.89
Yarn extension at break. AW	6.10	7.00	7.09	6.97	6.81	6.66	6.65	6.92	6.99	7.08
Yarn count (tex). AW	19.71	19.38	19.44	19.50	19.54	19.54	19.53	19.52	19.36	19.56
Thickness. AW	723.90	712.60	711.80	711.40	722.70	782.00	782.50	764.50	766.50	750.50
Colour - R value	35.37	35.11	35.27	35.57	35.37	34.97	34.94	35.07	34.98	35.03
Colour - G value	14.67	14.50	14.61	14.77	14.62	14.52	14.50	14.59	14.53	14.53
Colour - B value	12.93	12.76	12.82	12.99	12.81	13.04	12.92	13.03	12.96	12.95

CORAH GARMENT TRIAL
MEAN COURSES/3CM.

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE NO	1	2	3	4	5	
↓		No of washes					↓		No of washes				
W+L		34	55.9	56.6	56.3	56.5	57.2	14	54.6	55.2	55	55.5	55.4
		35	56.2	56.2	56.7	56.4	56.6	15	54.5	55.3	55.2	55	54.6
		36	56.3	57.1	56.5	57	56.7	16	54.8	55.1	55.6	55.7	55.5
		37	56.2	56.6	57.1	56.8	56.6	17	55.6	55.3	56.1	56	56.8
		38	55.8	56.8	56.7	56.9	56.5	18	55.1	55.5	55.8	55.8	56
		39	55.9	56.3	56.4	56.9	56.5	19	55.3	55.2	55.8	55.3	55.6
		40	55.6	56	56.5	56.4	57	20	55.2	55.3	55.6	55.9	55.4
W+L/W+T		35	59.5	59.9	59.6	59.7	59.3	15	57.7	58.2	57.7	57.6	57.2
		36	59.5	58.8	59.5	60	59.5	16	57	57.9	57.8	57.7	57
		37	58.9	59.8	59.9	60	59.5	17	57.9	59	58.6	59.3	58
		38	58.8	59.7	60.1	59.6	59.4	18	57.6	58.1	57.4	57.9	57.7
		39	58.9	58.6	59	59.3	58.9	19	57.9	58.5	57.7	56.3	58.1
		40	59.6	59.6	59.5	59.5	59.4	20	57.7	57.9	57.5	58.2	57.2
W+T		washes	1	2	3	4	5		1	2	3	4	5
		27	58.5	59	59.3	59.6	60.1	7	57.3	56.9	57.4	57.4	58.2
		28	57.8	58.7	59.4	59.6	59.5	8	57.2	57.5	57.4	57.6	57.4
		29	58.5	58.6	58.8	59.7	58.9	9	56.5	56.6	57.7	57.9	57.7
		30	58.2	59.4	59.7	58.8	59.6	10	57.3	57.1	58.2	58.4	57.8
		31	58	58.3	59.6	59.6	59.9	11	57.3	57.3	58	57.6	57.7
		32	58	59.1	59.9	60	60.2	12	57.1	57.3	57.3	58	57.8
		33	58.7	59.6	59	59.3	59.4	13	56.9	56.8	57.7	58.5	57.4
W+T/W+L		28	57.8	57.3	57.3	57.4	57.9	8	56.2	56.6	55.9	55.7	55.6
		29	57	58.1	57.8	57.4	56.2	9	56.4	56.1	55.6	56.8	55.9
		30	58	57.4	57.5	58.1	57.5	10	55.9	56.3	56.4	56	55.3
		31	57.4	57.6	57	56.8	56.8	11	55.4	55.7	55.3	55.7	55.5
		32	57.4	57.1	57.2	57.6	58	12	55.7	56.1	55.8	55.9	55.4
		33	57.6	57.8	57.6	57.6	57.3	13	56.1	56.1	56	56.2	56.2

CORAH GARMENT TRIAL
 MEAN WALES/3CM.

	Untreated					Resin treated						
	SAMPLE NO	1	2	3	4	5	SAMPLE NO	1	2	3	4	5
	↓	No of washes					↓	No of washes				
W+L	34	45.8	45.8	46.1	46.4	45.6	14	45.4	45.5	45.3	45.5	45.5
	35	46	46.2	45.7	45.9	45.9	15	45.2	45	45.1	45.2	44.9
	36	45.9	45.5	46.2	46.2	45.6	16	45.2	45.3	45.2	45.3	45.3
	37	45.9	45.9	45.9	46	45.9	17	45.9	45.4	45.2	45.3	45.2
	38	46.3	46.1	46.2	46	45.7	18	45.8	45.2	45.3	45.3	45.4
	39	46.2	45.8	45.9	45.8	45.4	19	45.6	45.8	45.2	45.8	45.5
	40	45.7	46	46.1	45.7	45.4	20	45.6	45.3	45.6	46	45.4
W+L/W+T	35	46.1	46	45.9	46	45.5	15	45.3	45.4	44.6	45.1	44.9
	36	46.2	46.2	45.5	45.6	45.6	16	45	45.7	45.6	45.1	44.7
	37	46.3	46	45.4	45.6	45.5	17	45.5	45.5	45.7	45.7	45
	38	45.7	45.5	46.1	45.6	46.1	18	45.6	44.9	45.1	45.4	44.9
	39	46.3	46	46	46	45.6	19	45.3	45.5	45.5	45.5	45.4
	40	46.2	45.6	46	45.6	46	20	45.5	45.8	45.3	45.7	45.2
W+T	washes	1	2	3	4	5		1	2	3	4	5
	27	46	46.5	46.4	46.1	46.1	7	45.5	45.3	45.3	46	45.5
	28	45.9	46.5	46.3	46.2	46.2	8	45.8	45.6	45.7	45.9	45.2
	29	46.1	46.2	46.1	46.2	45.9	9	45.6	45.4	45.6	45.7	45.4
	30	46.1	45.5	46.3	46.4	46.2	10	45.5	45.6	45.7	45.7	45.9
	31	45.9	46.5	46.5	46.2	46	11	45.9	45.9	45.6	46.3	45.9
	32	45.8	46.4	46.3	45.9	46	12	45.3	46.6	45.7	46	45.6
	33	45.8	46.2	46	46	45.8	13	45.4	45.4	45.5	45.7	45.6
W+T/W+L	28	45.8	46.5	46.1	45.5	45.6	8	45.3	45.6	45.4	45.2	45
	29	46.1	45.7	45.7	45.8	45.1	9	45.5	45.4	45.1	44.9	45.2
	30	46.3	45.5	45.5	45.9	45.1	10	45.4	45.1	45.9	45.2	45.2
	31	45.7	45.6	45.5	45.9	45.6	11	45.7	45.3	45.1	45.5	45.6
	32	45.7	45.5	46.1	45.8	45.5	12	45.4	44.9	45.7	46.3	45.1
	33	46.2	45.7	45.8	45.9	45.2	13	45.2	45.2	45.2	45.1	45

CORAH GARMENT TRIAL
 MEAN WEIGHT G.S.M.

	Untreated					Resin treated					
SAMPLE NO	1	2	3	4	5	SAMPLE NO	1	2	3	4	5
↓	No of washes					↓	No of washes				
W+L											
34	144.8	143.6	146.4	147.6	143.2	14	140	139.2	142.6	140.8	141.6
35	143.8	142.6	147	145.6	144.6	15	142	140.8	140.6	144	142.8
36	145.4	144.6	145	150	144	16	140.2	140.4	141.8	143.2	143.4
37	143.4	144.4	147.2	147.6	146	17	144.4	143.4	143.4	144.8	145.4
38	143.2	144.6	145.4	147.8	145.2	18	141.4	141.6	141.2	143.6	144
39	143	141.4	146.4	147.2	142.6	19	141.4	141.4	144.8	142.8	145.2
40	144	146.4	145.6	150.4	147.3	20	141	140.2	142	145.6	142.4
W+L/W+T											
35	155.4	158.6	149.6	151.8	152.2	15	150.4	160.6	147.4	151	152.6
36	152.8	160	152.6	154.2	152.4	16	150	160.2	150.4	147.2	149
37	154.6	161	151.2	154.2	152.4	17	148.2	160.4	147.8	151.4	150.2
38	154	160.2	153	153.2	152.6	18	149.6	158.4	147	153.2	150.2
39	154.2	159.8	153.6	152	151.4	19	148.6	159.4	147	149.2	151.2
40	153.6	160.4	154.4	154.2	151.2	20	149.8	159.6	150.6	148.2	147
W+T	washes	1	2	3	4	5	1	2	3	4	5
27	147.6	146.6	148.2	148.8	147.2	7	146.4	148	146.4	147.6	146.8
28	147.8	148	149.6	147.6	151.2	8	145.8	146.2	144	146	148.8
29	146.6	147.6	150.6	145.8	149.6	9	143.4	146.6	145.6	144.4	149.6
30	147.4	149.8	149.6	146.2	148.6	10	144.8	146.8	144.4	146	147
31	148	148	150.6	149.2	147.8	11	145.4	145.4	144.4	144.4	145.6
32	147.6	148.4	150.2	145.8	147.4	12	142.6	145.6	143.6	145.6	147.4
33	147.2	147.6	149.6	148.4	148.4	13	141.6	148.2	144.4	147.2	146.2
W+T/W+L											
28	145.2	146	149.4	148.2	151.5	8	143	144.4	148.4	144.4	145.2
29	143.4	146	148.2	150.8	149.2	9	143.4	145.2	144.8	146.6	145.4
30	145	146.2	152	149.2	151.4	10	147.2	143.8	146.2	149	145.6
31	142.6	143	151	152.4	151.8	11	143.6	140.4	142.4	142.6	146.8
32	147.2	144.2	149	149.8	151.4	12	143.8	143.8	144	142.4	142
33	146.4	145.2	153.2	149	153	13	143.4	144.2	143.6	141	144.8

CORAH GARMENT TRIAL
MEAN ANGLE OF SPIRALITY

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE NO	1	2	3	4	5	
↓		No of washes					↓		No of washes				

W+L													
	34	10.5	11.8	12.5	11.2	14	14	9.7	11.1	11.6	12	12	
	35	9.6	12	11.5	11.8	11.8	15	10	11.7	13.3	11.9	11.6	
	36	8.5	11	13	11.1	12	16	8.6	11.2	11.9	11.5	11.2	
	37	8.3	10.7	12	11.9	12.6	17	9.8	11.6	11.3	10.5	11.8	
	38	9.3	10.8	11.8	11.7	12.8	18	10.4	11.9	11.7	12.1	12.6	
	39	9	10	12	11.2	13.2	19	10.5	11.4	11.7	12.5	12.3	
	40	9.7	11.7	12.1	10.8	11.9	20	8.8	11.2	11.9	11.3	12.1	
W+L/W+T													
	35	13.9	12.7	12.1	12.2	11.9	15	10.1	10.4	12	11.4	12	
	36	12.7	12.6	10.8	12	12	16	11.3	11.3	11.5	9.8	10.7	
	37	11.2	11.6	13.3	12.5	13.6	17	11.1	10.5	11.8	11.1	11.9	
	38	10.6	11.7	13	11.7	12.7	18	10.7	11.3	12.9	11.7	10.8	
	39	12.1	12.4	10.8	11	12.7	19	12.2	12.6	13.3	11.2	11.5	
	40	10.4	11.7	12.2	10	12.1	20	10.4	12.2	12.4	11.3	11.5	
W+T washes													
		1	2	3	4	5		1	2	3	4	5	
	27	13.1	11.1	12	11.7	11.2	7	10.7	9.7	10.4	10.6	9.7	
	28	10.7	10.4	11.3	10.7	11.3	8	11.9	10.5	10.5	9.3	10.3	
	29	11.7	10.3	10.5	10.4	11.8	9	12.3	10.5	11	11.1	11.1	
	30	11.5	11	10.4	11.3	11	10	12.1	10.3	10.7	10.8	10.9	
	31	12.9	10.3	10.9	11.5	10.4	11	11.2	11.2	10.4	11.1	11.4	
	32	12.6	11.9	12.1	11.6	11.8	12	12.3	10.7	11.3	9.9	11	
	33	12.2	11.5	12.6	11.3	11.8	13	11.2	10.8	9.3	10.2	10.8	
W+T/W+L													
	26	12.5	10.3	12.2	11	13.1	6	12.1	11.2	11.7	10.6	13.4	
	29	11.7	10.5	11.2	11	13.4	9	12.7	11.9	12	11.3	13	
	30	12.2	9.8	10.7	11.3	14.2	10	12.9	11.2	11.3	11.3	14.2	
	31	12.3	11	11.3	10.9	12.6	11	13.3	11.9	11.6	11.5	12.7	
	32	13.2	12.6	11	10	13.7	12	12.9	10.2	11.6	9.8	14.2	
	33	12.9	9.9	11.2	10.6	13.7	13	12.1	10.6	10.2	10.8	12	
=====													

CORAH GARMENT TRIAL
 MEAN SEAM DISPLACEMENT CM.

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE NO		1	2	3	4	5
↓		No. of washes					↓		No. of washes				
W+L	34	4.8	3.6	4.3	5.1	4.7	14	3.3	3	2.9	3	3.7	
	35	2.7	3.7	4.9	3.9	4	15	2.6	2.4	3.1	4	3.6	
	36	3.1	3.6	4.1	4.7	3.9	16	1.9	3.2	4.3	3.3	2.7	
	37	4.2	4.1	4	5	4.6	17	4.1	3.2	4.4	4.4	4.6	
	38	3.1	4.2	4	4.2	4.4	18	2.9	2	2.5	3.9	2.6	
	39	2.3	3.1	5	3.7	4.4	19	3.1	2.5	2.2	2.7	3.5	
	40	4.1	3.5	3.4	3.3	4	20	4.3	4.2	3.7	3.4	4.3	
W+L/W+T	35	3.2	3	2.6	3.2	3.1	15	1.6	2	3.7	2	2.3	
	36	3.1	1.8	3.2	4.1	3.5	16	1.7	2.4	1.7	2.3	2.3	
	37	3.3	3.1	2.3	3.6	4.5	17	2	1.4	2.7	1.8	2.2	
	38	3.1	2.8	2.5	2.8	3.4	18	2	1.7	1.7	2.4	2.6	
	39	2.7	2.6	2.9	3.5	3.9	19	1.9	4	2.5	3	2.9	
	40	2	2.6	3.2	2.2	3.5	20	3.3	2.8	2.7	2.3	3.1	
	W+T washes	1	2	3	4	5		1	2	3	4	5	
27		2.1	3.3	2.2	2.4	2.9	7	2.3	3.4	2.5	3.5	2.7	
28		1.8	1.9	3.5	3.2	2.9	8	3.5	3.5	2.7	2.5	2.5	
29		2.8	3.1	2.9	3.2	2.6	9	2.1	2.1	2.6	1.6	2.2	
30		3	2.4	3.3	3.4	4.1	10	2.6	2.2	2.7	2.5	3	
31		3.2	3.3	3	3.4	2.9	11	2.3	2.6	3	2.9	3.6	
32		1.7	3.1	3.2	3.2	3.7	12	2.4	1.7	1.8	1.6	3.2	
33	3	3.7	3.6	2.7	4.1	13	1.7	3.1	2.6	2.1	1.9		
W+T/W+L	28	4.6	3.4	4.8	4.1	3.9	8	4.3	3.7	3.5	4.6	4.9	
	29	4.4	3.5	3.7	4.3	5	9	3.8	2.6	3.6	3.1	3.7	
	30	5.6	4	5.3	5.2	4.6	10	4.2	3.5	3.7	3.8	3.9	
	31	4.2	3.1	3.7	4.2	4.5	11	3.4	2.7	3.3	3.1	4.1	
	32	4.8	3.2	3.6	3.6	4.1	12	3.8	2.1	4.8	4.2	3.9	
	33	4.1	2.7	2.5	4.4	4	13	3.4	2.4	3.1	3.1	2.6	

CORAH GARMENT TRIAL
MEAN LENGTH SHRINKAGE

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE	1	2	3	4	5	
↓		No of washes					↓	No of washes					
W+L		34	2.6	2.4	3.2	3.8	3.9	14	2.7	2.7	3	3.3	3.3
		35	4	3.8	3.5	4.2	4.2	15	3.2	3	2.7	3	3.8
		36	3.5	3	3	2.9	3.2	16	3.1	2.4	2.8	3.3	3.6
		37	3.9	3.2	5.5	4.4	4.7	17	2.3	1.8	1.6	2.8	2.6
		38	4.8	4.6	4	5.5	5.7	18	1.8	2.1	2.6	3.7	2.7
		39	3.3	4.1	4	3.7	4.6	19	2.6	2.4	2.2	2.7	3.2
		40	3.9	3.6	4.3	4.6	4.5	20	2	2.8	2.9	2.9	2.9
W+L/W+T		35	8.2	9.5	9	9.5	9.6	15	7.8	7.4	7.3	7.6	8
		36	6.5	8.1	8	8.3	8.6	16	6.8	7	8.1	8	7.7
		37	7.6	8.4	9.5	9.9	9.8	17	5.5	6.5	6.5	7.6	7.6
		38	8.8	10.1	10.5	11.3	9.6	18	5.9	6.5	6.8	7.9	7.2
		39	7.9	9.3	8.5	9.5	9.8	19	6.7	6.8	7.4	7.2	7.4
		40	8.8	9.4	9.3	10.4	9.1	20	6.5	7.1	8	8.5	8.1
W+T		washes	1	2	3	4	5		1	2	3	4	5
		27	7.9	8.7	9.1	10.2	10.3	7	5.5	6.1	6.4	6.5	6.7
		28	7.9	9.1	9.2	9.6	10.3	8	5.9	7	7.1	7.6	7.4
		29	9.2	9.8	9.6	10.8	10.1	9	6.5	6.5	6.6	7.7	7.3
		30	8.1	8.9	9.2	9.4	10.8	10	5.9	6.6	7.7	7.7	7.6
		31	7.3	8.5	8.9	9.4	10.1	11	6.6	7.4	7	7.6	6
		32	7.8	8.5	9.2	9.2	10	12	7.5	6.6	7.3	7.6	7.9
		33	7.8	8.5	9	9.8	9.8	13	6.6	7.4	7.4	7.7	8.6
W+T/W+L		28	6.3	6.4	5.2	5.9	5.5	8	3.6	4.7	4.8	4.5	4
		29	6.4	6.5	6.5	6.6	6.9	9	4	4.4	3.8	4.8	4.9
		30	6.8	6.9	6.3	6.7	6.3	10	5	4.8	4.3	3.8	4.5
		31	5.9	6.1	5.8	6.3	5.1	11	4.6	4.7	4.1	4.4	4
		32	5.3	5.9	6.5	6.3	7.1	12	5.3	5.2	4.3	4.4	4.4
		33	5.7	6.4	5.5	5.6	6.3	13	4.7	4.9	3.3	5.2	4.3

CORAH GARMENT TRIAL
MEAN WIDTH SHRINKAGE

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE NO	1	2	3	4	5	
↓		No of washes					↓		No of washes				
W+L	34	3.3	2.4	2.7	3.3	2.4	14	3	2.8	3.2	2.4	2.2	
	35	4.4	4.1	3.4	3.2	3.9	15	3.7	2.6	2.8	2.5	2.4	
	36	3.6	2	2.9	2.6	2.4	16	2.3	2.7	1.6	2.7	1.9	
	37	4.4	4.2	4.1	4.2	3.1	17	2.2	1.5	0.7	1.6	0.8	
	38	4.2	4.3	4.1	4.1	3.5	18	2.8	1.9	2.1	1.7	1.8	
	39	3.6	4.4	4.3	3.8	3.3	19	2.7	2	1.5	0.7	1.5	
	40	5.5	5	4.3	5.1	4.2	20	3	1.9	1.7	2.2	1.7	
W+L/W+T	35	5.6	5.5	5.2	5.1	5.2	15	4.1	5.5	4	3.5	3.5	
	36	4.7	3.6	3.9	4.1	3.2	16	3.6	3.4	4	4.1	3	
	37	5.1	4.6	4.7	5.5	5.3	17	1.9	2.7	2.8	2.9	2	
	38	4.8	4.2	4	4.5	3.9	18	3.6	4	3.7	4	2.9	
	39	5.4	5.2	4.4	5.4	4.5	19	3.4	2.5	3.5	3.9	2.6	
	40	6.2	6.3	5.6	6.3	5.8	20	3.5	3.9	3.5	3.2	3.8	
W+T	washes	1	2	3	4	5		1	2	3	4	5	
	27	6.9	7.3	6.2	6.8	6.6	7	3.5	3.5	3.2	3.7	4	
	28	5.6	6.4	5	5.3	6.4	8	4.6	4	4.8	4.2	4.1	
	29	5.2	5.9	5.3	5.4	5.1	9	3.4	4.3	3.2	4.2	3.5	
	30	5	4.1	4.6	5	4.5	10	4.9	5.1	4.2	5	4.6	
	31	5.6	5.8	5.4	5.2	4.9	11	4.1	4.4	3.7	4.4	4.1	
	32	5.5	4.8	5	6.1	4.9	12	5.3	5	4.9	5.4	5.1	
	33	6.3	6.2	4.1	5.3	5.4	13	3.5	3.7	3.1	3.6	3.7	
W+T/W+L	28	3.8	3.5	3.4	3.3	3.3	8	1.8	2.3	1.8	1.7	1.6	
	29	2.8	2.3	1.7	3	2.7	9	1.2	1	0.1	0.6	2	
	30	3.2	2.1	1.6	1.5	1.5	10	3.4	2.8	2.6	1.9	3	
	31	2.1	2.6	2.3	2.2	2	11	1.7	2.4	1.9	2.6	1.8	
	32	2.6	2.6	2.8	2.6	2	12	3.7	2.7	2.2	2.3	2.5	
	33	2.8	2.3	2.7	1	2.5	13	1.5	1	0.1	1	0.8	

CORAH GARMENT TRIAL
 MEAN % SHRINKAGE - M&S MEASURING FRAME

		Untreated					Resin treated						
SAMPLE NO		1	2	3	4	5	SAMPLE NO	1	2	3	4	5	
↓		No. of washes					↓		No. of washes				

W+L													
	34	3.3	4.4	6.3	5.5	6.2	14	2.4	1.9	3.4	3	3.5	
	35	3	4.1	5.5	5.4	5.4	15	2.6	3.1	4	3.3	3.7	
	36	4	4.1	5.4	6.3	5.5	16	2.4	2.4	3.2	3.3	3.8	
	37	3.8	4.8	5.8	4.7	6.2	17	2	2.4	3.3	3.1	3.9	
	38	3.6	4.5	5.3	5.5	6.6	18	2	2.7	4.2	3.4	4	
	39	4.1	4.5	5.9	5.8	6.4	19	3.3	2.5	4.5	3.9	4.1	
	40	3.8	4.3	5.6	5.8	5.8	20	2.9	3.2	4.9	4	4.8	
W+L/W+T													
	35	9.1	9	9.4	10.1	10.4	15	6.8	6.6	6.3	7.8	7.6	
	36	9.5	9.4	9.9	11.1	10.6	16	6.5	6.4	6.9	7.5	7.5	
	37	9	9	9.6	10.5	10.3	17	6.6	5.8	6.7	8	7.7	
	38	9.1	9.2	9.9	10	10.4	18	7.3	6.3	7.2	7.8	7.8	
	39	9.7	9.6	9.7	11.2	10.9	19	7.5	7.4	7.8	8.6	8.1	
	40	9.6	8.3	9.5	11	11.3	20	7.7	7.4	8	8.3	8.5	
W+T													
	washes	1	2	3	4	5		1	2	3	4	5	
	27	6.9	7.7	6.8	8.5	10.1	7	4.9	5.3	5.4	5.6	7.3	
	28	7.3	8.4	9.6	9.2	10.3	8	5.9	6.1	7.5	7.6	8.6	
	29	7.1	7.9	9.1	8.7	10	9	4.9	5.3	6.7	5.8	7.3	
	30	6.9	7.9	9	9.1	10.2	10	5.1	5.6	7.1	6.4	7.6	
	31	5.2	8.5	9.3	9.5	10.9	11	4.6	5	6.4	6.2	7.5	
	32	7.3	8.3	9.6	10	10.5	12	5.5	5.2	6.1	6	7.6	
	33	7.9	6.7	5.6	9.7	11.1	13	5.4	5.4	6.5	5.6	7	
W+T/W+L													
	28	7.4	7.6	7	7.1	7.6	8	5.4	6.2	6.1	5.1	5.8	
	29	7.7	8.5	7.6	7.3	7.7	9	3.6	4.5	4.4	5.3	4.6	
	30	7	7.5	7.8	6.9	7.6	10	4.7	5.3	4.9	5.1	5.3	
	31	7.7	8	7.6	8.2	8.6	11	3.2	4.2	4.3	4.8	4.9	
	32	8.1	7.9	6.8	8	8.6	12	4.2	4.7	4.6	4.6	5	
	33	8.1	8.4	8	7.4	7.9	13	4.2	4.6	4.6	5	4.6	
