

INTERLABORATORY TRIAL

IIC/HANES/COTTON INCORPORATED

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1. INTRODUCTION

Towards the end of 1984 Geoffrey Krasnov at Hanes Printables produced a set of 3 single jersey fabrics knitted on an 18 gauge, 22" diameter, 1244 needle machine. The fabrics were knitted from a nominal Ne 1/20 cotton from two suppliers, Avondale and H & H, at three different stitch lengths and processed tubular through an L & L continuous bleach range, jet dyed using a direct dye in a 1 port Thies Rotostream, and finally compacted. Samples of yarn, greige and finished fabric were sent to Cotton Incorporated for testing. Cotton Incorporated subsequently sent IIC samples of the greige and finished fabric to enable a three-laboratory comparison to be carried out.

Although a complete analysis is not possible, because the three laboratories did not all carry out the same tests, on fabric in similar states of relaxation - in particular the reference state - some indication of interlaboratory agreement can be obtained.

2. TESTING

2.1. IIC

Full testing was carried out on greige and finished fabric both "as received" and in the reference state. Shrinkage was measured after 5 wash and tumble dry cycles only, using the 25cm template. All results were quoted by the laboratory in metric units but for the purposes of this analysis they have been converted to imperial units. Only those data relevant to the comparison are included in the main report but a copy of the full test data is included in an appendix.

2.2. Hanes Printables

Yarn count was tested before knitting from the package. Two yarn suppliers, Avondale and H & H, were sampled and 3 cones from each were tested. The average results are those quoted in the comparisons.

Stitch length in the greige fabric is not measured by Hanes but Run-in or Draw is measured during knitting. Stitch lengths quoted are therefore calculated from the measured run-in divided by the number of needles in the machine.

Courses, wales and weight on greige fabric were measured after a half-hour relaxation in a non-controlled environment. Greige fabric was not measured in the reference state. Finished weight is reported in lbs/sq.in. which is obtained by cutting and weighing a double thickness of fabric of prescribed dimensions. For the purposes of this analysis the weight measurements have been converted to oz/sq.yd. Shrinkage was measured after both 1 and 5 wash and tumble dry cycles.

Finished fabric dimensions were not measured after relaxation.

2.3. Cotton Incorporated

Cotton Incorporated reported similar test data to Hanes Printables. Greige yarn count was determined, presumably, from the cone but CI also measured yarn count in the finished (unrelaxed) fabric.

Courses, wales and weight were measured on greige fabric as received and courses, wales, weight and width on finished fabric as received.

Shrinkage was measured after both 1 and 5 wash and tumble dry cycles. Courses and wales were also measured after 5 wash and tumble dry cycles (3 measurements per sample).

3. RESULTS

Tables 1 - 4 show the test data reported by the 3 laboratories.

Tables 5 - 8 summarise the results of the statistical tests for significant differences between measurements made by each laboratory.

4. DISCUSSION

4.1. Greige Fabric (unrelaxed) - Table 5

Between IIC and CI there are no statistically significant differences in the measured properties although a mean difference of 0.5 in yarn count may prove of practical importance if this is repeated consistently.

Between IIC and Hanes there is a statistically significant difference at the 95% level between the two labs in the measurement of wales. IIC measures more wales than Hanes (mean difference - 1.08).

Between Hanes and CI there is also a statistically significant difference at the 95% level between the two labs in the measurement of wales. CI measures more wales than Hanes (mean difference + 1.25).

In addition, although not statistically significant, there is a mean difference of almost one count between the two determinations of yarn count from package. This may prove practically important if repeated consistently - for example, yarn count relates directly to fabric weight and the accuracy with which STARFISH can predict fabric weight depends on accurate data for knitted yarn count and stitch length.

The differences in the measurement of greige wales between IIC and Hanes and CI and Hanes may be due simply to relaxation in the greige fabrics during transportation between the 3 laboratories - this theory would appear to be supported by the fact that no difference was found between IIC and CI.

4.2. Greige Fabric (Reference State) - Table 6

Although the differences in measured courses and wales between IIC and CI are not statistically significant, CI consistently record more courses than IIC. This may indicate some differences in relaxation between the two laboratories and should be checked in further comparative studies.

4.3. Finished Fabric (unrelaxed) - Table 7

Between IIC and Hanes and Hanes and CI, agreement is good and no statistically significant differences in measurements are apparent.

Between IIC and CI this is also true with the exception of an apparently highly (99%) significant difference between measured fabric weights. An inspection of the data however (mean difference 0.0001) shows that for practical purposes the two laboratories are in fact in very good agreement and highly correlated (r^2 1.00).

4.4. Finished Fabric (Reference State) - Table 8

IIC and CI are in very good agreement for reference courses and wales and shrinkage after 5 wash and tumble dry cycles. Both IIC and CI however disagree with Hanes' measurement of length shrinkage. Between IIC and Hanes there is a highly significant difference (99%) for length shrinkage after 5 wash and tumble dry cycles (mean difference 2.7%).

Between Hanes and CI there is a difference of 1.8% after 1 wash and tumble dry cycle and 3.0% after 5 wash and tumble dry cycles. The difference after 1 wash and tumble dry cycle is significant at the 95% level and although the difference after 5 wash and tumble dry cycles is not statistically significant it may be so in practice, if similar results are repeated consistently.

5. CONCLUSIONS

On the evidence of this very small trial the three laboratories appear to be in reasonable agreement. However one or two areas discussed in section 4 may need attention, and therefore these results should not be taken to indicate a completely satisfactory level of agreement between laboratories. Further trials need to be carried out where, for example, a full determination of the reference state should be made by each laboratory, before the possibility of systematic differences can be discounted. It is of vital importance that our laboratories are either in very close agreement or highly correlated so that STARFISH predictions are relevant and so that any new data which is generated during co-operative studies will be compatible with the existing STARFISH data base.

6. COMPARISON WITH STARFISH 84

The equations and coefficients of the STARFISH 84 model are designed to allow the average finished reference dimensions of a given fabric to be predicted from a knowledge of the yarn count, stitch length and knitting machine (needles) used for its production plus information about the processing route the fabric will follow during dyeing and finishing. These can then be used to calculate the average dimensions of the fabric when it is finished, according to certain targets, on the assumption that these targets (e.g. length and width shrinkages, or finished courses and wales, or finished weight and width etc.) are actually hit.

In a normal commercial situation, even in a quality conscious, well-controlled mill, some variation in raw material (yarn), knitting (stitch length or run-in) and finishing, is both inevitable and unavoidable. Variations in these areas will automatically lead to variations in the dimensions and performance of finished fabrics from piece to piece.

In a recent study carried out at a large knitgoods manufacturer, many samples (c.40) of nominally the same greige and finished single jersey fabric were taken over a period of time and their properties measured. The variations in dimensions which were found in that study may be used to give some indication of the accuracy with which we can expect STARFISH to perform.

Variation coefficients for greige yarn and stitch length were approximately 2% and 1% respectively, although variations in yarn count greater than those measured in that study (where only one yarn supplier was sampled) could be expected if several yarn suppliers were included. For finished fabrics, the variation coefficients were approximately 2% for courses, 1.5% for wales, and 3.5% for weight and the standard deviations for shrinkage after 5 cycles of washing/rinsing and tumble drying were about 2.8% in both length and width.

Generally the levels of variation found in the finished reference state fabrics were lower than those found in the finished as delivered fabrics. Thus, for measurements on individual samples, differences between measured and predicted dimensions could be up to ± 2 times the CV% from the mean, while the mean of five or more samples could differ from predicted by up to ± 1 times the CV%. Therefore for this study (only 3 samples) we can be reasonably confident that STARFISH is performing as well as can be expected if the mean differences fall between ± 1 and ± 2 times the CV%.

e.g. Ne	±	2-4%
Stitch length	±	1-2%
Courses	±	2-4%
Wales	±	1.5-3%
Weight	±	3.5-7%
% shrinkage	±	2.8-5.6

Using these criteria as a basis for judgement the STARFISH 84 model was used to predict the average dimensions of both the greige and finished fabrics produced by Hanes.

Predictions were made using 1) IIC test data, 2) Hanes test data, 3) CI test data for the inputs of yarn count and stitch length. Predictions were made for greige reference, finished reference and finished as-delivered, based on 1) measured shrinkage, 2) measured courses and wales and were then compared with the measurements made in each laboratory where available.

Tables 9-14 show the STARFISH printouts; Tables 15-19 show the individual comparisons of measured vs predicted dimensions. The finishing route chosen from those available in the model at the present time was R-95 tubular finish. We do not have equations relating specifically to the processing route used by Hanes and therefore preliminary trial and error computing was used to assess which of the relevant existing STARFISH routes was most likely to fit the data.

6.1. IIC Test Data Summary

Greige Reference Mean % Difference $\frac{[\text{IIC-STARFISH}]}{\text{IIC}} \times 100$ Table 15

	\bar{x}	σ
Ne	+0.89	1.07
Stitch length	+1.08	0.58
CPI	-1.46	2.50
WPI	+1.36	0.57
Weight	-1.34	3.65

Finished Reference Mean % Difference

	\bar{x}	σ
Ne	+0.62	1.16
Stitch length	+1.4	0.97
CPI	+1.17	1.27
WPI	+0.3	1.21
Weight	+4.27	3.53

Generally the agreement between measured and predicted is excellent (better than $\pm 1.5\%$), and even in the case of finished reference weight the mean % difference is well within the outer limit of $\pm 2*CV\% = 7\%$. None of the mean differences are significantly different from zero.

Finished As Delivered [R-95] Mean % Difference Table 16

1) From measured Length and Width Shrinkages

	\bar{x}	σ
CPI	+0.29	1.04
WPI	-0.22	0.90
Weight	+1.54	3.23
Width	-0.4	0.26

2) From measured Courses and Wales

	\bar{x}	σ
Weight	+1.49	1.53
Width	-0.75	0.78
% Length S/kage	+0.48	0.65
% Width S/kage	-0.27	0.85

Agreement using the R-95 tubular finish route is excellent. On average, the mean % differences of all predicted dimensions are within $\pm 1.5\%$. None of the mean differences are significantly different from zero.

6.2. Hanes Test Data Summary Table 17

Finished as delivered Mean % Difference

1) From measured Length and Width Shrinkage

	\bar{x}	σ
CPI	+3.68	2.3
WPI	+0.75	1.71
Weight	-0.89	1.56
Width	-0.69	0.66

2) From measured Courses and Wales

	\bar{x}	σ
Weight	-5.1	2.55
Width	-0.18	1.39
% Length S/kage	+3.27	2.03
% Width S/kage	+0.8	1.74

The main area of disagreement between STARFISH 84 and Hanes measured data is for finished courses when measured length and width shrinkage are used as inputs. The reason for this can be inferred from the differences in length shrinkage recorded between Hanes and IIC. If Hanes are underestimating length shrinkage, then when shrinkage is used as an input, STARFISH will predict more courses on average than are actually measured. Conversely, when courses and wales are used as finishing targets, STARFISH will predict a higher length shrinkage than that measured by Hanes. This will also affect the weight prediction but the mean % difference between measured and predicted weight is still within $\pm 2*CV\%$ or 7%. Agreement between STARFISH and Hanes measured data for the other properties is excellent (less than $\pm 1\%$).

6.3. CI Test Data Summary Table 18

Greige Reference Mean % Difference

	\bar{x}	σ
CPI	-3.61	2.31
WPI	+1.40	1.85

Finished Reference Mean % Difference

	\bar{x}	σ
CPI	+0.90	0.30
WPI	-0.03	0.84

STARFISH does not predict greige reference courses as measured by Cotton Incorporated very well, although greige reference wales and finished reference courses and wales are matched closely by the predictions. This is probably due to the fact that CI consistently measure more courses than IIC (see 4.2.)

which although in the context of the interlaboratory comparison was not statistically significant, is highlighted here.

Finished As Delivered Mean % Difference Table 19

1) From measured Length and Width Shrinkage

	\bar{x}	σ
CPI	+0.38	5.59
WPI	+0.03	2.83
Weight	+4.07	7.19
Width	-1.42	0.58

2) From measured Courses and Wales

	\bar{x}	σ
Weight	+3.71	2.04
Width	-1.74	2.51
% Length S/kage	+0.23	4.9
% Width S/kage	+1.5	1.93

Agreement between measured and predicted finished as delivered dimensions is on average very good although an inspection of the individual results (Table 19) suggests that potentially the match between predictions and individual samples may on occasion be actually quite bad.

7. CONCLUSIONS

The level of agreement between measured and predicted dimensions using IIC test data is very encouraging especially for finished fabric. The finishing process used at Hanes which included a continuous pre-bleach stage has not so far been modelled by IIC therefore it is perhaps fortunate that one set of equations currently labelled R-95 can be used apparently successfully. However, although on average the results are very good a close inspection of the differences between individual qualities does suggest there may be some skew in the underlying equations.

There are several possible reasons for this:

- 1) the yarn used by Hanes may be intrinsically different from the yarns used by IIC in the development of the data base
- 2) because Ne 1/20 is actually at one extreme of the range of yarns examined by IIC, there may already be some uncorrected bias in the equations
- 3) the finishing route used by Hanes is not correctly modelled by the equations labelled R-95 tubular finish and the apparent match obtained in this series was fortunate rather than because the model is appropriate
- 4) the effect is a chance occurrence emphasised by having only 3 samples.

Hopefully the next set of fabrics produced by Hanes and received by IIC in January will help to resolve these questions.

The other point to emerge from this comparison is the level of agreement obtained between predicted and measured dimensions using data obtained by other laboratories. Obviously, we would expect, if the STARFISH model is basically correct, to be able to match our own test data reasonably well but it is encouraging that on average small variations in measurements obtained by other laboratories compared to IIC do not unduly affect the accuracy of the predictions. It does show however that where there are significant differences in test results between ourselves and other laboratories, e.g. shrinkage determination, discrepancies between measured and predicted dimensions can be quite large. It is therefore essential that good agreement in testing can be established between IIC and STARFISH user centres in particular so that confidence can be developed in the accuracy of the existing STARFISH model and new data can be collected to expand the data base.

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IIC/HANES/CI INTER-LABORATORY TRIAL

IIC TEST DATA - GREIGE BEFORE WASH

Sample No	Ne	Draw ins	St Lth ins	Crses /in	Wales /in	Weight oz/syd
1047D-5	20.195	153.01	0.123	52.58	23.96	5.3878
1047D-6	19.55	153.26	0.1232	50.38	25.06	5.2993
1047D-7	19.68	155.75	0.1252	48.26	24.47	5.2492

HANES TEST DATA - GREIGE BEFORE WASH (AS KNITTED)

Sample No	Ne	Draw ins	St Lth ins	Crses /in	Wales /in	Weight oz/syd
1047D-5	20.38	152	0.1222	53.5	23	5.259
1047D-6	20.38	154	0.1238	50.5	23.75	5.275
1047D-7	20.1	156	0.1254	49	23.5	5.033

CI TEST DATA - GREIGE BEFORE WASH

Sample No	Ne	Draw ins	St Lth ins	Crses /in	Wales /in	Weight oz/syd
1047D-5	19.6	151.4	0.1217	52	24	5.3
1047D-6	19.7	154.3	0.124	50	25	5.43
1047D-7	18.6	156.7	0.126	49	25	5.17

IIC/HANES/CI INTER-LABORATORY TRIAL

IIC TEST DATA - GREIGE REFERENCE

Sample No	Ne	St Lth ins	Crises /in	Wales /in	Weight oz/syd	L% 1W+TD	W% 1W+TD	L% 5W+TD	W% 5W+TD
1047D-5	20.29	0.1193	51.31	33.36	6.9006	n.a.	n.a.	+0.9	28
1047D-6	20.02	0.1203	50.46	33.44	6.7473	n.a.	n.a.	2.3	24.4
1047D-7	19.95	0.1225	48.01	32.85	6.4671	n.a.	n.a.	1.7	24.7

CI TEST DATA - GREIGE REFERENCE

Sample No	Ne	St Lth ins	Crises /in	Wales /in	Weight oz/syd	L% 1W+TD	W% 1W+TD	L% 5W+TD	W% 5W+TD
1047D-5	n.a.	n.a.	53	33.01	n.a.	n.a.	n.a.	n.a.	n.a.
1047D-6	n.a.	n.a.	51.33	33	n.a.	n.a.	n.a.	n.a.	n.a.
1047D-7	n.a.	n.a.	49	33	n.a.	n.a.	n.a.	n.a.	n.a.

IIC/HANES/CI INTER-LABORATORY TRIAL

IIC TEST DATA - FINISHED BEFORE WASH

Sample No	Ne	St Lth ins	Crises /in	Wales /in	Weight oz/syd	Width ins
1047D-5	20.36	0.1198	43.52	32.86	5.6532	19.13
1047D-6	20.5	0.1215	43.18	32.51	5.662	19.33
1047D-7	20.57	0.1234	41.74	31.75	5.3111	19.57

HANES TEST DATA - FINISHED BEFORE WASH

Sample No	Ne	St Lth ins	Crises /in	Wales /in	Weight oz/syd	Width ins
1047D-5	n.a.	n.a.	44	33	5.775	19.125
1047D-6	n.a.	n.a.	42	32	5.6713	19.375
1047D-7	n.a.	n.a.	41	31.5	5.5676	19.5

CI TEST DATA - FINISHED BEFORE WASH

Sample No	Ne	St Lth ins	Crises /in	Wales /in	Weight oz/syd	Width ins
1047D-5	21.9	n.a.	45	32	5.6609	19.25
1047D-6	20.3	n.a.	43	33	5.6713	19.63
1047D-7	21.1	n.a.	40	32	5.3188	19.75

IIC/HANES/CI INTER-LABORATORY TRIAL

IIC TEST DATA - FINISHED REFERENCE

Sample No	Ne	St Lth ins	Crses /in	Wales /in	Weight oz/syd	L% 1W+TD	W% 1W+TD	L% 5W+TD	W% 5W+TD
1047D-5	20.5	0.1181	47.58	33.53	6.1929	n.a.	n.a.	9.1	1.8
1047D-6	20.29	0.1196	47.08	33.02	6.1958	n.a.	n.a.	9.2	2.4
1047D-7	20.43	0.1223	45.72	32.17	5.836	n.a.	n.a.	9.5	2.1

HANES TEST DATA - FINISHED REFERENCE

Sample No	Ne	St Lth ins	Crses /in	Wales /in	Weight oz/syd	L% 1W+TD	W% 1W+TD	L% 5W+TD	W% 5W+TD
1047D-5	n.a.	n.a.	n.a.	n.a.	n.a.	5.5	2	7	2.6
1047D-6	n.a.	n.a.	n.a.	n.a.	n.a.	5.5	1.9	7	1.9
1047D-7	n.a.	n.a.	n.a.	n.a.	n.a.	5.5	1.3	7	1.9

CI TEST DATA - FINISHED REFERENCE

Sample No	Ne	St Lth ins	Crses /in	Wales /in	Weight oz/syd	L% 1W+TD	W% 1W+TD	L% 5W+TD	W% 5W+TD
1047D-5	n.a.	n.a.	48	33	n.a.	7	1	11	1
1047D-6	n.a.	n.a.	47	33	n.a.	7.5	2	10	2
1047D-7	n.a.	n.a.	46.33	32.33	n.a.	7.5	1.5	9	1

Students t statistic Degrees of Freedom 2

Significance level 95% 4.303 *
 99% 9.925 **
 99.9% 31.598***

Comparison: Greige before wash

	IIC/HANES			IIC/CI		
	Mean Diff.	t	r ²	Mean Diff.	t	r ²
Ne	0.4783	2.0723	0.1062	-0.5083	1.1603	0.0610
Run-in	-0.0067	0.0104	0.8178	0.1267	0.1191	0.7740
St.Lgth	0.0000	0.0000	0.8176	0.0001	0.1166	0.7855
CPI	0.5933	1.9994	0.9681	-0.0733	0.1458	0.9681
WPI	-1.0800	7.6656*	0.9471	0.1700	0.7614	0.7128
Weight	-0.1231	1.8120	0.5440	-0.0121	0.1383	0.1274

	HANES/CI		
	Mean Diff.	t	r ²
Ne	-0.9867	3.1191	0.9932
Run-in	0.1333	0.2832	0.9970
St.Lgth	0.0001	0.2540	0.9984
CPI	-0.6667	1.2344	1.000
WPI	1.2500	7.0711*	0.8929
Weight	0.1110	2.5614	0.7994

WPI: IIC measures more wales than Hanes } possibly due to relaxation during
 CI measures more wales than Hanes } transportation

IIC/CI No significant differences

NE: Hanes/CI No statistically significant difference but a mean difference of one cotton count may have practical significance.

Students t statistic Degrees of Freedom 2

Significance level	95%	4.303*
	99%	9.925**
	99.9%	31.598***

Comparison: Greige Reference State

IIC/CI

	<u>Mean Diff.</u>	<u>t</u>	<u>r²</u>
CPI	1.1833	3.7787	0.9687
WPI	-0.2133	0.9492	0.1504

CPI: No statistically significant difference between IIC/CI but a mean difference of 1.2 courses/inch has practical significance.

Students t statistic Degrees of Freedom 2

Significance level 95% 4.303*
 99% 9.925**
 99.9% 31.598***

Comparison: Finished Before Wash

	IIC/HANES			IIC/CI		
	Mean Diff.	t	r ²	Mean Diff.	t	r ²
Ne	-	-	-	0.6233	1.0089	0.4286
St.Lgth	-	-	-	-	-	-
CPI	-0.4800	0.7893	0.7420	-0.1467	0.1288	0.9490
WPI	-0.2067	0.8934	0.8482	-0.0400	0.0748	0.0435
Weight	0.1292	1.4763	0.7307	0.0001	12.6047**	1.0000
Width	-0.0100	0.2453	0.9423	0.2000	3.0861	0.8862

	HANES/CI		
	Mean Diff.	t	r ²
Ne	-	-	-
St.Lgth	-	-	-
CPI	0.3333	0.4082	0.9098
WPI	0.1667	0.2265	0.0357
Weight	-0.1210	1.3736	0.7272
Width	0.2100	4.0321	0.9897

Weight: IIC/CI - apparently a very significant difference statistically, but no practical difference, the results are also very highly correlated.

Students t statistic Degrees of Freedom 2

Significance level 95% 4.303*
 99% 9.925**
 99.9% 31.598***

Comparison: Finished Reference State

	IIC/HANES			IIC/CI		
	Mean Diff.	t	r ²	Mean Diff.	t	r ²
CPI	-	-	-	0.3167	1.2565	0.8662
WPI	-	-	-	-0.1300	0.5137	0.8622
L%1W+TD	-	-	-	-	-	-
W%1W+TD	-	-	-	-	-	-
L%5W+TD	-2.2700	15.7207**	0.4808	0.7333	0.8632	0.9231
W%5W+TD	0.0333	0.0693	0.7500	-0.7667	3.0873	0.7500

	HANES/CI		
	Mean Diff.	t	r ²
L%1W+TD	1.8367	9.1814*	1.0000
W%1W+TD	-0.2333	0.4956	0.0174
L%5W+TD	3.0033	4.2262	0.7500
W%5W+TD	-0.8000	1.3242	0.2500

Shrinkage: Significant differences in length shrinkage for 5W+TD between IIC/Hanes, and Hanes/CI for 1W+TD.

Apparently no statistically significant difference between Hanes/CI after 5W+TD but a mean difference of 3% has practical significance.

I I C - STARFISH 84 - MODEL PREDICTIONS

IIC
TABLE 9

Plain Single Jersey - singles, combed ring yarns

18g 22in 1244 needles

Greige

Greige Reference State Dimensions

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Average as knitted				Average Reference dimensions						
Yarn	StLen	C.Len	Tness	Yarn	StLen	Tness	courses	wales	weight	width
Ne	in	in	Fctr	Ne	in	Fctr	/in	/in	oz/sy	in(T)
20.2	0.1230	153.0	17.3	20.7	0.121	17.3	49.4	34.0	6.53	18.3 *
19.6	0.1232	153.3	17.6	20.0	0.122	17.6	49.5	33.7	6.72	18.5 *
19.7	0.1252	155.7	17.2	20.1	0.123	17.3	48.6	33.3	6.58	19.7 *

- NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is $\text{Root}(\text{Tex})/\text{St.Len}$ in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish
 Finished Reference State Dimensions

I I C
 TABLE 10

06-MAR-85 11:14

Average as knitted				Average Reference dimensions							
Yarn Ne	StLen in	C.Len in	Tness Fctr	Yarn Ne	StLen in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	
20.2	0.1230	153.0	17.3	20.9	0.121	17.3	47.5	33.3	6.25	18.7 *	
19.6	0.1232	153.3	17.6	20.3	0.121	17.6	47.7	33.0	6.44	18.9 *	
19.7	0.1252	155.7	17.2	20.4	0.123	17.2	46.8	32.7	6.30	19.0 *	

NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish
 Targets are Finished Length & Width Shrinkages

06-MAR-85 11:14

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
20.2	0.1230	153.0	17.3	43.2	32.7	5.58	19.0	-9.1	-1.8
19.6	0.1232	153.3	17.6	43.3	32.2	5.71	19.3	-9.2	-2.4
19.7	0.1252	155.7	17.2	42.3	32.0	5.58	19.5	-9.5	-2.1

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish
 Targets are Finished Courses & Wales

06-MAR-85 11:15

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
20.2	0.1230	153.0	17.3	43.5	32.9	5.65	18.9	-8.5	-1.2
19.6	0.1232	153.3	17.6	43.2	32.5	5.75	19.1	-9.5	-1.5
19.7	0.1252	155.7	17.2	41.7	31.8	5.47	19.6	-10.7	-2.8

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C - STARFISH 84 - MODEL PREDICTIONS

HANES
TABLE 11

Plain Single Jersey - singles, combed ring yarns
18g 22in 1244 needles
Greige

Greige Reference State Dimensions

07-MAR-85 09:55

Average as knitted				Average Reference dimensions							
Yarn	StLen	C.Len	Tness	Yarn	StLen	Tness	courses	wales	weight	width	
Ne	in	in	Fctr	Ne	in	Fctr	/in	/in	oz/sy	in(T)	
20.4	0.1222	152.0	17.3	20.9	0.121	17.4	49.7	34.2	6.52	18.2	*
20.4	0.1238	154.0	17.1	20.9	0.122	17.2	49.0	33.9	6.44	18.4	*
20.1	0.1254	156.0	17.0	20.6	0.124	17.1	48.4	33.5	6.44	18.6	*

NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is $\text{Root}(\text{Tex})/\text{St.Len}$ in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish
 Finished Reference State Dimensions

HANES
 TABLE 12

06-MAR-85 11:19

Average as knitted				Average Reference dimensions							
Yarn Ne	StLen in	C.Len in	Tness Fctr	Yarn Ne	StLen in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	
20.4	0.1222	152.0	17.3	21.1	0.120	17.3	47.8	33.5	6.23	18.6	*
20.4	0.1238	154.0	17.1	21.1	0.122	17.1	47.1	33.2	6.15	18.8	*
20.1	0.1254	156.0	17.0	20.8	0.123	17.0	46.5	32.8	6.15	19.0	*

NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish

Targets are Finished Length & Width Shrinkages

06-MAR-85 11:19

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
20.4	0.1222	152.0	17.3	44.5	32.6	5.64	19.1	-7.0	-2.6
20.4	0.1238	154.0	17.1	43.8	32.5	5.61	19.1	-7.0	-1.9
20.1	0.1254	156.0	17.0	43.3	32.1	5.61	19.4	-7.0	-1.9

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish

Targets are Finished Courses & Wales

06-MAR-85 11:20

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
20.4	0.1222	152.0	17.3	44.0	33.0	5.65	18.8	-8.0	-1.4
20.4	0.1238	154.0	17.1	42.0	32.0	5.29	19.4	-10.9	-3.5
20.1	0.1254	156.0	17.0	41.0	31.5	5.21	19.7	-11.9	-3.9

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

IIC -STARFISH 84- MODEL PREDICTIONS

CI
TABLE 13

Plain Single Jersey - singles,combed ring yarns
18g 22in 1244 needles

Greige

Greige Reference State Dimensions

07-MAR-85 09:55

Average as knitted				Average Reference dimensions							
Yarn	StLen	C.Len	Tness	Yarn	StLen	Tness	courses	wales	weight	width	
Ne	in	in	Fctr	Ne	in	Fctr	/in	/in	oz/sy	in(T)	
19.6	0.1217	151.4	17.8	20.1	0.120	17.8	50.1	34.0	6.78	18.3	*
19.7	0.1240	154.3	17.4	20.2	0.122	17.4	49.1	33.6	6.63	18.5	*
18.6	0.1260	156.7	17.6	19.0	0.124	17.6	48.5	32.8	6.90	19.0	*

- NB : Shrinkage convention is + for growth, - for contraction
- : Qualities marked with * have unreasonable finishing targets
- : Estimates are given in good faith but without liability
- : Yarn counts are given as Resultant for folded yarns
- : Tightness Factor is $\sqrt{\text{Tex}}/\text{St.Len}$ in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish
 Finished Reference State Dimensions

CI
 TABLE 14

06-MAR-85 11:22

Average as knitted				Average Reference dimensions							
Yarn Ne	StLen in	C.Len in	Tness Fctr	Yarn Ne	StLen in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	
19.6	0.1217	151.4	17.8	20.3	0.120	17.8	48.4	33.3	6.51	18.7	*
19.7	0.1240	154.3	17.4	20.4	0.122	17.4	47.3	32.9	6.35	18.9	*
18.6	0.1260	156.7	17.6	19.3	0.124	17.6	46.9	32.1	6.63	19.4	*

NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish

Targets are Finished Length & Width Shrinkages

06-MAR-85 11:22

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
19.6	0.1217	151.4	17.8	43.0	33.0	5.73	18.9	-11.0	-1.0
19.7	0.1240	154.3	17.4	42.6	32.2	5.60	19.3	-10.0	-2.0
18.6	0.1260	156.7	17.6	42.6	31.8	5.97	19.6	-9.0	-1.0

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

I I C -STARFISH 84- MODEL PREDICTIONS

Plain Single Jersey - singles,combed ring yarns
 18g 22in 1244 needles
 R-Jet95 (medium) + Tubular finish

Targets are Finished Courses & Wales

06-MAR-85 11:23

Average as knitted				Average as delivered				Shrinkage (5 W&T)	
Yarn Ne	StLen in	C.Len in	Tness Fctr	courses /in	wales /in	weight oz/sy	width in(T)	Length %	Width %
19.6	0.1217	151.4	17.8	45.0	32.0	5.82	19.4	-7.0	-3.9
19.7	0.1240	154.3	17.4	43.0	33.0	5.80	18.8	-9.1	+0.3
18.6	0.1260	156.7	17.6	40.0	32.0	5.64	19.4	-14.6	-0.3

NB : Shrinkage convention is + for growth, - for contraction
 : Estimates are given in good faith but without liability
 : Yarn counts are given as Resultant for folded yarns
 : Tightness Factor is Root(Tex)/St.Len in cm

STARFISH COMPARISON

IIC Test Data

Greige Reference

	NE IIC	NE *FISH	D	%D	SL INS IIC	SL INS *FISH	D	%D
1047D-5	20.29	20.7	+0.41	+2.02	0.1193	0.121	0.0017	+1.42
1047D-6	20.02	20.0	-0.2	-0.1	0.1203	0.122	0.0017	+1.41
1047D-7	19.95	20.1	+0.15	+0.75	0.1225	0.123	0.0005	+0.41
\bar{x}				+0.89				+1.08
σ				1.07				0.58

	CPI IIC	CPI *FISH	D	%D	WPI IIC	WPI *FISH	D	%D	Wtoz/yd IIC	Wtoz/yd *FISH	D	%D
1047D-5	51.31	49.4	-1.91	-3.72	33.36	34.0	+0.64	+1.92	6.9006	6.53	-0.3706	-5.37
1047D-6	50.46	49.5	-0.96	-1.90	33.44	33.7	+0.26	+0.78	6.7473	6.72	-0.0273	-0.41
1047D-7	48.01	48.6	+0.59	+1.23	32.85	33.3	+0.45	+1.37	6.4671	6.58	+0.1129	+1.75
\bar{x}				-1.46				+1.36				-1.34
σ				2.50				0.57				3.65

Finished Reference R-95

	NE IIC	NE *FISH	D	%D	SL INS IIC	SL INS *FISH	D	%D
1047D-5	20.5	20.9	+0.4	+1.95	0.1181	0.121	+0.0029	+2.46
1047D-6	20.29	20.3	+0.01	+0.05	0.1196	0.121	+0.0014	+1.17
1047D-7	20.43	20.4	-0.03	-0.15	0.1223	0.123	+0.0007	+0.57
\bar{x}				+0.62				+1.4
σ				1.16				0.97

	CPI IIC	CPI *FISH	D	%D	WPI IIC	WPI *FISH	D	%D	Wtoz/yd IIC	Wtoz/yd *FISH	D	%D
1047D-5	47.58	47.5	-0.08	-0.17	33.53	33.3	-0.23	-0.69	6.1929	6.25	+0.0571	+0.92
1047D-6	47.08	47.7	+0.62	+1.32	33.02	33.0	-0.02	-0.06	6.1958	6.44	+0.2442	+3.94
1047D-7	45.72	46.8	+1.08	+2.36	32.17	32.7	+0.53	+1.65	5.836	6.30	+0.464	+7.95
\bar{x}				+1.17				+0.3				+4.27
σ				1.27				1.21				3.53

STARFISH COMPARISON

IIC TEST DATA

Finished As Delivered

From Measured Length and Width Shrinkage

	CPI IIC	CPI *FISH	D	D%	WPI IIC	WPI *FISH	D	D%
1047D 5	43.52	43.2	-0.32	-0.74	32.86	32.7	-0.16	-0.49
6	43.18	43.3	+0.12	+0.28	32.51	32.2	-0.31	-0.95
7	41.74	42.3	+0.56	+1.34	31.75	32.0	+0.25	+0.79
\bar{x}				+0.29				-0.22
σ				1.04				0.90

	Wt/ozyd IIC	Wt/ozyd *FISH	D	D%	Wd ins IIC	Wd ins *FISH	D	D%
1047D 5	5.6532	5.58	-0.0732	-1.29	19.13	19.0	-0.13	-0.68
6	5.662	5.71	+0.048	+0.85	19.33	19.3	-0.03	-0.16
7	5.3111	5.58	+0.2689	+5.06	19.57	19.5	-0.07	-0.36
\bar{x}				+1.54				-0.4
σ				3.23				0.26

From Measured Courses and Wales

	Wt/ozyd IIC	Wt/ozyd *FISH	D	D%	Wd ins IIC	Wd ins *FISH	D	D%
1047D 5	5.6532	5.65	-0.0032	-0.06	19.13	18.9	-0.23	-1.20
6	5.662	5.75	+0.088	+1.55	19.33	19.1	-0.23	-1.19
7	5.3111	5.47	+0.1589	+2.99	19.57	19.6	+0.03	+0.15
\bar{x}				+1.49				-0.75
σ				1.53				0.78

	L% IIC	L% *FISH	D	W% IIC	W% *FISH	D
1047D 5	9.1	8.5	-0.6	1.8	1.2	-0.6
6	9.2	9.5	+0.3	2.4	1.5	-0.9
7	9.5	10.7	+1.2	2.1	2.8	+0.7
\bar{x}			+0.48			-0.27
σ			0.65			0.85

STARFISH COMPARISON
HANES TEST DATA

Finished as Delivered

From Measured Length and Width Shrinkage

	CPI H	CPI *FISH	D	%D	WPI H	WPI *FISH	D	%D
1047D 5	44	44.5	+0.5	+1.74	33.0	32.6	-0.4	-1.21
6	42	43.8	+1.8	+4.29	32.0	32.5	+0.5	+1.56
7	41	43.3	+2.3	+5.61	31.5	32.1	+0.6	+1.90
\bar{x}				+3.68				+0.75
σ				2.3				1.71

	Wt/ozyd ² H	Wt/ozyd ² *FISH	D	%D	Wd in H	Wd in *FISH	D	%D
1047D 5	5.775	5.64	-0.135	-2.34	19.125	19.1	-0.025	-0.13
6	5.6713	5.61	-0.0613	-1.08	19.375	19.1	-0.275	-1.42
7	5.5676	5.61	+0.0424	+0.76	19.5	19.4	-0.1	-0.51
\bar{x}				-0.89				-0.69
σ				1.56				0.66

From Measured Courses and Wales

	Wt/ozyd ² H	Wt/ozyd ² *FISH	D	%D	Wd in H	Wd in *FISH	D	%d
1047D 5	5.775	5.65	-0.125	-2.16	19.125	18.8	-0.325	-1.7
6	5.6713	5.29	-0.3813	-6.72	19.375	19.4	+0.025	+0.13
7	5.5676	5.21	-0.3576	-6.42	19.5	19.7	+0.2	+1.03
\bar{x}				-5.1				-0.18
σ				2.55				1.39

	L% H	L% *FISH	D	W% H	W% *FISH	D
1047D 5	7	8	+1.0	2.6	1.4	-1.2
6	7	10.9	+3.9	1.9	3.5	+1.6
7	7	11.9	+4.9	1.9	3.9	+2.0
\bar{x}			+3.27			+0.8
σ			2.03			1.74

STARFISH COMPARISONCI TEST DATAGreige Reference

	CPI CI	CPI *FISH	D	%D	WPI CI	WPI *FISH	D	D%
1047D 5	53	50.1	-2.9	-5.47	33	34	+1.0	+3.03
6	51.33	49.1	-2.23	-4.34	33	33.6	+0.6	+1.79
7	49	48.5	-0.5	-1.02	33	32.8	-0.2	-0.61
\bar{x}				-3.61				+1.40
σ				2.31				1.85

Finished Reference

	CPI CI	CPI *FISH	D	%D	WPI CI	WPI *FISH	D	D%
1047D 5	48	48.4	+0.4	+0.83	33	33.3	+0.3	+0.91
6	47	47.3	+0.3	+0.64	33	32.9	-0.1	-0.30
7	46.33	46.9	+0.57	+1.23	32.33	32.1	-0.23	-0.71
\bar{x}				+0.90				-0.03
σ				0.30				0.84

STARFISH COMPARISON

CI TEST DATA

Finished as Delivered

From Measured Length and Width Shrinkage

	CPI CI	CPI *FISH	D	%D	WPI CI	WPI *FISH	D	%D
1047D 5	45	43	2.0	-4.44	32	33	+1.0	+3.13
6	43	42.6	-0.4	-0.93	33	32.2	-0.8	-2.42
7	40	42.6	+2.6	+6.50	32	31.8	-0.2	-0.63
\bar{x}				+0.38				+0.03
σ				5.59				2.83

	Wtozyd ^d CI	Wtozyd ^a *FISH	D	%D	Wd in CI	Wd in *FISH	D	%D
1047D 5	5.6609	5.73	+0.0691	+1.22	19.25	18.9	-0.35	-1.82
6	5.6713	5.60	-0.0713	-1.26	19.63	19.3	-0.33	-1.68
7	5.3188	5.97	+0.6512	+12.24	19.75	19.6	-0.15	-0.76
\bar{x}				+4.07				-1.42
σ				7.19				0.58

From Measured Courses and Wales

	Wtozyd ^d CI	Wtozyd ^a *FISH	D	%D	Wd in CI	Wd in *FISH	D	%D
1047D 5	5.6609	5.82	+0.1591	+2.81	19.25	19.4	+0.15	+0.78
6	5.6713	5.80	+0.1287	+2.27	19.63	18.8	-0.83	-4.23
7	5.3188	5.64	+0.3212	+6.04	19.75	19.4	-0.35	-1.77
\bar{x}				+3.71				-1.74
σ				2.04				2.51

	L% CI	L% *FISH	D	W% CI	W% *FISH	D
1047D 5	11	7	-4.0	1	3.9	+2.9
6	10	9.1	-0.9	2	+0.3	+2.3
7	9	14.6	+5.6	1	0.3	-0.7
\bar{x}			+0.23			+1.5
σ			4.9			1.93

A P P E N D I X

IIC Test Data
Hanes Test Data
CI Test Data

-ooOoo-

104705 (152)

104706 (154)

104707 (156)

TESTS REQUIRED	19	95%CL	2F	95%CL	39	95%CL	4F	95%CL	59	95%CL	6F	95%CL	95%CL
FABRIC WEIGHT BW	✓ 182.7	1.8	191.7	2.8	179.7	4.5	192.0	3.4	178.0	3.6	180.1	2.0	
G.S.M. AW	✓ 234.0	1.9	210.0	3.8	228.8	1.8	210.1	2.3	219.3	1.6	197.9	1.5	
1/3 CM BW	✓ 62.1	0.2	51.4	0.4	59.5	0.4	51.0	0.6	57.0	0.6	49.3	0.5	
1/3 CM AW	✓ 60.6	0.4	56.2	0.3	59.6	0.4	55.6	0.4	56.7	0.4	54.00	0	
1/3 CM BW	✓ 28.3	0.4	38.8	0.5	29.6	0.5	38.4	0.4	28.9	0.4	37.5	0.4	
1/3 CM AW	✓ 39.4	0.4	39.6	0.4	39.5	0.4	39.0	0.3	38.8	0.3	38.0	0	
KNIT LENGTH BW	✓ 3.125	0.01	3.044	0.01	3.130	0.01	3.085	0.01	3.179	0.01	3.135	0.01	
KNIT LENGTH AW	✓ 3.031	0.01	3.000	0.01	3.055	0.01	3.039	0.01	3.112	0.01	3.106	0.01	
WORST STRENGTH BW	✓ 709.2	24.4	613.8	24.9	686.8	24.3	621.6	21.0	715.5	24.5	659.7	19.7	
KN/m ² AW	✓ 633.0	26.4	608.5	16.8	644.5	27.4	578.8	29.4	702.7	19.9	594.3	20.8	
DISTENSION BW	✓ 18.3	1.7	18.0	0.8	18.7	0.6	18.5	0.4	18.0	0.8	17.5	0.6	
DISTENSION AW	✓ 21.2	0.5	18.9	1.0	20.5	0.3	18.3	29.6	20.3	0.3	18.5	0.7	
SPIRALITY ANGLES BW	✓ 3.57	0.4	4.7	1.4	4.4	0.6	4.3	1.2	2.8	0.5	0.6	2.0	
SPIRALITY ANGLES AW	✓ 9.3	0.7	6.2	0.6	8.8	0.6	6.3	0.3	6.9	0.4	3.9	0.4	
WIDTH BW	✓ 62.1	1.3	46.6	0.5	60.4	1.2	49.1	0.1	61.2	0.8	49.7	0.9	
WIDTH AW	✓ 77.6	12.0	613.0	10.0	792.7	12.6	607.0	7.4	771.1	14.0	602.8	10.5	
THICKNESS BW	✓ 1137.1	9.6	945.2	15.6	1085.4	15.5	956.2	16.2	1079.6	15.1	921.2	9.2	
WORN COUNT BW	✓ 29.24		29.0		30.2		28.8		30.0		28.7		
WORN COUNT AW	✓ 29.1		28.8		29.5		29.1		29.6		28.9		
U.E.S. 9 BW	✓ 353.2	14.6	330.8	16.8	327.1	15.7	323.4	13.7	346.0	15.9	346.1	10.4	
U.E.S. 9 AW	✓ 326.3	17.6	335.4	17.0	320.7	14.6	338.6	18.1	318.6	16.8	334.6	9.5	
EXT BW	✓ 7.7	0.5	7.5	0.4	7.4	0.3	7.3	0.4	7.2	0.2	7.5	0.2	
EXT AW	✓ 6.8	0.3	6.4	0.3	6.8	0.1	6.7	0.2	7.0	0.2	7.0	0.2	

FABRIC DETAILS:

18gS-J 3 GREIGE + 3 FINISHED
20'scc

COMMENTS:

FABRIC FROM COTTON INC FOR INTERLABS TRIAL
KNITTED AT HANES.
GREY YARN TO FOLLOW

% SHRINKAGE

Ref 1109

1047D-5 (152)

1047D-6 (154)

1047D-7 (156)

	19	95%CL	2F	95%CL	39	95%CL	4F	95%CL	59	95%CL	6F	95%CL	95%CL	95%CL
WASH + TUMBLE DRY														
LENGTH														
WIDTH														
1 WASH + 4 RINSES + TUMBLE DRY	0.9	0.8	9.1	0.4	2.3	0.9	9.2	0.4	1.7	0.3	9.5	0.4		
LENGTH														
WIDTH	28.0	1.2	1.8	0.6	24.4	0.5	2.4	0.6	24.7	1.2	2.1	1.1		
WASH + LINE DRY														
LENGTH														
WIDTH														
1 WASH + 4 RINSES + LINE DRY														
LENGTH														
WIDTH														
SIZE TESTED	50CM		50	5	NO. REPS	LINE	50							
	25CM		25				25							

Hanes Printables, Inc.

Post Office Box 15901
Winston-Salem, NC 27103
Telephone 919/727-7711

September 14, 1984

Mr. Brian Jones
Cotton Incorporated
4505 Creedmoor Rd.
Raleigh, N. C. 27612

Dear Brian:

Enclosed are greige and finished samples of 20/1 100% cotton 18 cut jersey fabric knit on a 22" cylinder with 1244 needles. I have attached a chart showing the individual cells with the necessary measurements as well as our lab testing results.

The finishing process was as follows:

- batch for bleaching
- continous bleach (L&L bleach range) at 30 lb/min.
- jet dye (1 port Rotostream) direct dye
- rope squeeze extract 150 ypm
- pad-nonionic softner 75 ypm approximately 90% wet-out
speed 19" exit width 18½"
- dry-belt dryer 320° at 17 ypm, +1% shrinkage in length,
½" width shrinkage (exit 18½")
- compact 9% at 19 3/8" exit width

All three fabrics were finished together at identical settings.

The enclosed cones of yarn are labeled with the tested counts. They were:

H&H	#1	20.64	} 20.09
	#2	19.88	
	#3	19.76	

AVON	#1	20.25	} 20.38
	#2	20.31	
	#3	20.57	

As we discussed, an extractibles test on each should be performed.

I have planned a set of trials utilizing 20/1, 18 cut 22" with a total of 10 cells. I am attempting to define the best manner by which we finish nearest to the reference state at a given finished dimension and yield. Whether the loop size should be minimized in knitting, reduced during drying or at compaction has been a constant question in my mind. The mechanics of yarn interaction and loop distortion at given process points makes this area of research most interesting as well as being perfect data for STARFISH.



HANES PRINTABLES

SAMPLE	YARN	MEASURED YARN SIZE	GREIGE YIELD (OZ/YD ²)	GREIGE CPI X WPI	FINISHED CPI x WPI	FINISHED WIDTH	FINISHED YIELD (LBS/IN ²)	S H R I N K A G E	
								L E N G T H 1 WASH 5 WASH	W I D T H 1 WASH 5 WASH
1047D-5	20/1 Avondale	20.38	5.259 152"run in	53.5 x 23	44 x 33	19.125"	.000557	5.5% 7.0%	2.0% 2.6%
1047D-6	20/1 Avondale	20.38	5.275 154"run in	50.5 x 23.75	42 x 32	19.375"	.000547	5.5% 7.0%	1.9% 1.9%
1047D-7	20/1 H&H	20.10	5.033 156"run in	49 x 23.5	41 x 31.5	19.5"	.000537	5.5% 7.0%	1.3% 1.9%

GREIGE WEIGHT AND CPI X WPI TAKEN AFTER 1/2 HOUR OF RELAXATION IN A NON CONTROLLED ENVIRONMENT.

COTTON INCORPORATED	GREIGE	FINISHED	NE	oz/yd ² Run-in	Greige CPIxWPI	Finished CPIxWPI	Finished Width	Finished Weight lbs/in ²	L E N G T H		W I D T H	
									1	5	1	5
1047D 5 (152)	19.6			5.30 151.4	52 x 24	45 x 32	19.14	.000549	7.0	11.0	1.0	1.0
6 (154)	19.7			5.43 154.3	50 x 25	43 x 33	19.625	.000552	7.5	10.0	2.0	2.0
7 (156)	18.6			5.17 151.7	49 x 25	40 x 32	19.750	.000521	7.5	9.0	1.5	1.0

CI.

Relaxed

HANES 3 FABRICS

154 Yellow 1047D-6
 C W
 47 X 33
 47 X 33
 47 X 33

156 Yellow 1047D-7
 C W
 47 X 32.5
 46 X 32
 46 X 32.5

152 Yellow 1047D-5
 C W
 48 X 33
 48 X 33
 48 X 33

152 Greige 1047D-5
 C W
 53 X 33
 53 X 33
 53 X 33

154 Greige 1047D-6
 C W
 51 X 33
 52 X 33
 51 X 33

156 Greige 1047D-7
 C W
 49 X 33
 49 X 33
 49 X 33