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Spring City 1988
Part 1: White, Single Jersey fabrics

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

Contents

1. Introduction

For some time now, we have been contemplating the theoretical possibility of providing a type of STARFISH system which would be self-calibrating. This means that, within an individual mill, it would be possible to feed the computer with routine in-house quality control data which would be analysed automatically to produce an internal calibration for a STARFISH type prediction model. There would be different models for each individual quality, for each processing route across qualities, and maybe for each individual yarn supplier within and across qualities. The data for each individual quality would be updated periodically from the routine quality control results and new models could be constructed to represent any given set of in-house circumstances whenever necessary.

The theory of the system has been worked out in rough outline. It contains at least three critical assumptions which would have to be checked out experimentally.

1. That the theoretical assumptions which lie behind the so-called Phase 3 STARFISH model are actually valid (within practical experimental limits). The most important of these is that there are a limited number of universal constants which, once they have been accurately determined, can be applied to smooth the experimental data, to shortcut the STARFISH analysis, and to extend it relatively quickly and cheaply into new areas of yarn type, fabric type, and finishing process.
2. That a STARFISH Phase 3 type equation can be built on the basis of data which do not refer to the Reference State. In other words, the universal constants (if they exist) are substantially the same for fabrics in any state of relaxation or, if not quite the same, then at least their dispersion is sufficiently small that the assumption of a constant value results in equations which are not too inaccurate for practical use within a given mill environment.
3. That routine mill quality control data is (or can easily be made to be) sufficiently reliable to serve as input data for a STARFISH type analysis and, furthermore, models developed on the basis of smoothed data are sufficient to make predictions for individual fabric qualities. This last is not only a statistical argument - it is also a question of confidence in the validity of a prediction which may deviate quite significantly from values actually measured in the mill on a given development sample even though it should be a good estimate for the long-term mean values of that same quality were it to be brought into production.

Of course, a self-calibrating model is merely a special case of a model of the more conventional type which is built around a series of STARFISH equations developed out of routine quality control data. This is not a trivial difference in terms of the software programming effort which would be needed to actually implement the self-calibrating system, but it means that the principle which underlies the concept can be tested relatively easily before programming resources need to be committed.

In early 1986, a visit was paid to a company in Gaffney, South Carolina, called Spring City Knitting, which seemed to be an ideal test-bed for evaluating the concept of a model based on routine QC data. For example, they appeared to have pretty good control over their stitch length in knitting, they monitored yarn count routinely, they maintained computerised records of their quality control data which was printed out as monthly averages, and they seemed to be enthusiastic about STARFISH and willing to help with its further development. The only minor drawback at the time, which actually persists to this day, was that the Phase 3 analysis, which is

postulated to be the foundation of the system, had not actually been completed. Nevertheless, the opportunity was too good to miss so they were persuaded to part with about three months of computer records for a limited number of qualities for a preliminary analysis to be made.

The result of this analysis was not unequivocal, but the distinct impression was gained that their in-house quality control testing was producing results which, on average, lay parallel to the typical STARFISH equations with a more or less constant offset. This, if it is true, is an indication that Phase 3 type models can indeed be built on the basis of data from fabrics which are not in the Reference State and it encouraged us to proceed further. During a visit to Spring City in the Summer of 1987, these results were reported and the suggestion was made that a more comprehensive set of data should be analysed. As a result, in early 1988 we received computer printouts covering the monthly summaries for June to December 1987 for a pretty large number of qualities.

This report summarises the analysis which has so far been made on the bleached single jersey qualities from that data set. In the future it is hoped to find time to study the data for at least the dyed single jersey fabrics and hopefully the lx1 ribs also.

2. The Data

The stack of computer printouts and associated information is about two inches thick. It contains data on thirteen different yarns and sixty-five different fabric qualities. Of these, 40 are single jersey, 11 are lx1 rib, and 14 are 2x2 rib. The single jersey qualities use yarn counts ranging from Ne18 to Ne28. The computer summaries are broken down into sizes (i.e. knitting machine diameter) by quality. There are three basic wet processing routes namely Continuous Bleach (CB), or Bleach and Dye, or Scour and Dye. Dyeing is either in a winch (Gaston County) or a jet (Gaston County or Hisaka). Final finishing is always tubular, either via a Compactor or Calender (Heliot), or L&L machine. Drying machines are Tubetex drum or Santex relax drier (just being installed in Summer 87 and probably commissioned by about August or September). A Scholl Subtilo jet was also being installed and the winches were to be scrapped.

For each size and quality, the printouts normally listed the average Whiteness (if white), the Courses per inch (measured with a line grating), the Weight in oz/sq yard, the Length and Width Shrinkages, the actual Finished Width, and the number of samples tested. Occasionally the Burst Strength would also be recorded.

For all of the single jersey qualities, the measured properties were tabulated by hand, recording also the number of samples, the nominal size, and the month. The number of needles and nominal stitch length were extracted from the quality specification sheets and recorded alongside each set of data (the stitch lengths are often slightly different for each machine size within a given quality). Wales per inch were then determined from the measured width and the number of needles.

The white qualities were grouped according to the processing route. For single jersey these were CB/Compact (6 qualities, 166 records), CB/L&L (6 qualities, 90 records), and CB/Calender (one quality, one record). The data for each record were entered into the computer under Datapak for each quality in turn grouped according to size. Within each size, the data were entered in order of the month. Next, the relaxed courses, wales and weight were calculated using the measured values and the shrinkages.

Each record is the monthly average of all samples tested within a given size and quality for a

given month. The average number of samples per record was eight but, for about half of the 257 records the number of samples tested was five or fewer, and three quarters of the records had ten or fewer. The actual frequency distribution for samples per record is given in *Appendix 1* which also contains a summary of the nominal constructions of these qualities as well as the whole of the tabulated data.

Also in this appendix the as-measured and the relaxed courses, wales and weight are shown plotted in the order that they are tabulated - i.e. in ascending sizes and succeeding months - so that any trends within sizes and over time might be spotted. The mean value over the whole quality is shown together with bars which indicate plus and minus 5% from the mean for courses, wales and weight, or plus and minus two percentage points for the shrinkages. These limits were chosen because it was felt that, considering the values are monthly means over several individual test samples, they should all fall within such limits if the knitting, the processing, and the testing procedures are under good control. In fact there are quite a few data points which represent only one or two individual samples so these might occasionally be expected to lie outside the limits but no attempt has been made so far to identify these on the plots (though the number of individuals is given in the tables).

Inspection of the plots in *Appendix 1* leads to the following observations.

1. Courses are much more variable than wales. A fair number of the individual course measurements fall outside the plus and minus 5% lines whereas hardly any of the wale values do. This is probably due to the different methods of measurement. Courses are measured by line gratings, which are only accurate to a single course at best and more likely to two. Since the average course level is around 40, an error of 5% will be common and may not be removed when averaging over small numbers of individuals. Wales on the other hand were derived from the measured width which can easily be measured to within 2%, especially on the wider sizes.
2. Length shrinkage is much more variable than width. This is also not surprising since width shrinkage is determined rather accurately by the finished width, which is under close control, whereas length shrinkage depends on the efficiency of compacting or L&L finishing, which will be subject to more variation. On the whole, the compacted qualities have much lower length shrinkages than the L&L finished ones.
3. In several of the qualities there is a suggestion of a drift in the number of courses per inch over time. This is particularly clear with quality 4893 which also has the greatest number of records as well as the greatest number of samples within each record, and which therefore may be giving the most accurate representation of what is going on.

3 Conventional STARFISH Analysis

One problem with the analysis of routine QC data is that yarn count and stitch length will never be measured on finished fabrics, so that the STARFISH Step 1 coefficients can not be estimated. In general, there are two ways to overcome this problem. Either the required measurements have to be introduced into the QC system or we have to do without Step 1, i.e. the regression equations must be based directly on the grey count and stitch length.

This same problem was considered, of course, in the early days of development of the current STARFISH system. At that time it was decided that it would be necessary to include Step 1

because we wanted to be able to assess the effect of wet processing on count and stitch length separately. However for a self-calibrating system, or even for the less sophisticated type of model considered in this exercise, the elimination of Step 1 has distinct practical advantages. There may also be one crucial disadvantage which is that the universal constants of the Phase 3 model may only be constant with respect to the relaxed stitch length - i.e. when Step 1 is included - especially for drastic processes such as tubular mercerising.

This rather tricky question will obviously have to be thoroughly investigated experimentally but, for this particular exercise we do not actually have any Step 1 coefficients, so we are left with only three options.

1. Assume values for the Step 1 coefficients by reference to similar wet processing routes already in STARFISH.
2. Calculate an approximate value for Cl - the tex coefficient - by comparing measured and calculated weights, and assume a value for C2 - the stitch length coefficient - from STARFISH.
3. Eliminate Step 1 from the analysis.

It was decided to take option 3 for the time being and also to use the whole of the white fabric set as the database for the regression analysis. This was because our previous experience shows that there is not much of an influence, if any, of the final finishing operation, because some of the yarns were severely under-represented when the L&L set was considered separately, and because the results of the next section, where a Phase 3 type approach is taken, show that combination of the two sets is probably justified.

Since the stitch length is nominally identical for all samples within a given size and quality, the data were first averaged within sizes and then converted to metric units.

The grey tex values to be used were obtained by averaging the supplied Ne test results over the appropriate time period and over yarn suppliers. For a given nominal yarn count, the same value for tex was taken throughout, even though different yarn suppliers will often have been used for different qualities and even though the yarn count did vary slightly over time. In fact the amount of variation in yarn count over time and between suppliers was not all that much and the amount of extra variation introduced by taking a grand mean could not have been very great.

In the case of the stitch length we have no way of knowing how closely the nominal values were actually represented in the knitted fabrics, although judging by what we saw during our visit to the production site, it seems that they do take a fair amount of care to ensure good control over the course length using electronic monitoring devices on a daily basis.

The standard STARFISH multiple linear regression analysis was applied to the values for relaxed courses and wales as functions of the reciprocal of grey nominal stitch length and the square root of the measured grey tex.

The coefficients which were found for these equations are given below.

	Courses		**Wales**
C3	-3.834	**C6**	6.503
C4	5.604	**C7**	3.059

C5	0.669	**C8**	-0.630

The data used for the STARFISH analysis, and some plots of the resulting curves against those data are given in *Appendix 2*. Also given in *Appendix 2* are plots of measured courses and wales against those calculated using these regression equations. Inspection of these plots leads to the following conclusions.

1. On the whole, the curves are a pretty good description of the average data across the whole of the count and quality range, both for courses and wales, which suggests that practically useful STARFISH type equations can indeed be deduced from routine QC data.
2. In most cases there is more scatter in the courses than in the wales, so that the latter are predicted more consistently. This was perhaps to be expected from the variation in the original data, as discussed in the previous section. Even though these data are averaged within sizes, the number of samples making up the average is still sometimes very few.
3. Almost all of the predictions are within one course or one wale of the measured mean values, although in a number of cases there are individual data points which seem to be relatively far outside the main cluster. It is not possible to deduce the reason for these discrepancies from the information to hand but the most likely sources would seem to be inaccuracies in the testing lab, or transcription errors in extracting the data from the computer printouts and transferring them into our computer (a tedious and complicated business).

Notwithstanding the scatter and the outliers, there is good reason to believe that it is indeed possible, in principle, to derive practically useful prediction models based purely on in-house QC records, provided that an adequate range of qualities (i.e. a good range of yarn counts within fabric types and process routes) is available.

4 Phase 3 Type Analysis

The Phase 3 model is based on the following general equations.

$$Relaxed\ Courses = Ic + Sc / L \quad [1]$$

$$Relaxed\ Wales = Iw + Sw / L \quad [2]$$

and

$$Ic = Yc + Fc / T \quad [3]$$

$$Iw = Yw + Fw / T \quad [4]$$

where

T	is the reference tex;
L	is the reference stitch length;
Sc, Sw	are universal constants for a given fabric type;
Yc, Yw	are constants which are suspected to be mainly influenced by the yarn type;
Fc, Fw	are constants which are suspected to be mainly influenced by the wet finishing process.

Note that *Ic* and *Iw* are simply the intercepts of the best-fit straight lines through plots of relaxed courses and wales against the reciprocal of relaxed stitch length for a given yarn count; *Sc* and *Sw* are the corresponding slopes.

It should be emphasised that, at the current state of progress with the Phase 3 analysis, the attribution of the yarn characteristics only to the *Y* constants and the wet finishing characteristics only to the *F* constants, though very appealing, is pretty tentative (for example, there is some evidence that the *F* constants are influenced by the twist liveliness of the yarn).

There seems to be a distinct possibility that *Fc* is approximately equal in value and opposite in sign to *Fw* but this has not yet been proved.

Although *Sc* and *Sw* are almost certainly constants and are independent of yarn type and wet process for reference state single jersey, it remains to be proved that corresponding 'universal' constants exist for lx1 rib and interlock, and that they are all independent of the state of relaxation.

Another point to note is that the reciprocal of tex is used in Phase 3 rather than the square root of tex as in the current (Phase 2) model. This is believed to be a result of the structure of the original (CP78) data set which was used to derive the earliest STARFISH equations. In that set, there was not a great range in the tex values and it happened that the square root of tex gave the highest correlation coefficients. Furthermore, it was easy to be persuaded at the time that courses and wales should be directly influenced by the yarn diameter which is adequately modelled by root tex. Our current thinking is that not only yarn diameter but also yarn twist (and fibre type) is implicated and, since the number of turns per unit length is also roughly proportional to the square root of tex, this factor may have to be represented twice - hence the tex is a more likely parameter than its square root.

Whatever the theoretical justification (if any) for the form of the present Phase 3 equations, at the present state of the analysis, there is no doubt that a reciprocal tex parameter is preferred over root tex. Now that the data base has been expanded to a much wider range of yarn count values, we are increasingly finding cases where the Phase 2 model is not adequate at the extremes of tex.

For the present purpose, all that we can do is to act as though the outline equations and assumptions about constants given above are close enough to the truth for practical purposes and see what comes out. This means that the following scheme can be followed.

1. Assume values of *Sc* and *Sw* taken from the current Phase 3 analysis. For single jersey these are 6.6 and 2.2 respectively. There is more confidence attached to the value of *Sc* than to *Sw* because a greater range of samples has been analysed in greater detail for courses than for wales.

2. For each quality in turn calculate the average *Ic* and *Iw* by substituting the measured courses and wales into equations [1] and [2]. These *Ic* and *Iw* values actually represent a single quality / process calibration and can be used, for example, in developing a range of body-fit fabrics (where only the stitch length has to be optimised) or for selecting appropriate finishing targets.

3. For a group of qualities, all having the same wet processing, find the average values for *Yc*, *Yw*, *Fc*, and *Fw* from the relationships between *Ic*, *Iw* and reciprocal tex given in equations

[3] and [4]. This represents a calibration of the wet process and can be used to implement a full Phase 3 type predictive model.

At the outset, the same question has to be raised as was considered at the beginning of the previous section, namely should we attempt to estimate the Step 1 coefficients or should the model be based on direct regressions with the nominal grey values of tex and stitch length. In fact both approaches were used and found to be equally valid although, of course, the *Y* and the *F* constants were somewhat different. Only the approach which includes Step 1 will be reported here simply so that the method can be illustrated. In any actual future Phase 3 calibration exercise it may well be more expedient to use the simpler approach.

First, all the data for bleached fabrics were averaged within sizes and qualities and converted to metric units, the same as for the previous section. Next the relaxed weight was calculated for each row of data using the nominal values for grey tex and stitch length and the relaxed courses and wales. Obviously these are not expected to be the same as the relaxed weights obtained from measured weight and shrinkages, but the ratio of the two weights represents the change in tex caused by wet processing, i.e. it gives directly the *C1* value of Step 1. Therefore the ratio of the weights was averaged over all qualities and sizes to obtain the mean value for *C1*. For the CB/Compact set, this was found to be 0.964. For the CB/L&L set it was 0.946. The corresponding standard STARFISH constant is *C1 = 0.965* so this value was used.

It was then necessary to assume a value for *C2*, the Step 1 stitch length factor. The standard STARFISH Step 1 stitch length factor for bleached fabrics is *C2 = 0.982* so this was used.

Next the *Ic* and *Iw* values were calculated for each size within qualities using the appropriate transforms of equations [1] and [2]. Simple linear regression of *Ic* and *Iw* on reciprocal tex then provides the values for *Yc*, *Yw*, *Fc*, and *Fw*. Since *Ic* and *Iw* are independent of the stitch length, they can now be averaged over sizes within qualities to enable a better comparison of the two main wet processing routes to be made. All of the data are given in *Appendix 3* together with some plots which illustrate the variability in *Ic* and *Iw* within a quality and as a function of reciprocal tex.

In addition, the earlier data set, from 1986, was recalled and a similar analysis was carried out on it with very similar results which are also to be found in *Appendix 3*.

The Phase 3 coefficients which have emerged from this analysis for the various data sets are given below.

Data Set	**Yc**	**Yw**	**Fc**	**Fw**
CB/Compact	-1.245	3.707	-58.7	47.5
CB/L&L	-1.083	2.749	-69.6	80.5
All 1988	-1.777	4.076	-47.9	40.9
1986	-1.744	3.068	-49.7	64.3
All 86 + 88	-1.488	3.323	-56.4	60.3

Inspection of the graphs in *Appendix 3* leads to the following conclusions.

1. There is a very good chance that one may calibrate individual qualities and processes in a given mill purely on the basis of routine QC data, provided that the scatter can be contained by averaging over a good number of samples. Individual sample values are almost certainly much too variable.
2. When a good range of yarn counts is in use, then predictive models of the Phase 3 type can be built with a degree of accuracy which is probably perfectly adequate for the practical industrial situation.
3. When there is not a sufficiently wide range of yarn counts in use within a given fabric type and wet process route, one can still calibrate individual quality/process combinations (using equations [1] and [2]) so that stitch length and finishing targets may be optimised within a quality. (Further work on the Phase 3 principle is likely to show how the *Yc*, *Yw*, *Fc*, and *Fw* values can be deduced from other fabric types and process routes so that an approximate full model can be built on quite skimpy data but that remains in the future.)
4. Although the Phase 3 coefficients given above look rather different for the different data sets it is by no means clear that we are dealing with real differences here. There is a strong suggestion from the graphs that a single relationship applies for all of the bleached fabrics whatever the final finishing process. In addition, there is a very close negative correlation between *Yc* and *Fc*, and between *Yw* and *Fw*. Inspection of the plots of *Yc* against *Fc* and of *Yw* against *Fw* lends some support to the notion that *Fc* is equal in value but opposite in sign to *Fw*. This will be very convenient if it is true, because it means that every calibration of any set of qualities will yield two independent estimates for the Phase 3 'Finishing Factor'.

5 Single Quality Calibration Exercise

To show how an individual quality would be continuously calibrated 'on the run' in a practical situation, we can study the results from one of the qualities in more detail. The quality chosen was 4893 (sizes 16-21) because it contains a good number of samples in every size for every month of the study.

First, the individual data rows were converted to metric units and the corresponding *Ic* and *Iw* values were calculated from equations [1] and [2]. Next the *Ic* and *Iw* values were averaged over sizes but within months, so that the monthly time sequence of *Ic* and *Iw* were available. These were entered into the table at the appropriate locations and used to estimate relaxed courses and wales for each row of data. The monthly *Ic* and *Iw* values were plotted as a function of time and the estimated relaxed courses and wales were compared to the measured values. Relaxed weight was estimated from the estimated relaxed courses and wales and was plotted against measured relaxed weight as well as against weight calculated from the measured relaxed courses and wales.

Note

> *The terminology is getting a bit confused here because we do not actually have any measured values for relaxed courses, wales and weight. In this context, 'measured' means not only those measured values which were extracted from the original computer printouts, but also those values which have been calculated from the measured as delivered values, (e.g. relaxed courses calculated from measured courses and length shrinkage), as well as those which*

have been assumed for relaxed tex and stitch length. 'Estimated' means those values for courses, wales, and weight which have been calculated using the newly derived Phase 3 calibration coefficients. 'Calculated' weight is that found from 'measured' relaxed courses and wales and 'measured' relaxed tex and stitch length.

Finally the monthly *Ic* and *Iw* values were tabulated and a monthly updated mean was calculated, to show how the *Ic* and *Iw* values would be continuously updated in practice. This updated mean is not a simple running mean but is the average of the new monthly value and the previous average. Thus it is heavily weighted towards the historical trend and damps down any violent swings caused by random variation in the monthly data but nevertheless tracks any real changes in the underlying values with only a small drag. All of the data and graphs are given in *Appendix 4*.

Inspection of these graphs leads to the following conclusions.

1. Courses and wales are quite neatly estimated by using the monthly mean *Ic* and *Iw* values. All estimates are within about plus or minus half a unit.
2. There seems to have been a change in some aspect of the production (or the testing) regime around September. This happens to coincide with the time when the Santex drier would have come into regular service but maybe that is coincidental. Whatever the change was, it affected the courses by about 0.5 units of *Ic* (just over 1% in terms of relaxed courses) but the wales were probably unchanged. Unfortunately the time series is not quite long enough to say unequivocally that this change is real but it certainly has the appearance of being so. Even though this particular change was not very large, it is easy to see the advantage of being able to automatically track changes which may be occurring in the production and which may have an influence on the relaxed dimensions of the fabric.
3. The estimated weights are a reasonable model for those actually measured but there is a systematic offset of about 5g (3%). However there is an extremely good correspondence with the calculated weight. This kind of discrepancy between measured and calculated weights is one that we are very familiar with and it is natural therefore to assume that it is to be attributed to testing technique.

6 Conclusions

The results of this preliminary study can only be considered as extremely encouraging. It appears that :-

1. Provided that sufficient samples are taken and averaged, routine quality control data are suitable for calibrating an individual vertically integrated mill. In other words, the STARFISH principle is equally applicable to fabrics which are not in their Reference State (at least under the conditions investigated here).
2. Provided that a sufficient range of yarn counts is in regular use, predictive STARFISH models of the current (Phase 2) generation can be built on the basis of routine quality control data. This means that mill-specific equations can be added to the current standard computer programme without any actual experimental fabric processing - only desk work is required.
3. The Phase 3 approach has received strong support. Using this approach, individual fabric

qualities can be calibrated from routine quality control data and the calibrations can be updated on a monthly basis to take care of any changes in local conditions - for example new finishing equipment or changes in yarn suppliers or changes in testing procedures. Where a sufficient range of yarn counts is in use, a full predictive model can be built which can also be continuously updated.

4. The importance of this type of approach for the commercial viability of the STARFISH system can hardly be exaggerated. It not only enables the system to be accurately installed in suitable mills without (or with negligible) experimental work, and renders the system directly relevant to individual manufacturers, but it also has strong implications for the rationalisation of quality management procedures in the industry. For example, one can easily visualise a quality control system which spends great effort on control of yarn count and stitch length in the knitting room but monitors only the final weight and width of the cloth (all other testing being superfluous except for occasional calibration checks - to make sure that the relaxed dimensions are still as expected and to update the model if necessary).

APPENDIX 1

The Original Data

Fabric quality numbers and nominal constructions for the white fabrics.

Frequency distribution for number of samples per computer record.

Tabulated QC data from the computer printouts

- per month and size;
- averaged over months within sizes;
- averaged over months and sizes within qualities.

Plots of Courses, Wales, Weight, and Shrinkages by month and size.

WHITE QUALITIES

	Quality Number	Nominal Count Ne	Nominal St.Length inch	Number of ~~Samples~~ records
COMPACT	2223	18	0.138	4
	2233	20	0.138	9
	4893	24	0.138	80
	1273	26	0.133	33
	1373	26	0.133	23
	2843	28	0.123	17
L&L	2553	18	0.136	4
	2333	20	0.131	42
	2533	20	0.131	1
	3123	20	0.129	32
	3133	20	0.129	10
	3043	28	0.122	1
CALENDER	3883	28	0.124	1

NB : Number of ~~samples~~ records = No of sizes times number of months sampled within each size.
: For details of machine sizes, number of needles, nominal course length for each size, etc, see quality spec sheets in project file.
: For details of measured yarn counts for different yarn suppliers see test sheets in project file.

FREQUENCY DISTRIBUTION FOR THE NUMBER OF SAMPLES PER COMPUTER RECORD

Class	X	f	f.X	cum f	cum f%
1-5	3	130	390	130	50.6
6-10	8	55	440	185	72.0
11-15	13	28	364	213	82.9
16-20	18	24	432	237	92.2
21-25	23	7	161	244	94.9
26-30	28	7	196	251	97.7
31-35	33	3	99	254	98.8
36-40	38	2	76	256	99.6
41-50	43	1	43	257	100.0
		257	2201		

Mean = 8.6

Half of the records have fewer than five samples

Three quarters have fewer than ten samples

SPRING CITY 1988

BLEACHED FABRICS : AVERAGED WITHIN QUALITIES

	No. Spls	Yarn Ne	StLen in	Measured as-delivered Dimensions CPI	WPI	Weight	%LS	%WS	Relaxed Dimensions CPI	WPI	Weight
CB/COMPACT											
2223 Mean	15	18.3	0.1381	39.2	27.95	5.52	2.83	6	40.35	29.74	6.05
sd	n.a.	n.a.	4.0E-4	0.72	0.43	0.1	1.25	0.7	0.34	0.37	0.09
CV%									0·842	1·24	
2233 Mean	28	20.3	0.138	37.96	28.31	4.81	5.71	4.83	40.26	29.75	5.36
sd	n.a.	n.a.	0.0023	1.11	0.5	0.02	0.92	1.6	1.14	0.55	0.08
									2·83	1·85	
4893 Mean	1097	24.1	0.1367	38.2	29.17	4.19	4.52	5.7	40	30.94	4.66
sd	n.a.	n.a.	0.0017	1.24	0.51	0.1	1.64	1.36	0.89	0.25	0.09
									2·22	0·81	
1273 Mean	142	26	0.1331	38.11	29.03	3.7	4.67	8.69	39.98	31.8	4.25
sd	n.a.	n.a.	2.0E-4	0.68	0.65	0.06	1.41	1.69	0.41	0.34	0.04
									1·02	1·07	
1372 Mean	213	26	134	38.37	29.71	3.84	4.37	6.01	40.12	31.62	4.27
sd	n.a.	n.a.	3.0E-4	0.3	0.45	0.03	1.36	1.49	0.81	0.19	0.06
									2·02	0·60	
2843 Mean	184	28.2	0.1233	42.38	31.56	3.94	3.81	5.98	44.07	33.56	4.35
sd	n.a.	n.a.	9.0E-4	0.74	0.99	0.14	1.63	1.24	0.48	0.67	0.07
									1·09	2·00	
CB/L&L											
2333 Mean	198	20.3	0.1322	38.72	29.83	4.85	7.37	4.85	41.8	31.36	5.5
sd	n.a.	n.a.	1.0E-3	1.27	0.49	0.15	2.27	1.5	0.72	0.55	0.09
									1·72	1·75	
3123 Mean	216	20.3	0.1295	39.6	29.76	4.88	6.33	5.82	42.33	31.6	5.53
sd	n.a.	n.a.	0.0015	1.71	0.51	0.17	2.43	1.32	1.18	0.43	0.1
									2·76	1·36	
3133 Mean	96	20.3	0.1293	41.14	29.71	5.13	6.24	5.53	43.86	31.45	5.8
sd	n.a.	n.a.	0.0014	1.08	0.38	0.05	1	1.4	0.69	0.16	0.07
									1·57	0·51	
2553 Mean	10	18.3	0.1357	39.5	28.72	5.48	4.88	3.55	41.53	29.78	5.98
sd	n.a.	n.a.	2.0E-4	0.58	0.46	0.15	0.85	1.98	0.86	0.33	0.1
									2·07	1·11	
2533 Mean	2	20.3	0.1299	40	29.1	5.05	4.5	7.5	41.88	31.46	5.72
3043	1	26.2	0.1224	38	32.9	3.4	15	8	44.71	35.76	4.35
CB/CALENDER											
3083	1	28.2	0.1242	38	30.9	3.5	9	10.5	41.76	34.53	4.3

CB/Compact is a much better data set

Courses more variable than wales : $\overline{CV\%}$ Relaxed courses 1.82 ± 0.7
wales 1.23 ± 0.5

Compact → better shrinkage than L&L

See page 6.

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CONTINUOUS BLEACH/COMPACT - AVERAGED WITHIN SIZES

	SIZE	No.	Yarn	StLen	Measured as-delivered Dimensions						Relaxed Dimensions		
	in	Spls	Ne	in	CPI	WPI	Weight	Width	%LS	%WS	CPI	WPI	Weight
QUALITY 2223													
1	15	4	18.3	0.1377	40	27.45	5.63	15.07	1.4	6.5	40.6	29.36	6.1
2	17	3	18.3	0.1385	39	28.2	5.5	17	3.7	6.3	40.5	30.1	6.1
3	18	8	18.3	0.1382	38.6	28.2	5.44	18.06	3.4	5.2	39.96	29.75	5.94
QUALITY 2233													
4	17	2	20.3	0.1385	38.5	27.8	4.8	17.25	7	4	41.4	28.96	5.38
5	19	6	20.3	0.1404	36.3	28.65	4.79	19.29	5.9	2.75	38.58	29.46	5.23
6	21	8	20.3	0.1397	37.35	29	4.8	21.09	5.9	4.55	39.69	30.39	5.35
7	22	8	20.3	0.1348	38.9	28	4.8	21.84	5.25	6.6	41.06	29.98	5.42
8	23	4	20.3	0.1366	38.75	28.1	4.85	23.07	4.5	6.25	40.57	29.98	5.41
QUALITY 4893													
9	16	125	24.1	0.1375	38.18	29.53	4.23	16.25	3.58	5.2	39.61	31.16	4.62
10	17	111	24.1	0.1373	38.13	29.56	4.23	17.26	4.43	4.57	39.9	30.98	4.64
11	18	106	24.1	0.1343	40.5	28.23	4.25	18.07	2.16	8.49	41.39	30.85	4.74
12	19	145	24.1	0.1368	38.63	28.79	4.18	19.17	3	6.8	39.82	30.89	4.62
13	20	186	24.1	0.1372	38.91	28.46	4.18	20.23	2.96	6.9	40.1	30.57	4.62
14	21	116	24.1	0.1373	38.06	28.93	4.16	21.15	5.07	5.81	40.09	30.72	4.65
15	22	122	24.1	0.1366	38.17	29.06	4.22	22.29	4.3	5.79	39.88	30.84	4.69
16	23	11	24.1	0.1362	38.58	29.56	4.36	23.35	2.88	4.78	39.72	31.06	4.71
17	24	74	24.1	0.1373	37.49	29.41	4.14	24.27	4.46	5.23	39.23	31.04	4.57
18	25	12	24.1	0.1389	36.4	29.67	4.06	25.5	7.2	3.82	39.22	30.86	4.55
19	26/1	41	24.1	0.1369	36.97	28.8	4.05	26.28	6.05	6.17	39.38	30.7	4.6
20	26/2	16	24.1	0.1329	39.37	29	4.21	26.1	4.5	7.5	41.23	31.35	4.77
21	27/1	11	24.1	0.1385	35.87	29.85	4.03	27.36	8.15	3.42	39.07	30.91	4.55
22	27/2	1	24.1	0.1342	40	29.9	4.4	27.3	5	5	42.11	31.47	4.88
23	28	20	24.1	0.1385	37.72	28.82	4.22	28.29	4	6.07	39.28	30.69	4.68
QUALITY 1273													
24	10	20	26	0.133	37.08	30.02	3.71	10.4	6.1	7.46	39.48	32.45	4.27
25	11	24	26	0.133	38.95	28.03	3.69	11.14	2.03	11.37	39.75	31.64	4.25
26	12	37	26	0.1333	37.97	28.43	3.58	12.13	4.73	10.1	39.85	31.63	4.18
27	13	31	26	0.1329	38	28.98	3.7	13.11	4.4	9.64	39.75	32.07	4.28
28	14	14	26	0.1329	38.72	29.07	3.75	14.26	4.2	8.05	40.43	31.62	4.26
29	15	10	26	0.1333	38.57	29.27	3.74	15.36	4.97	6.95	40.62	31.46	4.23
30	16	6	26	0.1333	37.5	29.4	3.75	16.32	6.27	7.27	40.01	31.7	4.31
QUALITY 1373													
31	16	5	26	0.1344	38	29.5	3.83	16.26	2	7.3	38.78	31.82	4.22
32	18	35	26	0.1341	38.18	30.3	3.86	18.21	4.64	3.7	40.04	31.47	4.21
33	20	57	26	0.134	38.42	30.05	3.87	20.38	5.47	5.35	40.64	31.75	4.32
34	22	71	26	0.1335	38.78	29.18	3.83	22.22	5.02	6.96	40.81	31.37	4.34
35	24	45	26	0.1338	38.45	29.53	3.79	24.2	4.7	6.73	40.34	31.67	4.26
QUALITY 2843													
36	16	8	28.2	0.1219	41.93	29.73	3.82	16.15	4.4	7.97	43.89	32.31	4.34
37	17	1	28.2	0.1241	43	31.5	4	17.5	4	5.5	44.79	33.33	4.41
38	18	21	28.2	0.1224	42.75	31.4	3.92	18.35	3.5	6.9	44.29	33.73	4.36
39	20	29	28.2	0.1235	42.5	32.1	3.86	20.19	3.95	5.35	44.24	33.92	4.25
40	21	2	28.2	0.1239	43	32.5	4.2	21.25	1	4.5	43.43	34.03	4.44
41	22	43	28.2	0.1239	41.12	32.12	3.83	22.23	6.02	5.67	43.76	34.06	4.33

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CONTINUOUS BLEACH/L&L - AVERAGED WITHIN SIZES

	Size in	No. Spls	Yarn Ne	StLen in	Measured as-delivered Dimensions CPI	WPI	Weight	Width	%LS	%WS	Relaxed Dimensions CPI	WPI	Weight
QUALITY 2333													
1	13	9	20.3	0.1316	40.13	29.23	5.13	13	3.1	5.5	41.39	30.94	5.6
2	14	4	20.3	0.1329	36.5	29.43	4.53	14.00	12	7	41.5	31.65	5.54
3	15	7	20.3	0.1322	37.43	29.93	4.84	15.03	0	4.73	40.69	31.42	5.52
4	16	17	20.3	0.1323	37.4	29.82	4.69	16.09	9.22	4.36	41.19	31.18	5.4
5	17	15	20.3	0.1324	38.3	29.77	4.94	17.12	7.9	4.53	41.58	31.18	5.62
6	18	6	20.3	0.1331	38.43	30.23	4.97	18.27	8.17	1.77	41.9	30.78	5.51
7	19	24	20.3	0.1328	38.02	30.15	4.79	19.12	7.92	2.97	41.3	31.08	5.36
8	20	7	20.3	0.1332	39.8	30.5	5	20.06	5.85	3.35	42.29	31.57	5.5
9	21	35	20.3	0.1327	39.1	30.72	4.75	21.08	8.02	6.7	42.51	32.94	5.53
10	22	43	20.3	0.1296	39.62	29.55	4.83	21.93	7.97	5.92	43.06	31.41	5.58
11	23	8	20.3	0.1326	39	29.85	4.77	23.1	5.4	4.65	41.24	31.31	5.3
12	24	13	20.3	0.1317	38.5	29.7	4.81	24.06	7.93	5.67	41.8	31.49	5.53
13	26	10	20.3	0.131	41.17	28.97	4.96	26.11	4.27	5.93	43.01	30.79	5.51
QUALITY 3123													
14	13	2	20.3	0.1303	42	29.2	5.05	13	1.5	6	42.64	31.06	5.45
15	14	2	20.3	0.1316	38.5	29	4.6	14.3	10	7	42.78	31.18	5.5
16	15	2	20.3	0.13	37	30	4.75	15	8	7.8	40.22	32.54	5.6
17	16	2	20.3	0.1302	37	30	4.65	16	8.8	6.3	40.57	32.02	5.44
18	17	2	20.3	0.1294	40	30	4.9	17	4.3	4.8	41.8	31.51	5.38
19	18	2	20.3	0.1304	40	30.7	5.15	18	6.5	3	42.78	31.65	5.68
20	21	25	20.3	0.1266	41.7	29.18	4.99	20.95	5.18	6.6	43.97	31.25	5.64
21	22	65	20.3	0.1273	40.63	29.63	4.94	21.85	6.4	6.06	43.41	31.54	5.62
22	23	71	20.3	0.1297	39.36	29.99	4.94	23.03	5.3	5.41	42.2	31.71	5.52
23	24	43	20.3	0.1296	39.77	29.88	4.81	23.89	7.33	5.25	42.92	31.54	5.48
QUALITY 3133													
24	21	11	20.3	0.1307	42.1	29.25	5.19	20.93	5.5	6.85	44.54	31.4	5.9
25	22	35	20.3	0.1273	41.67	29.57	5.08	21.92	5.7	6.17	44.18	31.51	5.74
26	23	36	20.3	0.1297	39.63	30.13	5.15	22.91	7.7	3.6	42.94	31.26	5.78
27	24	14	20.3	0.1296	41.15	29.9	5.12	23.87	6.05	5.5	43.8	31.64	5.77
QUALITY 2553													
28	22	2	18.3	0.1358	40	29.3	5.55	22.15	4.5	1.5	41.88	29.75	5.9
29	23	3	18.3	0.1358	39	28.2	5.43	23	4	6	40.63	30	6.02
30	24	3	18.3	0.1355	40	28.8	5.3	24	6	4.2	42.55	30.06	5.89
31	25	2	18.3	0.1359	39	28.6	5.65	25	5	2.5	41.05	29.33	6.1
QUALITY 2533													
32	28	2	20.3	0.1299	40	29.1	5.05	28	4.5	7.5	41.88	31.46	5.72
QUALITY 3043													
33	18	1	28.2	0.1224	38	32.9	3.4	17.5	15	8	44.71	35.76	4.35
QUALITY 3883													
34	21	1	28.2	0.1242	38	30.9	3.5	21	9	10.5	41.76	34.53	4.3

NB : Quality 3883 is CB/Calender

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CONTINUOUS BLEACH/COMPACT

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
QUALITY 2223 : 18 Ne													
Sept	2	15	828	0.1377	40	27.6	5.75	15	-1.5	6.5	39.41	29.52	6.06
Nov	2	15	828	0.1377	40	27.3	5.5	15.15	4.3	6.5	41.8	29.2	6.15
Sept	3	17	960	0.1385	39	28.2	5.5	17	3.7	6.3	40.5	30.1	6.1
Oct	8	18	1020	0.1382	38.6	28.2	5.44	18.06	3.4	5.2	39.96	29.75	5.94
mean				0.138	39.4	27.82	5.55		2.47	6.12	40.42	29.64	6.06
sd				4.0E-4	0.71	0.45	0.14		2.68	0.62	1.02	0.38	0.09
QUALITY 2233 : 20 Ne													
Aug	2	17	960	0.1385	38.5	27.8	4.8	17.25	7	4	41.4	28.96	5.38
Aug	5	19	1104	0.1404	36.6	28.2	4.78	19.58	5.3	2.5	38.65	28.92	5.18
Dec	1	19	1104	0.1404	36	29.1	4.8	19	6.5	3	38.5	30	5.29
Aug	6	21	1224	0.1397	36.2	28.9	4.75	21.18	5.8	3.6	38.43	29.98	5.23
Sept	2	21	1224	0.1397	38.5	29.1	4.85	21	6	5.5	40.96	30.79	5.46
Aug	6	22	1224	0.1348	38.8	28	4.87	21.82	5	5.7	40.84	29.69	5.44
Sept	2	22	1224	0.1348	39	28	4.73	21.87	5.5	7.5	41.27	30.27	5.41
Sept	2	23	1296	0.1366	37.5	28.2	4.65	23	5.5	7	39.68	30.32	5.29
Oct	2	23	1296	0.1366	40	28	5.05	23.15	3.5	5.5	41.45	29.63	5.54
mean				0.1379	37.9	28.37	4.81		5.57	4.92	40.13	29.84	5.36
sd				0.0023	1.39	0.52	0.11		0.99	1.75	1.31	0.62	0.12

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CONTINUOUS BLEACH/COMPACT : QUALITY 4893 (16-21") 24.1NE

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 16													
Jun	20	16	960	0.1375	36.9	29.5	4.08	16.26	3.1	6.5	38.00	31.55	4.5
Jul	20	16	960	0.1375	37.4	29.5	4.13	16.27	4.8	4.6	39.29	30.92	4.55
Aug	24	16	960	0.1375	37.7	29.8	4.16	16.12	4.3	5.3	39.39	31.47	4.59
Sep	16	16	960	0.1375	38.3	29.5	4.3	16.27	1.5	3.4	38.88	30.54	4.52
Nov	26	16	960	0.1375	39.2	29.4	4.33	16.31	4.3	5.4	40.96	31.00	4.70
Dec	11	16	960	0.1375	39.6	29.5	4.36	16.29	3.5	6	41.04	31.38	4.81
SIZE 17													
Jun	26	17	1020	0.1373	37.8	29.5	4.19	17.31	6.8	3.6	40.56	30.6	4.66
Jul	17	17	1020	0.1373	36.9	29.7	4.16	17.18	4.9	6	38.8	31.6	4.65
Aug	19	17	1020	0.1373	37.2	29.8	4.11	17.12	6	3.8	39.57	30.90	4.55
Sep	7	17	1020	0.1373	38.9	29.4	4.4	17.34	3	3.6	40.1	30.5	4.71
Oct	13	17	1020	0.1373	38.9	29.6	4.28	17.25	3	5	40.1	31.16	4.64
Nov	15	17	1020	0.1373	39.1	29.4	4.26	17.33	2	4.8	39.9	30.88	4.57
Dec	14	17	1020	0.1373	38.1	29.5	4.24	17.3	5.3	5.2	40.23	31.12	4.72
SIZE 18													
Jun	27	18	1020	0.1343	39.4	28.1	4.12	18.18	3.9	8.9	41	30.85	4.71
Jul	14	18	1020	0.1343	39.6	28.3	4.19	18.03	2.3	8.4	40.53	30.9	4.68
Aug	13	18	1020	0.1343	39.2	28.3	4.11	18.02	2.3	7.7	40.12	30.66	4.56
Sep	12	18	1020	0.1343	41.8	28.2	4.3	18.00	0.7	9	42.09	30.99	4.76
Oct	12	18	1020	0.1343	39.8	28.4	4.38	17.98	2.9	7	40.99	30.54	4.85
Nov	9	18	1020	0.1343	41.6	28.1	4.33	18.12	2.6	9.1	42.71	30.91	4.89
Dec	19	18	1020	0.1343	42.1	28.2	4.29	18.09	0.4	9.3	42.27	31.09	4.75
SIZE 19													
Jun	38	19	1104	0.1368	37.9	28.7	4.14	19.24	4.2	6.5	39.56	30.7	4.62
Jul	16	19	1104	0.1368	37.3	28.5	4.11	19.38	4.1	5.8	38.89	30.25	4.55
Aug	28	19	1104	0.1368	38.8	28.8	4.16	19.14	3.3	6.8	40.12	30.9	4.62
Sep	12	19	1104	0.1368	39.4	28.8	4.24	19.14	0.2	6.2	39.48	30.7	4.53
Oct	18	19	1104	0.1368	39	28.9	4.22	19.12	3.7	6.7	40.5	30.98	4.7
Nov	18	19	1104	0.1368	39.1	28.9	4.22	19.08	3.2	7	40.39	31.06	4.69
Dec	15	19	1104	0.1368	38.9	28.9	4.15	19.11	2.3	8.6	39.82	31.62	4.65
SIZE 20													
Jun	34	20	1152	0.1372	37.9	28.4	4.12	20.26	3.7	6.6	39.36	30.41	4.58
Jul	24	20	1152	0.1372	37.5	28.5	4.09	20.2	2.5	6.7	38.46	30.55	4.5
Aug	42	20	1152	0.1372	37.8	28.7	4.03	20.07	3.6	7.1	39.21	30.89	4.5
Sep	21	20	1152	0.1372	39.7	28.4	4.25	20.25	0.8	7	40.02	30.54	4.61
Oct	22	20	1152	0.1372	38.7	28.4	4.16	20.27	4.6	7.4	40.57	30.67	4.71
Nov	35	20	1152	0.1372	39.5	28.5	4.24	20.24	4.2	6.1	41.23	30.35	4.71
Dec	8	20	1152	0.1372	41.3	28.3	4.34	20.34	1.3	7.4	41.04	30.56	4.75
SIZE 21													
Jun	29	21	1224	0.1373	37.1	28.8	4.08	21.28	5.3	5.9	39.18	30.61	4.58
Jul	12	21	1224	0.1373	37.9	28.8	4.08	21.22	4	7.5	39.48	31.14	4.59
Aug	24	21	1224	0.1373	37.7	29	4.09	21.07	4.7	5.2	39.56	30.59	4.53
Sep	9	21	1224	0.1373	38.9	29	4.29	21.1	5.9	5.3	41.34	30.62	4.81
Oct	17	21	1224	0.1373	39.1	28.9	4.32	21.15	4.7	4.7	41.03	30.33	4.76
Nov	20	21	1224	0.1373	37.7	28.9	4.12	21.21	6	6.3	40.11	30.84	4.68
Dec	5	21	1224	0.1373	38	29.1	4.12	21.02	4.9	5.8	39.96	30.89	4.6

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CONTINUOUS BLEACH/COMPACT : QUALITY 4893 (22-28")

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 22													
Jun	36	22	1296	0.1366	37	29	4.18	22.34	6	5.6	39.36	30.72	4.71
Jul	16	22	1296	0.1366	38	28.9	4.2	22.41	3.4	5.9	39.34	30.71	4.62
Aug	28	22	1296	0.1366	37.6	29.2	4.18	22.17	4.3	5	39.29	30.74	4.6
Sep	3	22	1296	0.1366	37.7	28.8	4.2	22.53	4.8	5	39.6	30.32	4.64
Oct	15	22	1296	0.1366	38.9	29.1	4.27	22.25	4	5.8	40.52	30.89	4.72
Nov	17	22	1296	0.1366	39.3	29.2	4.35	22.19	3.4	6.2	40.68	31.13	4.8
Dec	15	22	1296	0.1366	38.7	29.2	4.19	22.17	4.2	7	40.4	31.4	4.7
SIZE 23													
Jun	5	23	1380	0.1362	37.4	29.6	4.2	23.34	4.6	4.9	39.2	31.13	4.63
Jul	2	23	1380	0.1362	37.5	29.8	4.15	23.15	1.8	4.5	38.19	31.2	4.43
Oct	1	23	1380	0.1362	38	29.6	4.2	23.3	3	8.5	39.16	32.35	4.73
Nov	1	23	1380	0.1362	39	29	4.4	23.8	4	3	40.63	29.9	4.73
Dec	2	23	1380	0.1362	41	29.8	4.85	23.15	1	3	41.41	30.72	5.05
SIZE 24													
Jun	17	24	1428	0.1373	37.7	28.8	4.18	24.75	3.7	5.7	39.15	30.54	4.6
Jul	3	24	1428	0.1373	36	29.9	4	23.87	5.3	5.8	38.01	31.74	4.48
Aug	17	24	1428	0.1373	36.9	29.6	4.06	24.16	6.4	5.2	39.42	31.22	4.58
Sep	10	24	1428	0.1373	36.9	29.4	4.15	24.28	3.7	3.8	38.32	30.56	4.48
Oct	10	24	1428	0.1373	37	29.6	4.2	24.09	5.8	5.3	39.28	31.26	4.71
Nov	3	24	1428	0.1373	38.3	29.1	4.13	24.5	3.3	4.8	39.61	30.57	4.49
Dec	14	24	1428	0.1373	39.6	29.5	4.25	24.21	3	6	40.82	31.38	4.66
SIZE 25													
Jun	4	25	1512	0.1389	35.8	29.8	4.85	25.38	8.9	3.8	39.3	30.98	4.62
Jul	4	25	1512	0.1389	34.8	29.6	4.83	25.58	7.4	4	37.58	30.83	4.53
Aug	7	25	1512	0.1389	37	29.2	4	25.9	7.5	3	40	30.1	4.46
Oct	2	25	1512	0.1389	38	30.1	4.15	25.15	5	4.5	40	31.52	4.57
SIZE 26													
Jun	14	26	1512	0.1369	36.7	28.9	3.92	26.2	8.8	5.5	40.24	30.58	4.55
Jul	6	26	1512	0.1369	37.7	28.7	4.17	26.37	6.1	5.8	40.15	30.47	4.71
Aug	10	26	1512	0.1369	38.2	28.9	3.96	26.2	5.7	6.6	40.51	30.94	4.5
Sep	11	26	1512	0.1369	35.3	28.7	4.16	26.36	3.6	6.8	36.62	30.79	4.63
Oct	6	26	1512	0.1329	40.2	28.9	4.23	26.2	1.6	8.3	40.85	31.52	4.69
Nov	8	26	1512	0.1329	38.4	29	4.05	26.09	8.1	7.9	41.78	31.49	4.78
Dec	2	26	1512	0.1329	39.5	29.1	4.35	26	3.8	6.3	41.06	31.06	4.83
SIZE 27													
Jun	6	27	1632	0.1385	36.2	29.7	4.07	27.52	6.6	4.5	38.76	31.1	4.56
Sep	1	27	1632	0.1385	35	30.2	4.1	27	7	2.5	37.63	30.97	4.52
Oct	3	27	1632	0.1385	36.3	30.1	4.07	27.13	8.5	3.7	39.67	31.26	4.62
Nov	1	27	1632	0.1385	36	29.4	3.9	27.8	10.5	3	40.22	30.31	4.49
Dec	1	27	1632	0.1342	40	29.9	4.4	27.3	5	5	42.11	31.47	4.88
SIZE 28													
Jun	7	28	1632	0.1385	35.3	28.5	4.14	28.59	5.4	8	37.32	30.98	4.76
Jul	2	28	1632	0.1385	37.5	29.1	4.2	28	5.8	5	39.81	30.63	4.69
Aug	7	28	1632	0.1385	38.3	28.8	4.31	28.3	3.3	5.9	39.61	30.61	4.74
Dec	4	28	1632	0.1385	39.8	28.9	4.23	28.28	1.5	5.4	40.41	30.55	4.54

Note changes in stitch length for sizes 26/27" after October

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CONTINUOUS BLEACH/COMPACT : QUALITY 1273 26Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 10													
Jun	2	10	624	0.133	36	30.3	3.55	10.3	8.3	8	39.26	32.93	4.21
Jul	2	10	624	0.133	36.5	29.3	3.65	10.65	6.5	9.5	39.04	32.38	4.31
Aug	4	10	624	0.133	38.5	29.8	3.88	10.48	5.8	8.7	40.87	32.64	4.51
Oct	8	10	624	0.133	36.1	30.1	3.64	10.38	6.4	3.8	38.57	31.29	4.04
Dec	4	10	624	0.133	38.3	30.6	3.83	10.2	3.5	7.3	39.69	33.01	4.28
SIZE 11													
Jun	4	11	624	0.133	36.3	28.2	3.6	11.08	5	13.3	38.21	32.53	4.37
Jul	4	11	624	0.133	38.8	28	3.73	11.15	1.7	13.2	39.47	32.26	4.37
Aug	6	11	624	0.133	39.8	27.9	3.75	11.18	0.5	11.1	40	31.38	4.24
Oct	4	11	624	0.133	39.5	27.9	3.8	11.2	1.4	8.8	40.06	30.59	4.23
Nov	4	11	624	0.133	38.3	28.2	3.5	11.08	3.3	10.5	39.61	31.51	4.04
Dec	2	11	624	0.133	41	28	3.75	11.15	0.3	11.3	41.12	31.57	4.24
SIZE 12													
Jun	3	12	690	0.1333	39.7	28.5	3.63	12.1	3.8	10.8	41.27	31.95	4.23
Jul	5	12	690	0.1333	37	28.1	3.54	12.28	4.9	11.8	38.91	31.86	4.22
Aug	8	12	690	0.1333	36.9	28.5	3.55	12.1	5.3	9.6	38.97	31.53	4.15
Oct	8	12	690	0.1333	36.3	28.7	3.45	12.01	8.5	9.3	39.67	31.64	4.16
Nov	10	12	690	0.1333	39.6	28.5	3.7	12.09	0.4	9.6	39.76	31.53	4.11
Dec	3	12	690	0.1333	38.3	28.3	3.63	12.2	5.5	9.5	40.53	31.27	4.24
SIZE 13													
Jun	4	13	760	0.1329	37.5	29.1	3.7	13.08	5	10	39.47	32.33	4.33
Jul	3	13	760	0.1329	38	29	3.77	13.1	5.3	9.3	40.13	31.97	4.39
Aug	7	13	760	0.1329	37.4	29	3.63	13.1	5.6	10.1	39.62	32.26	4.28
Oct	7	13	760	0.1329	38	29.1	3.61	13.04	4.1	8.8	39.62	31.91	4.13
Nov	10	13	760	0.1329	39.1	28.7	3.79	13.23	2	10	39.9	31.89	4.3
SIZE 14													
Jun	3	14	828	0.1329	39	28.4	3.77	14.6	4.5	9.3	40.84	31.31	4.35
Aug	5	14	828	0.1329	36.2	29.5	3.5	14.04	10	8.9	40.22	32.38	4.27
Oct	3	14	828	0.1329	39.7	29.4	4.03	14.1	-1	5.5	39.31	31.11	4.22
Dec	3	14	828	0.1329	40	29	3.7	14.3	3.3	8.5	41.37	31.69	4.18
SIZE 15													
Jun	2	15	900	0.1333	37.5	29.4	3.65	15.3	7.5	6.3	40.54	31.38	4.21
Jul	2	15	900	0.1333	39	29.2	3.65	15.4	8	7.5	42.39	31.57	4.29
Aug	2	15	900	0.1333	38.5	29	3.9	15.5	2	8	39.29	31.52	4.33
Oct	4	15	900	0.1333	39.3	29.5	3.75	15.23	2.4	6	40.27	31.38	4.09
SIZE 16													
Jul	2	16	960	0.1333	38	29.1	3.75	16.5	6.8	8	40.77	31.63	4.37
Aug	2	16	960	0.1333	37	29.4	3.7	16.3	7	7	39.78	31.61	4.28
Oct	2	16	960	0.1333	37.5	29.7	3.8	16.15	5	6.8	39.47	31.87	4.29

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CONTINUOUS BLEACH/COMPACT : QUALITY 1373 26Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 16													
Oct	5	16	960	0.1344	38	29.5	3.83	16.26	2	7.3	38.78	31.82	4.22
SIZE 18													
Jun	3	18	1104	0.1341	38	30.1	3.8	18.33	4	5	39.58	31.68	4.17
Aug	12	18	1104	0.1341	37.3	30.3	3.73	18.24	5.9	5.2	39.64	31.96	4.18
Sep	8	18	1104	0.1341	38.4	30.1	3.98	18.34	4.4	3.4	40.17	31.16	4.31
Oct	7	18	1104	0.1341	38.6	30.3	3.99	18.19	4	2.1	40.21	30.95	4.25
Nov	5	18	1104	0.1341	38.6	30.7	3.82	17.96	4.9	2.8	40.59	31.58	4.13
SIZE 20													
Jun	18	20	1224	0.134	37.4	30.2	3.79	20.28	7	5.3	40.22	31.89	4.3
Jul	6	20	1224	0.134	38.2	29.8	3.83	20.52	3.9	5.6	39.75	31.57	4.22
Aug	13	20	1224	0.134	38.5	30.1	3.91	20.36	5.7	5.8	40.83	31.95	4.4
Sep	7	20	1224	0.134	39.1	29.9	4.01	20.5	5.1	4.8	41.2	31.41	4.44
Nov	7	20	1224	0.134	38.6	30.1	3.84	20.34	5.1	4.4	40.67	31.49	4.23
Dec	6	20	1224	0.134	38.7	30.2	3.83	20.27	6	6.2	41.17	32.2	4.34
SIZE 22													
Jun	31	22	1296	0.1335	38.3	29.2	3.81	22.18	6.9	8	41.14	31.74	4.45
Jul	6	22	1296	0.1335	36.7	29.3	3.77	22.15	6.4	7.7	39.21	31.74	4.36
Aug	15	22	1296	0.1335	37.8	29.3	3.71	22.11	7.3	6.6	40.78	31.37	4.28
Sep	14	22	1296	0.1335	39.3	29.2	3.96	22.22	4	3.8	40.94	30.35	4.29
Nov	5	22	1296	0.1335	41.8	28.9	3.92	22.42	0.5	0.7	42.01	31.65	4.32
SIZE 24													
Jun	18	24	1428	0.1338	38.1	29.3	3.69	24.38	4	6.8	39.69	31.44	4.12
Jul	2	24	1428	0.1338	36	29.8	3.5	24	8	8.5	39.13	32.57	4.16
Aug	11	24	1428	0.1338	38.7	29.3	3.76	24.37	3.3	6.8	40.02	31.44	4.17
Sep	10	24	1428	0.1338	37.9	29.4	3.88	24.32	3.9	5	39.44	30.95	4.25
Nov	2	24	1428	0.1338	39	29.8	4.05	24	5.5	6	41.27	31.7	4.56
Dec	2	24	1428	0.1338	41	29.6	3.85	24.15	3.5	7.3	42.49	31.93	4.3

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CONTINUOUS BLEACH/COMPACT : QUALITY 2843 28Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 16													
Jun	2	16	960	0.1219	42.5	30	3.9	16	0.3	9	42.63	32.97	4.3
Jul	2	16	960	0.1219	41	29	3.7	16.55	6.3	8	43.76	31.52	4.29
Aug	4	16	960	0.1219	42.3	30.2	3.85	15.9	6.6	6.9	45.29	32.44	4.43
SIZE 17													
Oct	1	17	1104	0.1241	43	31.5	4	17.5	4	5.5	44.79	33.33	4.41
SIZE 18													
Jun	4	18	1152	0.1224	43	31.4	4.03	18.33	3.4	7.4	44.51	33.91	4.51
Jul	6	18	1152	0.1224	40.8	31.7	3.72	18.18	6	5.6	43.4	33.58	4.19
Aug	9	18	1152	0.1224	43.2	31.2	3.87	18.48	2.3	7.1	44.22	33.58	4.26
Sep	2	18	1152	0.1224	44	31.3	4.05	18.4	2.3	7.5	45.04	33.84	4.48
SIZE 20													
Jun	7	20	1296	0.1235	41.9	31.8	3.83	20.39	5.8	6.5	44.48	34.01	4.35
Aug	19	20	1296	0.1235	41.1	32.3	3.82	20.07	5.5	6.4	43.49	34.51	4.32
Sep	1	20	1296	0.1235	44	31.9	3.9	20.3	1.5	4.5	44.67	33.4	4.15
Nov	2	20	1296	0.1235	43	32.4	3.9	20	3	4	44.33	33.75	4.19
SIZE 21													
Nov	2	21	1380	0.1239	43	32.5	4.2	21.25	1	4.5	43.43	34.03	4.44
SIZE 22													
Jul	5	22	1428	0.1239	40.2	32.1	3.82	22.24	6.6	5	43.04	33.79	4.31
Aug	15	22	1428	0.1239	41.8	32.2	3.78	22.19	5	7	44	34.62	4.28
Sep	19	22	1428	0.1239	41.5	32	3.88	22.32	5.2	4.7	43.78	33.58	4.29
Oct	4	22	1428	0.1239	41	32.2	3.86	22.16	7.3	6	44.23	34.26	4.43

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CONTINUOUS BLEACH/L&L : QUALITY 2333 (13-19") 20Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 13													
Sep	5	13	760	0.1316	37.4	29.1	4.6	13.05	6.3	7	39.91	31.29	5.28
Nov	2	13	760	0.1316	42.5	29.7	5.6	12.8	-1	4.5	42.00	31.1	5.81
Dec	2	13	760	0.1316	40.5	28.9	5.2	13.15	4	5	42.19	30.42	5.7
SIZE 14													
Jun	1	14	828	0.1329	35	29	4.5	14.3	12	7.5	39.77	31.35	5.53
Nov	1	14	828	0.1329	38	30	4.65	13.8	14	5	44.19	31.58	5.69
Dec	2	14	828	0.1329	36.5	29.3	4.45	14.15	10	8.5	40.56	32.02	5.4
SIZE 15													
Jun	1	15	900	0.1322	36	30	4.8	15	8.5	5.5	39.34	31.75	5.55
Sep	4	15	900	0.1322	38.8	29.8	5.02	15.08	5.5	4.7	41.06	31.27	5.57
Nov	2	15	900	0.1322	37.5	30	4.7	15	10	4	41.67	31.25	5.44
SIZE 16													
Jun	1	16	960	0.1323	36	30	4.5	16	13	4	41.38	31.25	5.39
Sep	7	16	960	0.1323	36.7	29.9	4.79	16.03	9.3	4.3	40.46	31.24	5.52
Oct	5	16	960	0.1323	36.8	29.8	4.7	16.1	10.3	4	41.03	31.04	5.46
Nov	2	16	960	0.1323	39.5	29.4	4.75	16.3	6.5	5	42.25	30.95	5.35
Dec	2	16	960	0.1323	38	30	4.7	16	7	4.5	40.86	31.41	5.29
SIZE 17													
Sep	8	17	1020	0.1324	37.6	29.8	5.01	17.09	9.4	4.3	41.5	31.14	5.78
Nov	4	17	1020	0.1324	38.3	29.5	4.88	17.28	7.5	4.3	41.41	30.83	5.51
Dec	3	17	1020	0.1324	39	30	4.93	17	6.8	5	41.85	31.58	5.57
SIZE 18													
Sep	3	18	1104	0.1331	39.3	30.5	5.2	18.1	5.5	2.3	41.59	31.22	5.63
Nov	2	18	1104	0.1331	38	30	4.9	18.4	13	1	43.68	30.3	5.69
Dec	1	18	1104	0.1331	38	30.2	4.8	18.3	6	2	40.43	30.82	5.21
SIZE 19													
Aug	7	19	1152	0.1328	36.9	30	4.8	19.2	7.3	4.7	39.81	31.48	5.43
Sep	4	19	1152	0.1328	38.5	30.4	4.9	18.96	7	2.7	41.4	31.24	5.42
Oct	7	19	1152	0.1328	38	30	4.66	19.22	9	1	41.76	30.3	5.17
Dec	6	19	1152	0.1328	38.7	30.2	4.8	19.1	8.4	3.5	42.25	31.3	5.43

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CONTINUOUS BLEACH/L&L : QUALITY 2333 (20-26") 20Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 20													
Oct	2	20	1224	0.1332	40	30.6	4.95	20	4	5	41.67	32.21	5.43
Dec	5	20	1224	0.1332	39.6	30.4	5.06	20.12	7.7	1.7	42.9	30.93	5.58
SIZE 21													
Sep	4	21	1296	0.1327	37	30.7	4.72	21.12	8.6	4.9	40.48	32.28	5.43
Oct	19	21	1296	0.1327	40.1	30.7	4.76	21.1	7	7.1	43.12	33.05	5.51
Nov	7	21	1296	0.1327	39.1	30.6	4.61	21.16	10.3	7.8	43.59	33.19	5.57
Dec	5	21	1296	0.1327	40.2	30.9	4.9	20.96	6.2	7	42.86	33.23	5.62
SIZE 22													
Aug	2	22	1296	0.1296	39.5	29.8	4.98	21.75	7	5	42.47	31.37	5.64
Oct	22	22	1296	0.1296	40.6	29.5	4.9	22	6.3	5.5	43.33	31.22	5.53
Nov	2	22	1296	0.1296	38	29.7	4.6	21.8	12	6.5	43.18	31.76	5.59
Dec	17	22	1296	0.1296	40.4	29.2	4.83	22.17	6.6	6.7	43.25	31.3	5.54
SIZE 23													
Nov	4	23	1380	0.1326	39	29.9	4.73	23.08	4	4.5	40.63	31.31	5.16
Dec	4	23	1380	0.1326	39	29.8	4.82	23.12	6.8	4.8	41.85	31.3	5.43
SIZE 24													
Oct	7	24	1428	0.1317	39.7	29.7	4.89	24.02	6	5	42.23	31.26	5.48
Nov	4	24	1428	0.1317	39.8	29.8	4.98	24	6.8	4	42.7	31.04	5.57
Dec	2	24	1428	0.1317	36	29.6	4.55	24.15	11	8	40.45	32.17	5.56
SIZE 26													
Sep	6	26	1512	0.131	41.5	28.9	4.98	26.18	2.3	6.3	42.48	30.84	5.44
Nov	2	26	1512	0.131	41.5	28.8	4.95	26.25	4.5	5.5	43.46	30.48	5.48
Dec	2	26	1512	0.131	40.5	29.2	4.95	25.9	6	6	43.09	31.06	5.6

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CONTINUOUS BLEACH/L&L : QUALITY 3123 20Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZES 13-18													
Jul	2	13	760	0.1303	42	29.2	5.05	13	1.5	6	42.64	31.06	5.45
Jul	2	14	828	0.1316	38.5	29	4.6	14.3	10	7	42.78	31.18	5.5
Jul	2	15	900	0.13	37	30	4.75	15	8	7.8	40.22	32.54	5.6
Jul	2	16	960	0.1302	37	30	4.65	16	8.8	6.3	40.57	32.02	5.44
Aug	2	17	1020	0.1294	40	30	4.9	17	4.3	4.8	41.8	31.51	5.38
Aug	2	18	1104	0.1304	40	30.7	5.15	18	6.5	3	42.78	31.65	5.68
SIZE 21													
Jun	3	21	1224	0.1266	44	29.1	5.23	21	1.3	6.3	44.58	31.06	5.66
Jul	3	21	1224	0.1266	40	29.2	4.8	20.93	9.2	7.3	44.05	31.5	5.7
Aug	7	21	1224	0.1266	43.3	29.1	5.04	21	3.5	7	44.87	31.29	5.62
Sep	3	21	1224	0.1266	41.3	29.2	4.9	20.93	4.7	6.3	43.34	31.16	5.49
Nov	4	21	1224	0.1266	40	29.3	4.95	20.88	6.8	5.8	42.92	31.1	5.64
Dec	5	21	1224	0.1266	41.6	29.2	5.02	20.96	5.6	6.9	44.07	31.36	5.71
SIZE 22													
Jun	6	22	1296	0.1273	39.7	29.6	4.8	21.9	10.8	7.5	44.51	32	5.82
Jul	6	22	1296	0.1273	40.7	29.6	5.06	21.87	6.5	5.3	43.53	31.26	5.71
Aug	24	22	1296	0.1273	41.7	29.8	5.18	21.71	4.2	5.9	43.53	31.67	5.75
Sep	13	22	1296	0.1273	40.2	29.7	4.95	21.79	5	6.4	42.32	31.73	5.57
Oct	6	22	1296	0.1273	39.8	29.6	4.85	21.88	7.3	6.3	42.93	31.59	5.58
Nov	3	22	1296	0.1273	40.3	29.5	4.77	21.93	6	6.7	42.87	31.62	5.44
Dec	7	22	1296	0.1273	42	29.6	4.99	21.89	5	4.3	44.21	30.93	5.49
SIZE 23													
Jun	6	23	1380	0.1297	42	29.9	5.03	23.1	4.3	4.5	43.89	31.31	5.5
Jul	13	23	1380	0.1297	40.4	29.9	5.08	23.11	4.7	4.5	42.39	31.31	5.58
Aug	11	23	1380	0.1297	40.6	30.1	4.99	22.96	5.1	4.1	42.78	31.39	5.48
Sep	12	23	1380	0.1297	39.9	30	5.03	23.03	7.8	4.2	43.28	31.32	5.69
Oct	8	23	1380	0.1297	39.4	30.1	4.91	22.95	5.6	6	41.74	32.02	5.53
Nov	17	23	1380	0.1297	39.9	29.9	4.91	23.06	4.9	5.2	41.96	31.54	5.45
Dec	4	23	1380	0.1297	37.5	30	4.65	23	4.7	9.4	39.35	33.11	5.39
SIZE 24													
Jun	3	24	1428	0.1296	40	29.5	4.97	24.17	5.2	4.7	42.19	30.95	5.5
Aug	26	24	1428	0.1296	39.4	29.8	4.92	23.93	7.1	5	42.41	31.37	5.57
Sep	7	24	1428	0.1296	38.9	29.7	4.74	24.04	8.5	5.5	42.51	31.43	5.48
Oct	1	24	1428	0.1296	39	30	4.9	23.8	8.5	5	42.62	31.58	5.64
Nov	4	24	1428	0.1296	41.3	30	5	23.83	5.4	5.5	43.66	31.75	5.59
Dec	2	24	1428	0.1296	40	30.3	4.35	23.55	9.3	5.8	44.1	32.17	5.09

SPRING CITY 1988

CONTINUOUS BLEACH/L&L : QUALITY 3133 20Ne

	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
SIZE 21													
Oct	5	21	1224	0.1307	41	29.4	5.14	20.82	7.4	6.4	44.28	31.41	5.93
Dec	6	21	1224	0.1307	43.2	29.1	5.25	21.04	3.6	7.3	44.81	31.39	5.87
SIZE 22													
Oct	12	22	1296	0.1273	41.1	29.4	5.11	22.01	6.8	5.9	44.1	31.24	5.83
Nov	6	22	1296	0.1273	41.8	29.6	4.98	21.9	5.4	6.3	44.19	31.59	5.62
Dec	17	22	1296	0.1273	42.1	29.7	5.15	21.85	4.9	6.3	44.27	31.7	5.78
SIZE 23													
Oct	11	23	1380	0.1297	39.6	30	5.21	23.01	7.4	2.8	42.76	30.86	5.79
Nov	5	23	1380	0.1297	39	30.4	5.1	22.68	9.4	3.4	43.05	31.47	5.83
Dec	20	23	1380	0.1297	40.3	30	5.13	23.03	6.3	4.6	43.81	31.45	5.74
SIZE 24													
Nov	7	24	1428	0.1296	40.3	29.9	5.11	23.87	6.8	5	43.24	31.47	5.77
Dec	7	24	1428	0.1296	42	29.9	5.13	23.87	5.3	6	44.35	31.81	5.76

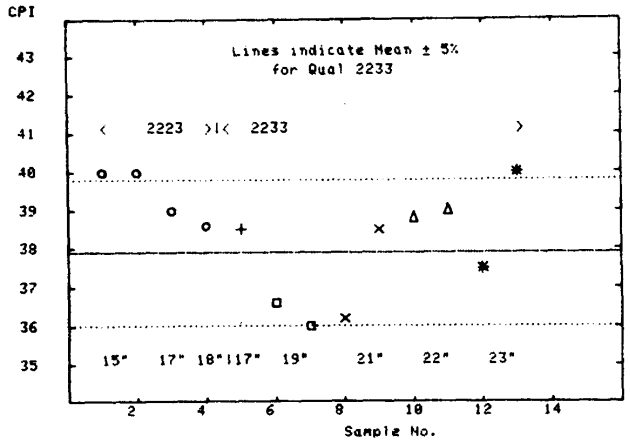
SPRING CITY 1988

CONTINUOUS BLEACH/L&L : MINOR QUALITIES

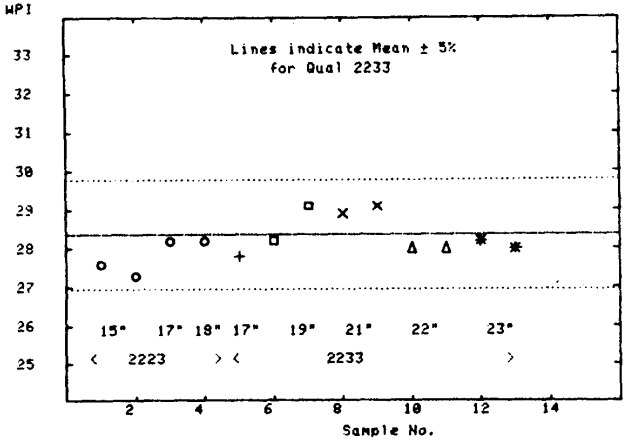
	N	Size in	No Ndls	StLen in	CPI	WPI	Weight	Width	%LS	%WS	Relax CPI	Relax WPI	Relax Weight
QUALITY 2553 : 18Ne													
Oct	2	22	1296	0.1358	40	29.3	5.55	22.15	4.5	1.5	41.88	29.75	5.9
Sep	3	23	1296	0.1358	39	28.2	5.43	23	4	6	40.63	30	6.02
Oct	3	24	1380	0.1355	40	28.8	5.3	24	6	4.2	42.55	30.06	5.89
Sep	2	25	1428	0.1359	39	28.6	5.65	25	5	2.5	41.05	29.33	6.1
QUALITY 2533 : 28Ne													
Aug	2	28	1632	0.1299	40	29.1	5.05	28	4.5	7.5	41.88	31.46	5.72
QUALITY 3043 : 28Ne													
Jun	1	18	1152	0.1224	38	32.9	3.4	17.5	15	8	44.71	35.76	4.35
QUALITY 3883 : 28Ne													
Sep	1	21	1296	0.1242	38	30.9	3.5	21	9	10.5	41.76	34.53	4.3

Note Quality 3883 is Bleach/Calender

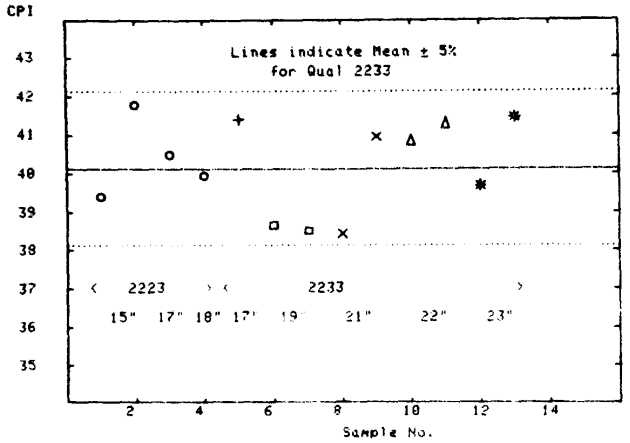
COURSES/INCH AS DELIVERED : QUALITIES 2223/2233 - BLEACHED



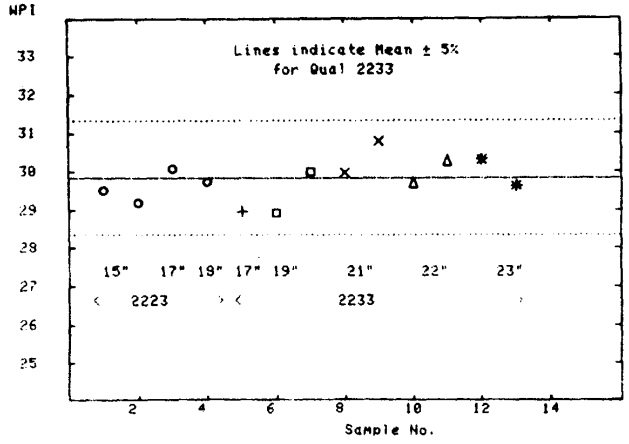
WALES/INCH AS DELIVERED : QUALITIES 2223/2233 - BLEACHED

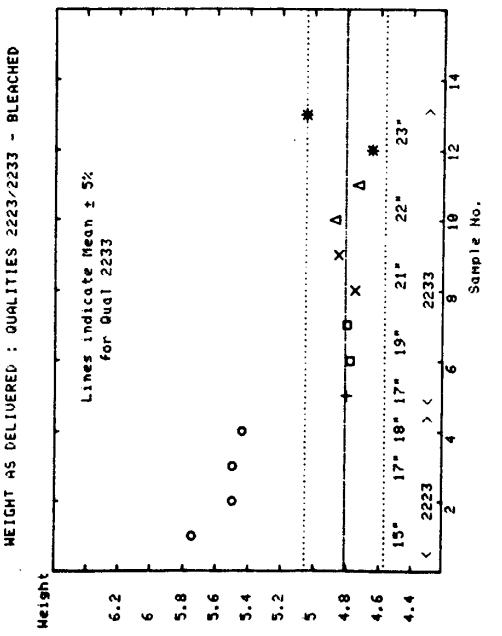


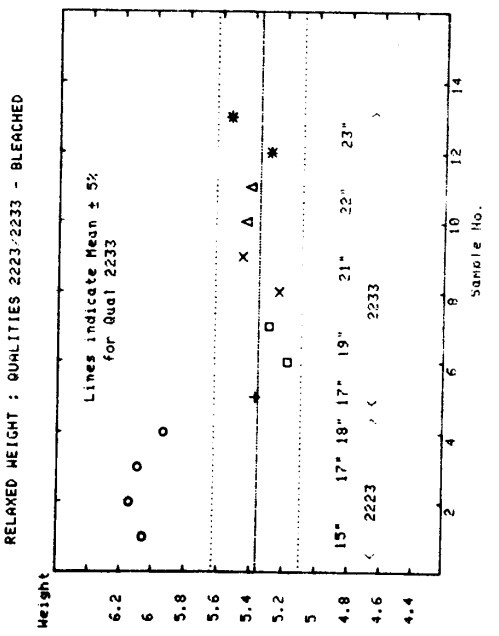
RELAXED COURSES/INCH : QUALITIES 2223/2233 - BLEACHED

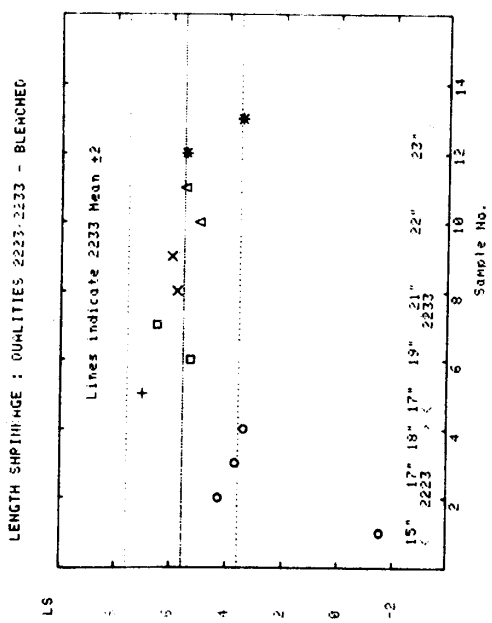


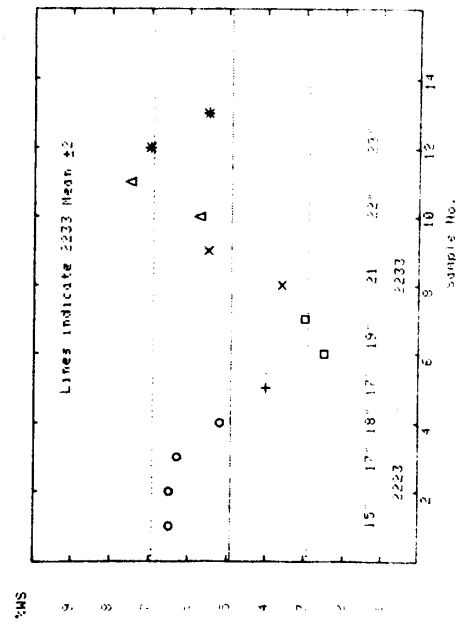
RELAXED WALES/INCH : QUALITIES 2223/2233 - BLEACHED

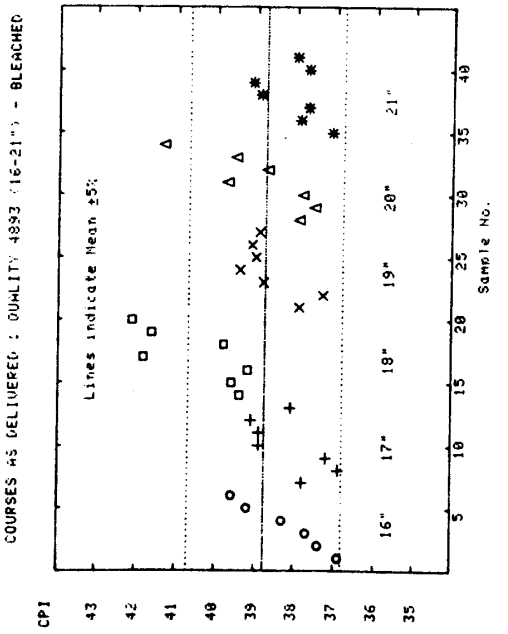


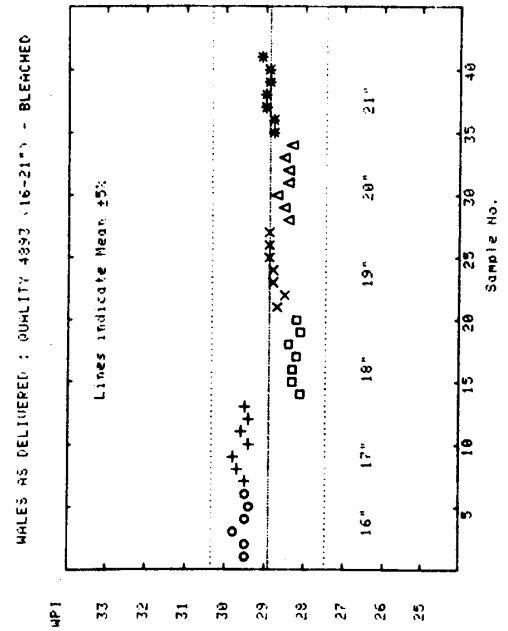

WEIGHT AS DELIVERED : QUALITIES 2223/2233 - BLEACHED
Weight
Lines indicate Mean ± 5%
for Qual 2233
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
15" 17" 18" 17" 19" 21" 22" 23"
2223 2233
2 4 6 8 10 12 14
Sample No.

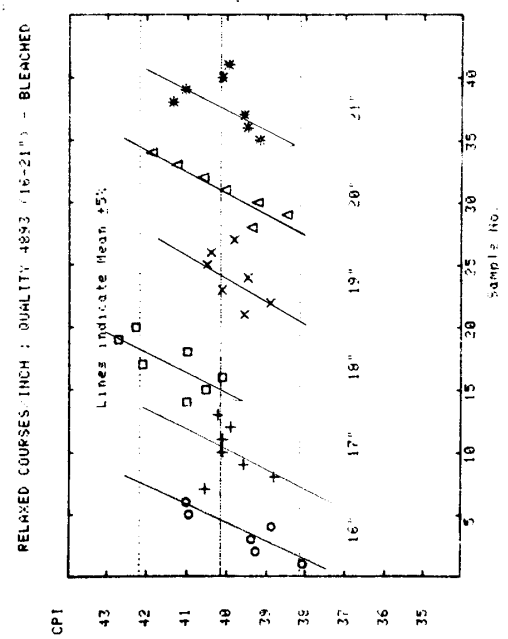

RELAXED WEIGHT : QUALITIES 2223/2233 - BLEACHED
Weight
Lines indicate Mean ± 5%
for Qual 2233
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
15" 17" 18" 17" 19" 21" 22" 23"
2223 2233
2 4 6 8 10 12 14
Sample No.

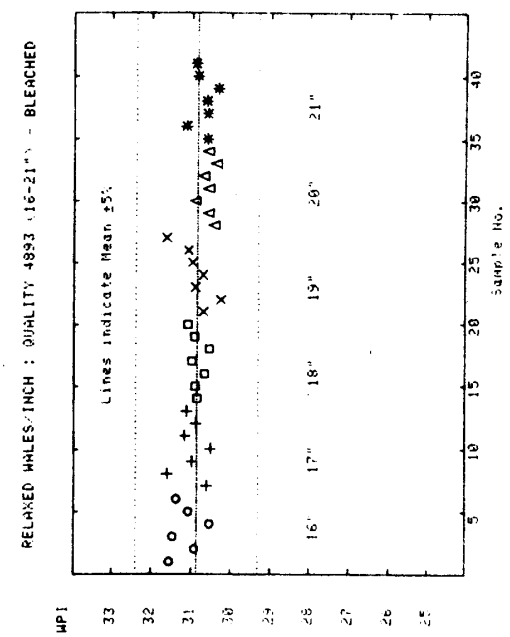

LENGTH SHRINKAGE : QUALITIES 2223/2233 - BLEACHED
LS
Lines indicate 2233 Mean ±2
6
4
2
0
-2
15" 17" 18" 17" 19" 21" 22" 23"
2223 2233
2 4 6 8 10 12 14
Sample No.

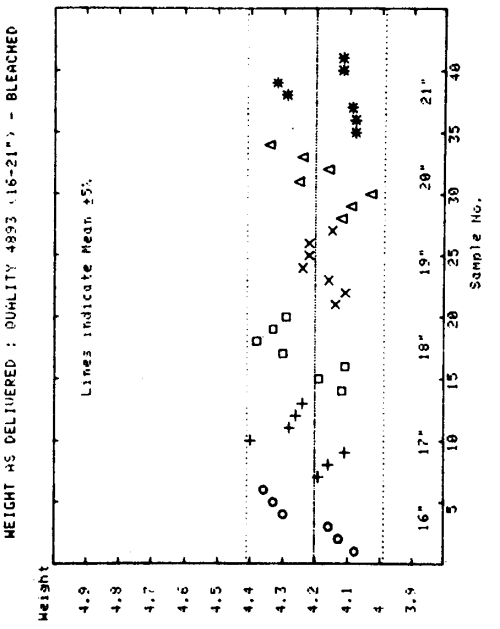

WIDTH SHRINKAGE : QUALITIES 2223/2233 - BLEACHED
%WS
Lines indicate 2233 Mean ±2
15" 17" 18" 17" 19" 21" 22" 23"
2223 2233
2 4 6 8 10 12 14
Sample No.

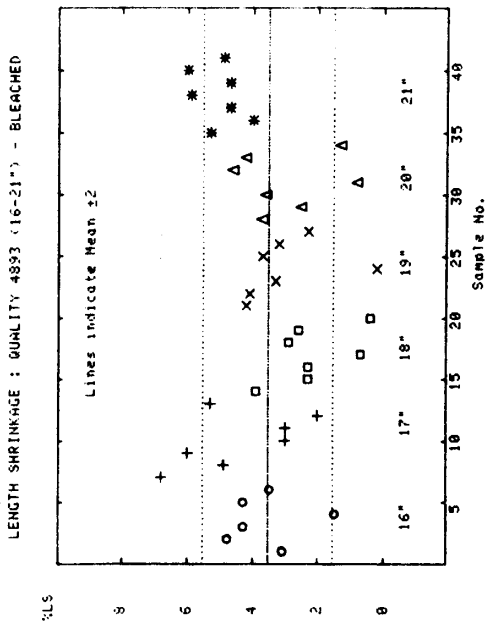

COURSES AS DELIVERED : QUALITY 4893 (16-21") - BLEACHED
Lines Indicate Mean ±5%
CPI
Sample No.
16" 17" 18" 19" 20" 21"

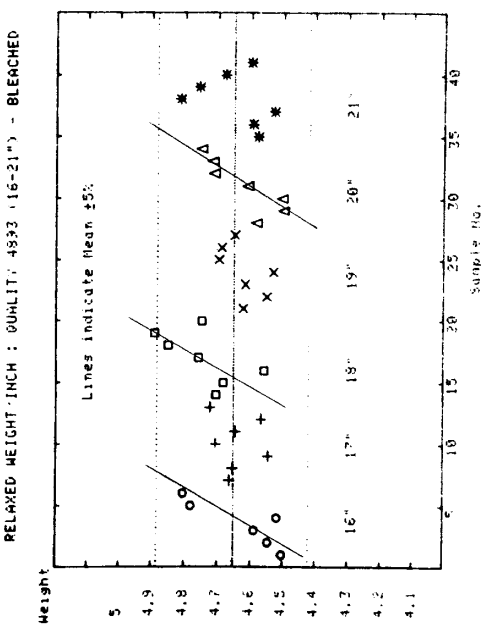

WALES AS DELIVERED : QUALITY 4893 (16-21") - BLEACHED
Lines Indicate Mean ±5%
WPI
Sample No.
16" 17" 18" 19" 20" 21"

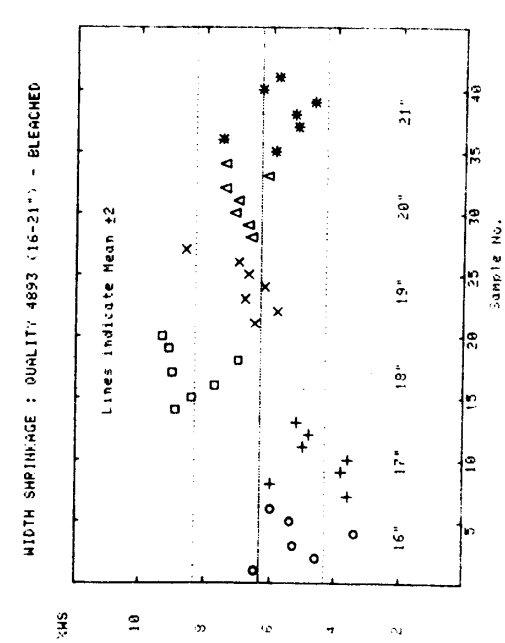

RELAXED COURSES INCH : QUALITY 4893 (16-21") - BLEACHED
Lines Indicate Mean ±5%
CPI
Sample No.

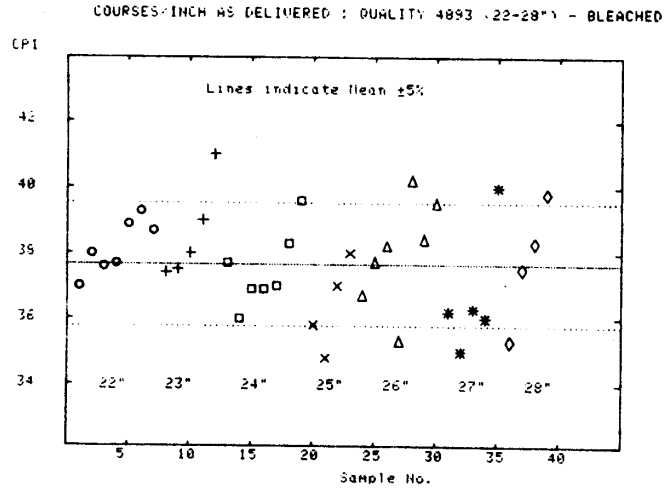

RELAXED WALES/INCH : QUALITY 4893 (16-21") - BLEACHED
Lines Indicate Mean ±5%
WPI
Sample No.
16" 17" 18" 19" 20" 21"

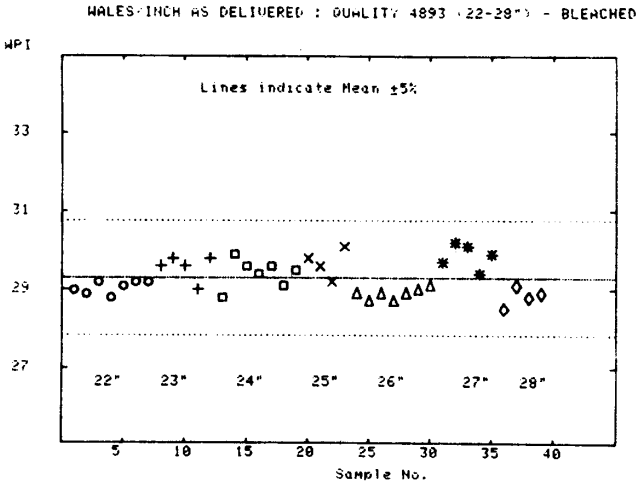

WEIGHT AS DELIVERED : QUALITY 4893 (16-21") - BLEACHED
Lines indicate Mean ±5%
Weight
Sample No.

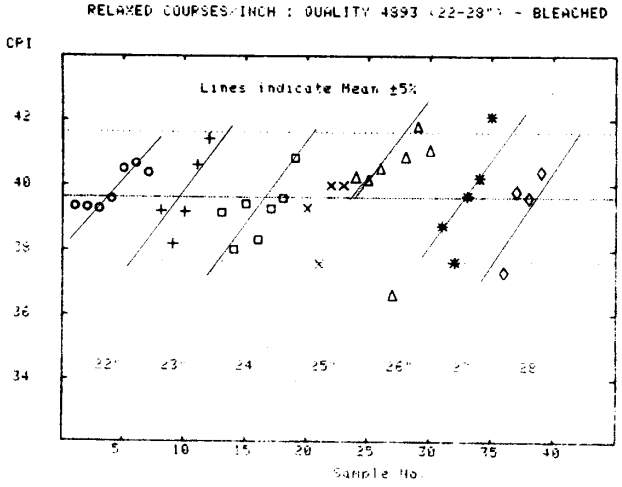

LENGTH SHRINKAGE : QUALITY 4893 (16-21") - BLEACHED
Lines indicate Mean ±2
%LS
Sample No.

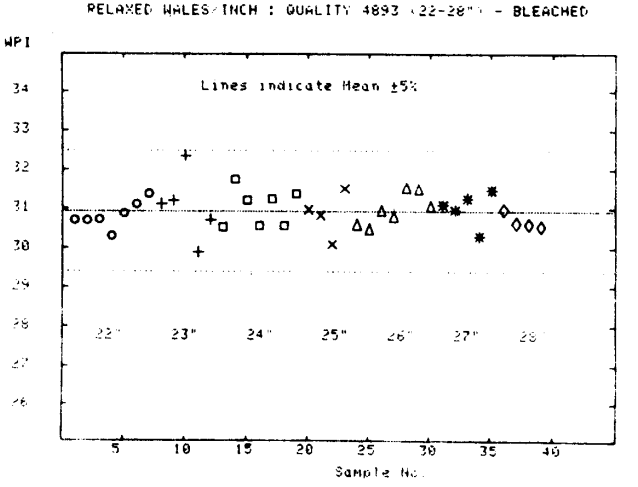

RELAXED WEIGHT/INCH : QUALITY 4893 (16-21") - BLEACHED
Lines indicate Mean ±5%
Weight
Sample No.


WIDTH SHRINKAGE : QUALITY 4893 (16-21") - BLEACHED
Lines indicate Mean ±2
%WS
Sample No.

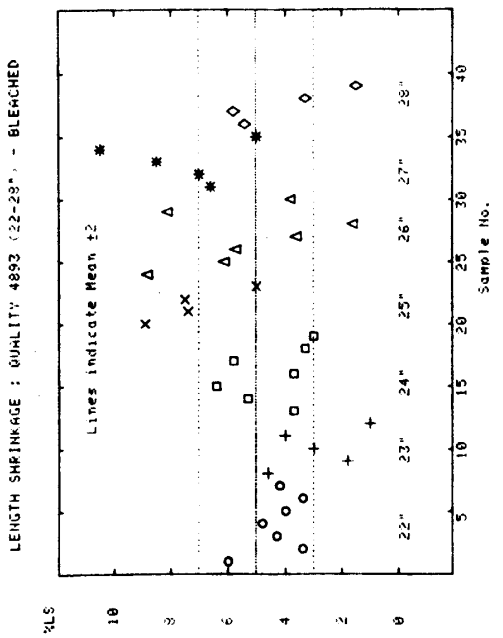

COURSES/INCH AS DELIVERED : QUALITY 4893 (22-28") - BLEACHED
CPI
Lines indicate Mean ±5%
42
40
38
36
34
22"
23"
24"
25"
26"
27"
28"
5
10
15
20
25
30
35
40
Sample No.

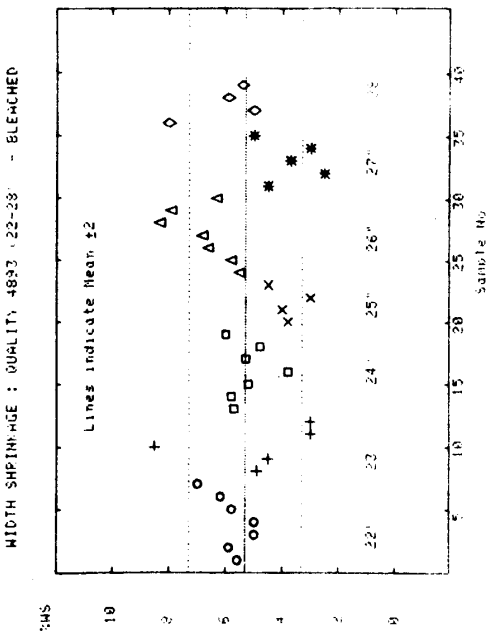

WALES/INCH AS DELIVERED : QUALITY 4893 (22-28") - BLEACHED
WPI
Lines indicate Mean ±5%
33
31
29
27
22"
23"
24"
25"
26"
27"
28"
5
10
15
20
25
30
35
40
Sample No.

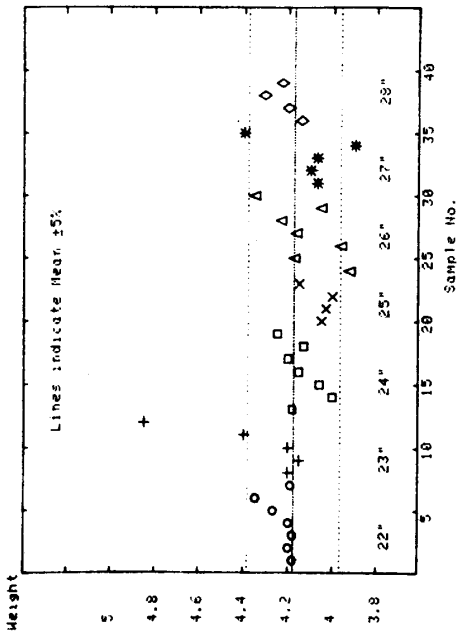

RELAXED COURSES/INCH : QUALITY 4893 (22-28") - BLEACHED
CPI
Lines indicate Mean ±5%
42
40
38
36
34
22"
23"
24"
25"
26"
27"
28"
5
10
15
20
25
30
35
40
Sample No.

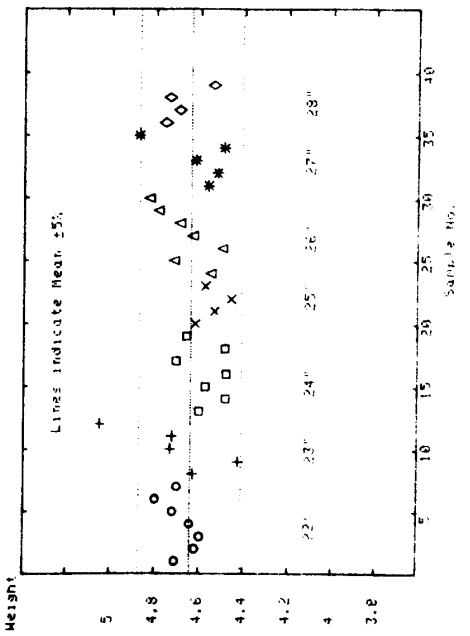

RELAXED WALES/INCH : QUALITY 4893 (22-28") - BLEACHED
WPI
Lines indicate Mean ±5%
34
33
32
31
30
22"
23"
24"
25"
26"
27"
28"
5
10
15
20
25
30
35
40
Sample No.

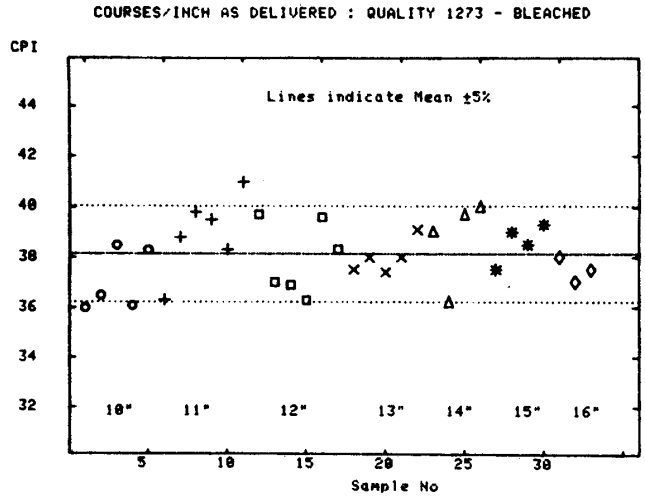
Appendix 1

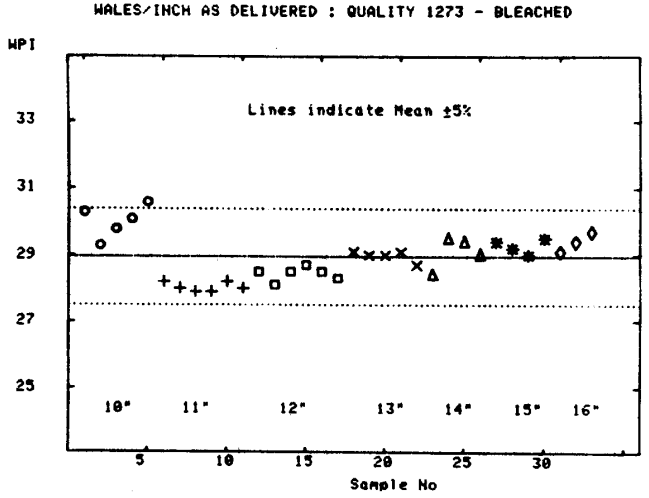

LENGTH SHRINKAGE : QUALITY 4893 (22-28") - BLEACHED
Lines indicate Mean ±2
%LS
Sample No.

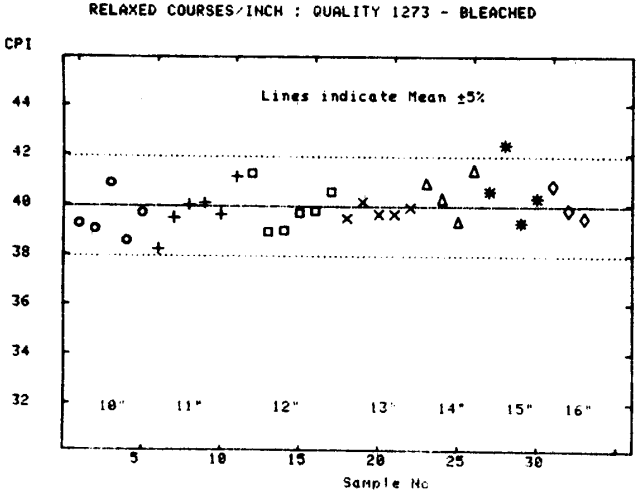

WIDTH SHRINKAGE : QUALITY 4893 (22-28") - BLEACHED
Lines indicate Mean ±2
%WS

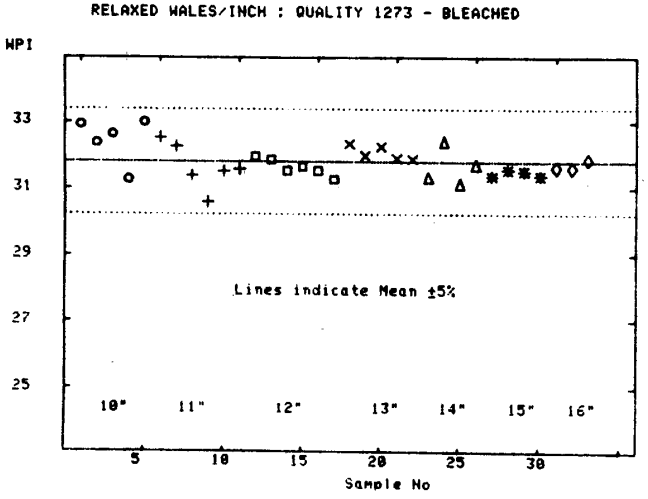

WEIGHT AS DELIVERED : QUALITY 4893 (22-28") - BLEACHED
Lines indicate Mean ±5%
Weight
Sample No.

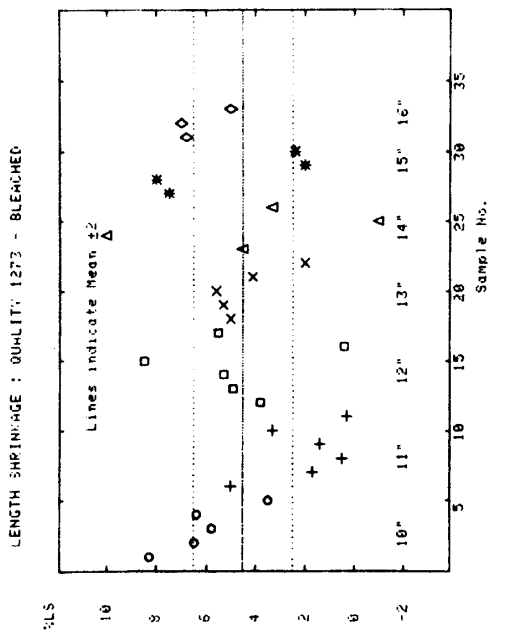

RELAXED WEIGHT : QUALITY 4893 (22-28") - BLEACHED
Lines indicate Mean ±5%
Weight

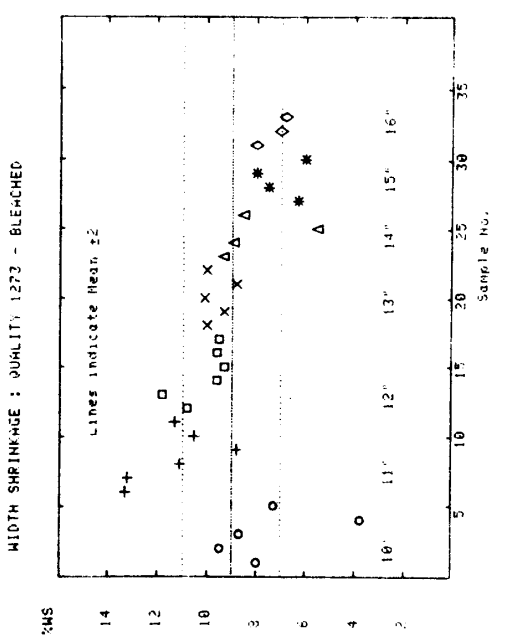

COURSES/INCH AS DELIVERED : QUALITY 1273 - BLEACHED
CPI
Lines indicate Mean ±5%
44
42
40
38
36
34
32
10"
11"
12"
13"
14"
15"
16"
5
10
15
20
25
30
Sample No

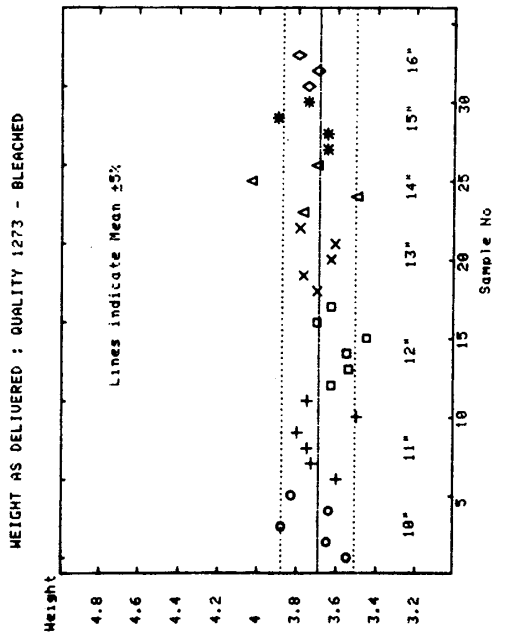

WALES/INCH AS DELIVERED : QUALITY 1273 - BLEACHED
WPI
Lines indicate Mean ±5%
33
31
29
27
25
10"
11"
12"
13"
14"
15"
16"
5
10
15
20
25
30
Sample No

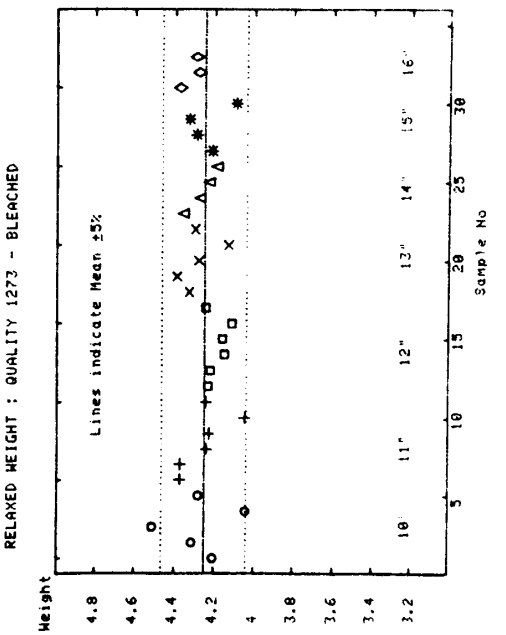

RELAXED COURSES/INCH : QUALITY 1273 - BLEACHED
CPI
Lines indicate Mean ±5%
44
42
40
38
36
34
32
10"
11"
12"
13"
14"
15"
16"
5
10
15
20
25
30
Sample No

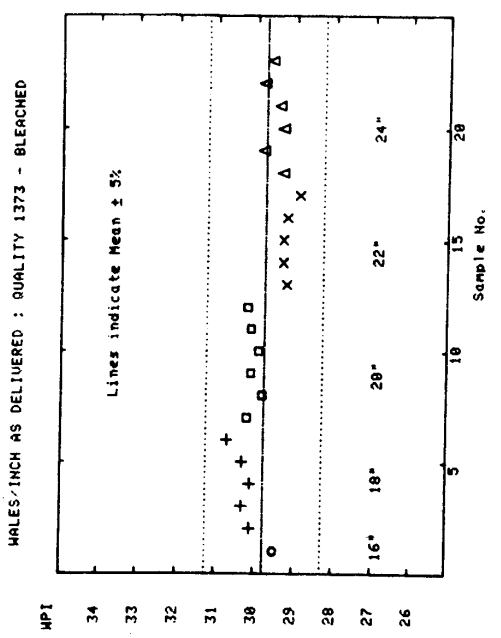

RELAXED WALES/INCH : QUALITY 1273 - BLEACHED
WPI
33
31
29
27
25
Lines indicate Mean ±5%
10"
11"
12"
13"
14"
15"
16"
5
10
15
20
25
30
Sample No

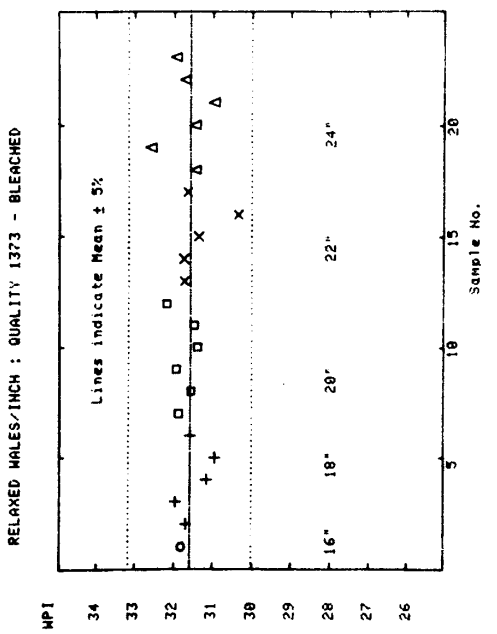

LENGTH SHRINKAGE : QUALITY 1273 - BLEACHED
Lines indicate Mean ±2
%LS
Sample No.

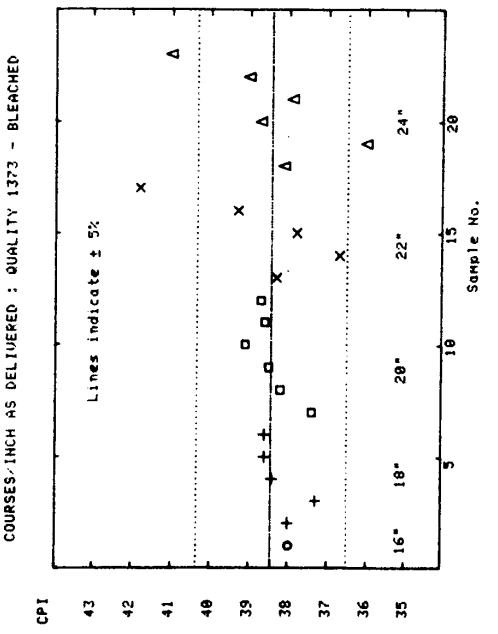

WIDTH SHRINKAGE : QUALITY 1273 - BLEACHED
Lines indicate Mean ±2
%WS
Sample No.

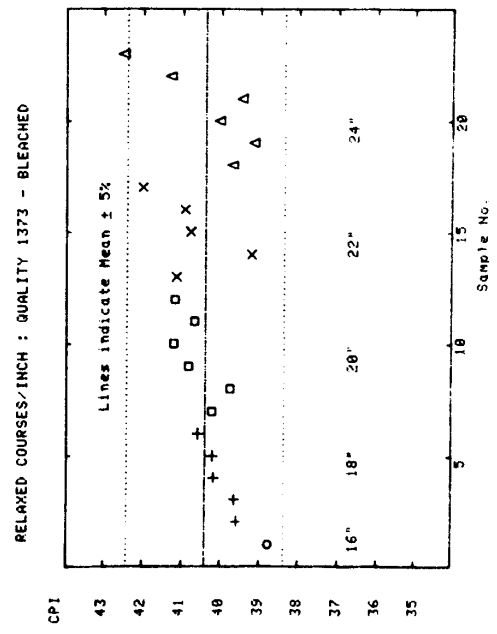

WEIGHT AS DELIVERED : QUALITY 1273 - BLEACHED
Lines indicate Mean ±5%
Weight
Sample No

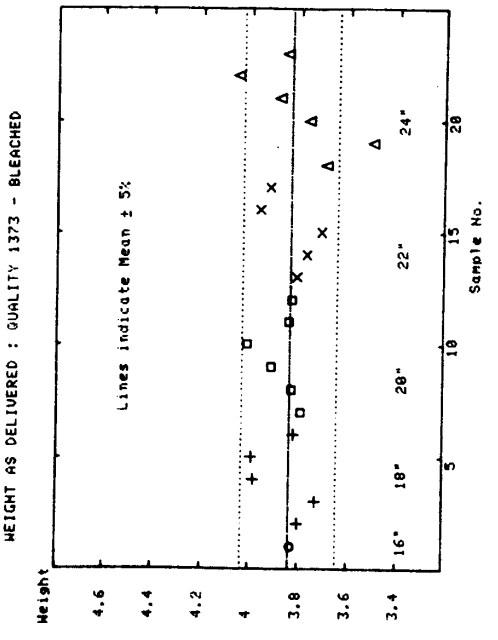

RELAXED WEIGHT : QUALITY 1273 - BLEACHED
Lines indicate Mean ±5%
Weight
Sample No

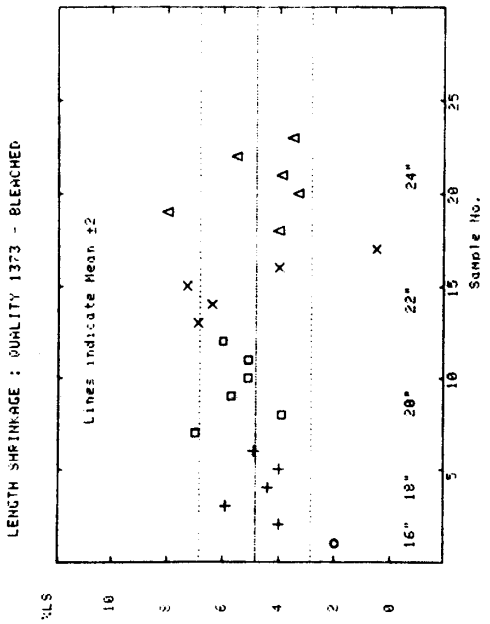

WALES/INCH AS DELIVERED : QUALITY 1373 - BLEACHED
Lines indicate Mean ± 5%
WPI
34
33
32
31
30
29
28
27
26
5
10
15
20
Sample No.
16"
18"
20"
22"
24"

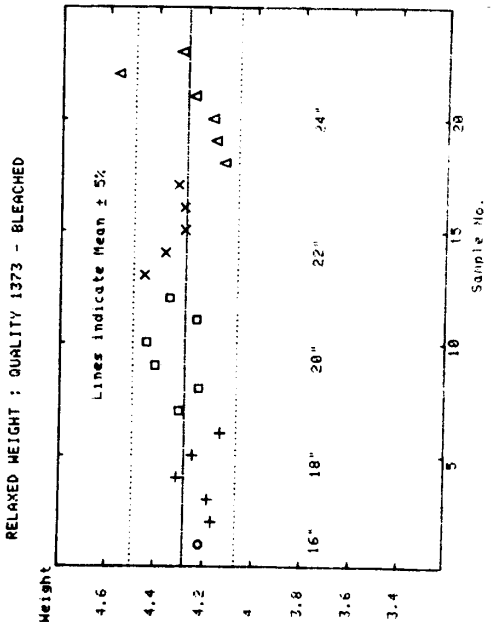

RELAXED WALES/INCH : QUALITY 1373 - BLEACHED
Lines indicate Mean ± 5%
WPI
34
33
32
31
30
29
28
27
26
5
10
15
20
Sample No.
16"
18"
20"
22"
24"

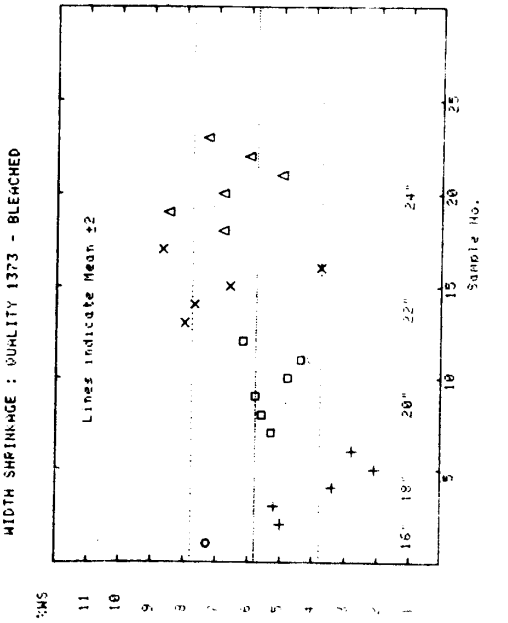

COURSES/INCH AS DELIVERED : QUALITY 1373 - BLEACHED
Lines indicate ± 5%
CPI
43
42
41
40
39
38
37
36
35
5
10
15
20
Sample No.
16"
18"
20"
22"
24"

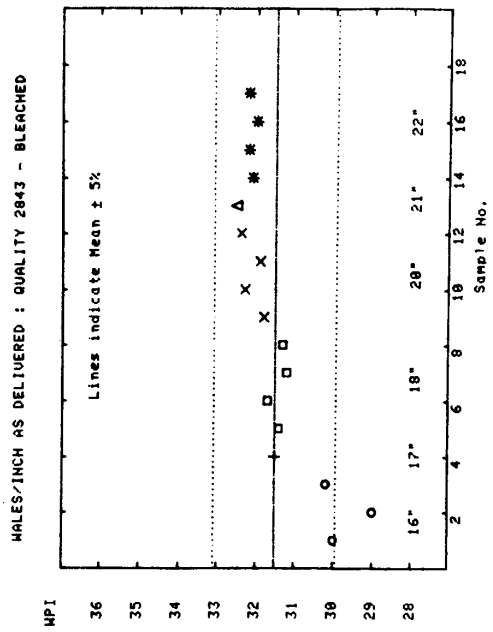

RELAXED COURSES/INCH : QUALITY 1373 - BLEACHED
Lines indicate Mean ± 5%
CPI
43
42
41
40
39
38
37
36
35
5
10
15
20
Sample No.
16"
18"
20"
22"
24"

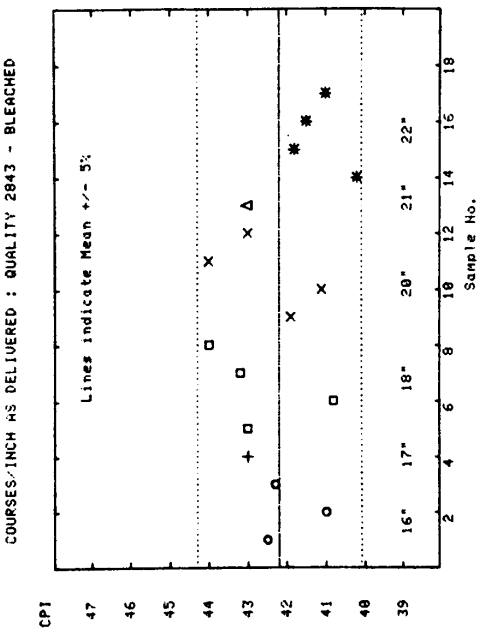

WEIGHT AS DELIVERED : QUALITY 1373 - BLEACHED
Lines indicate Mean ± 5%
Weight
4.6
4.4
4.2
4
3.8
3.6
3.4
16"
18"
20"
22"
24"
5
10
15
20
Sample No.

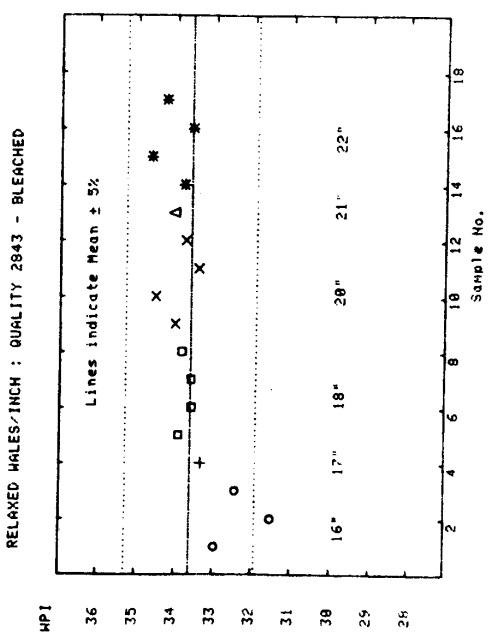

LENGTH SHRINKAGE : QUALITY 1373 - BLEACHED
Lines indicate Mean ±2
%LS
10
8
6
4
2
0
16"
18"
20"
22"
24"
5
10
15
20
25
Sample No.

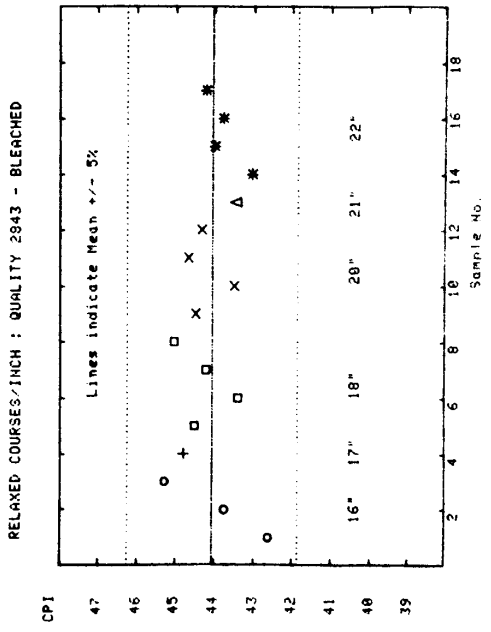

RELAXED WEIGHT : QUALITY 1373 - BLEACHED
Lines indicate Mean ± 5%
Weight
4.6
4.4
4.2
4
3.8
3.6
3.4
16"
18"
20"
22"
24"
5
10
15
20
Sample No.

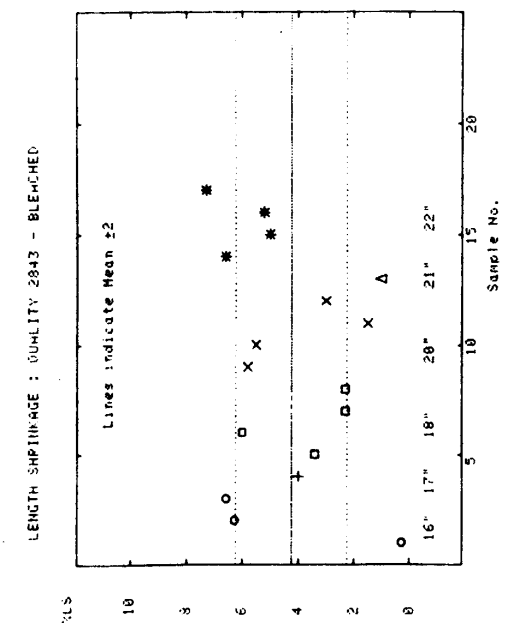

WIDTH SHRINKAGE : QUALITY 1373 - BLEACHED
Lines indicate Mean ±2
%WS
11
10
9
5
4
16"
18"
20"
22"
24"
5
10
15
20
25
Sample No.

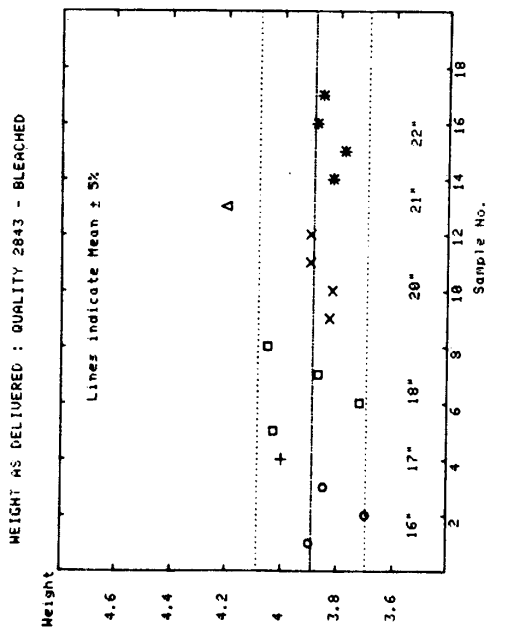

WALES/INCH AS DELIVERED : QUALITY 2843 - BLEACHED
Lines indicate Mean ± 5%
WPI
Sample No.

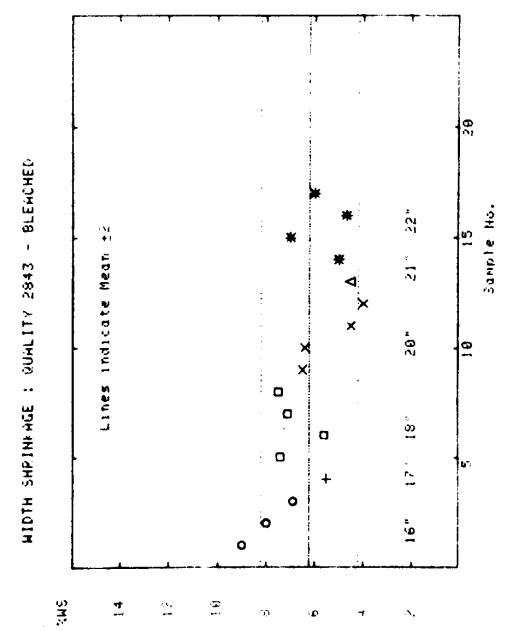

COURSES/INCH AS DELIVERED : QUALITY 2843 - BLEACHED
Lines indicate Mean +/- 5%
CPI
Sample No.

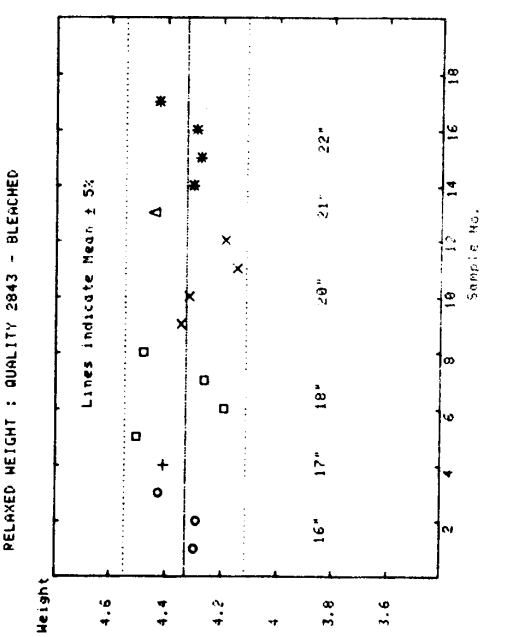

RELAXED WALES/INCH : QUALITY 2843 - BLEACHED
Lines indicate Mean ± 5%
WPI
Sample No.

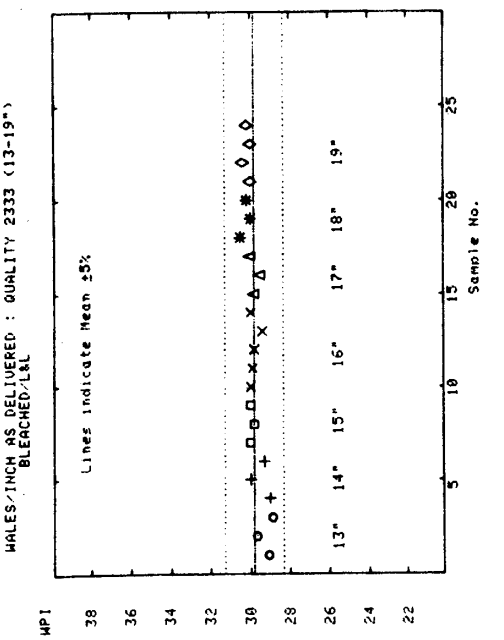

RELAXED COURSES/INCH : QUALITY 2843 - BLEACHED
Lines indicate Mean +/- 5%
CPI
Sample No.

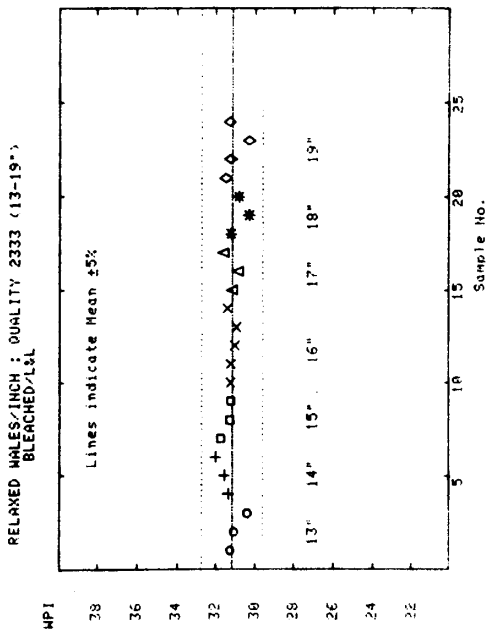

LENGTH SHRINKAGE : QUALITY 2843 - BLEACHED
Lines indicate Mean ±2
%LS
Sample No.
16" 17" 18" 20" 21" 22"

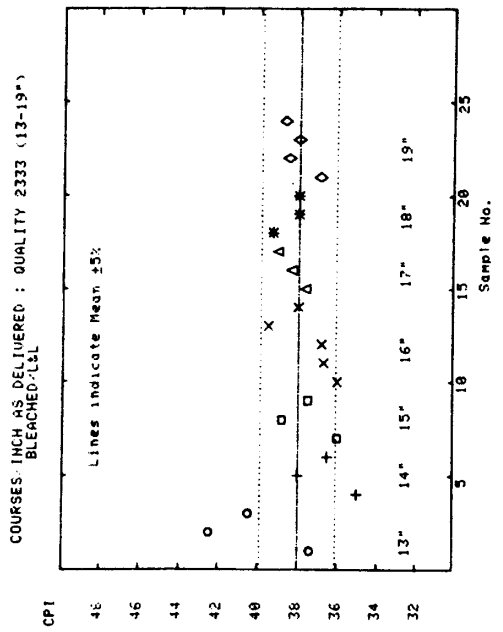

WEIGHT AS DELIVERED : QUALITY 2843 - BLEACHED
Lines indicate Mean ± 5%
Weight
Sample No.
16" 17" 18" 20" 21" 22"

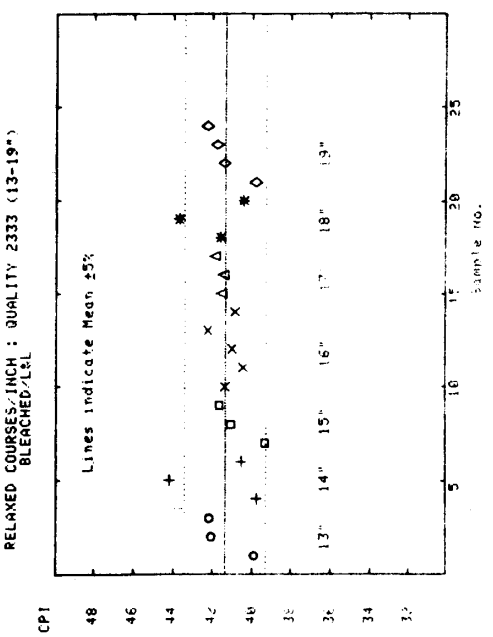

WIDTH SHRINKAGE : QUALITY 2843 - BLEACHED
Lines indicate Mean ±2
%WS
Sample No.
16" 17" 18" 20" 21" 22"

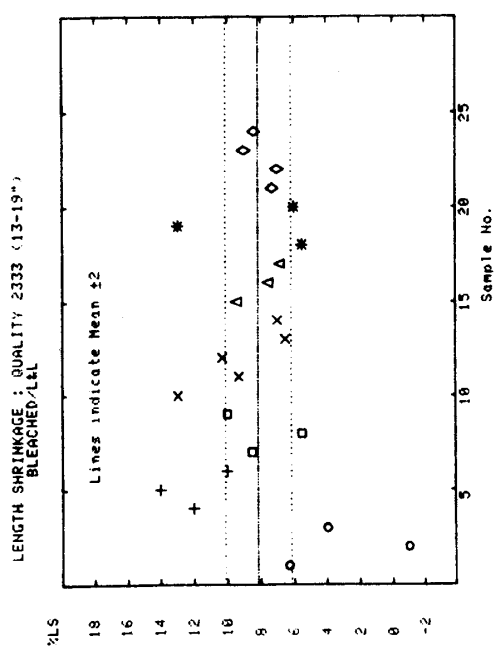

RELAXED WEIGHT : QUALITY 2843 - BLEACHED
Lines indicate Mean ± 5%
Weight
Sample No.
16" 17" 18" 20" 21" 22"

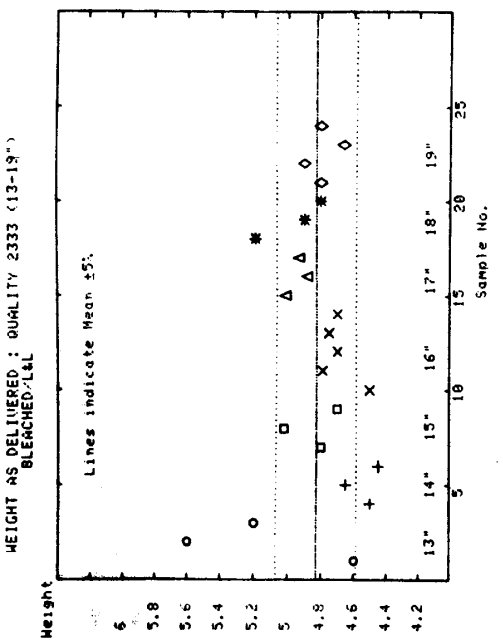

WALES/INCH AS DELIVERED : QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
13" 14" 15" 16" 17" 18" 19"

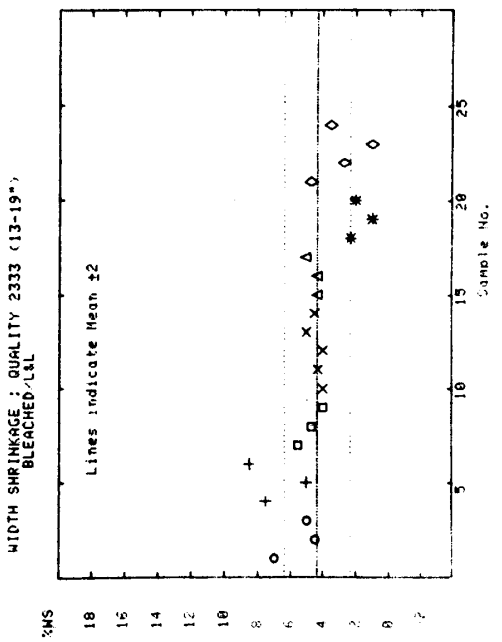

RELAXED WALES/INCH : QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
13" 14" 15" 16" 17" 18" 19"

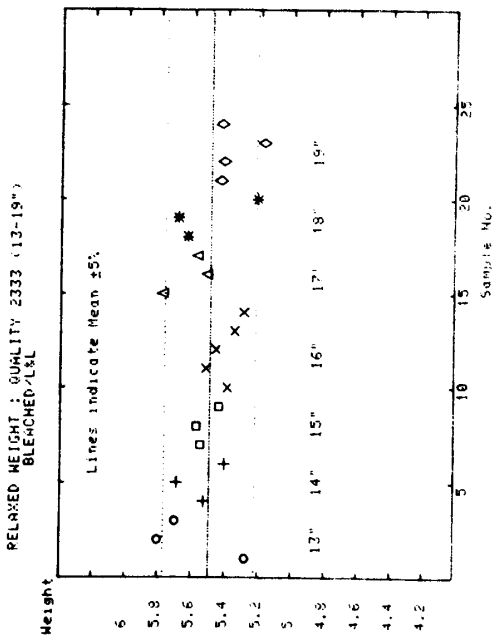

COURSES/INCH AS DELIVERED : QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
CPI
Sample No.
13" 14" 15" 16" 17" 18" 19"

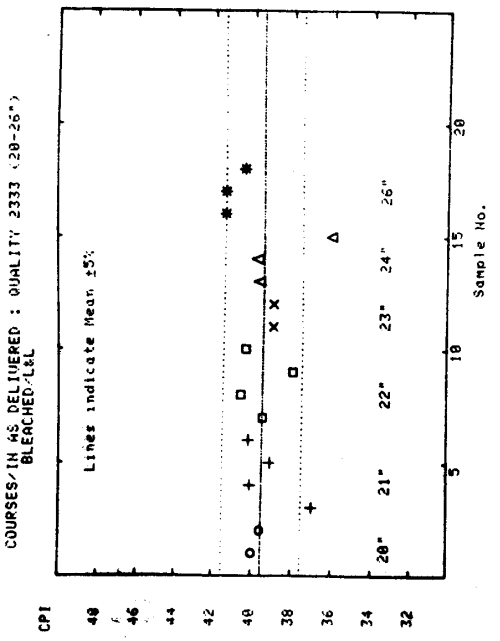

RELAXED COURSES/INCH : QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
CPI

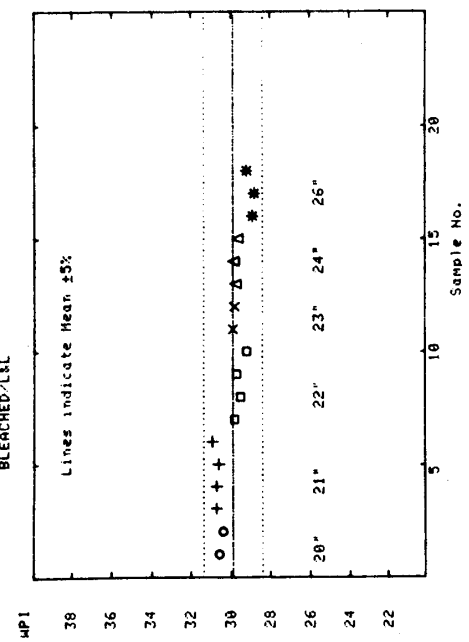

LENGTH SHRINKAGE ; QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±2
%LS
Sample No.

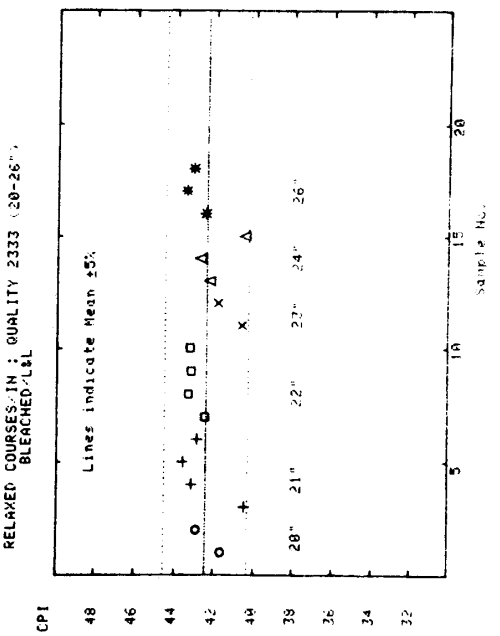

WEIGHT AS DELIVERED ; QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
Weight
Sample No.

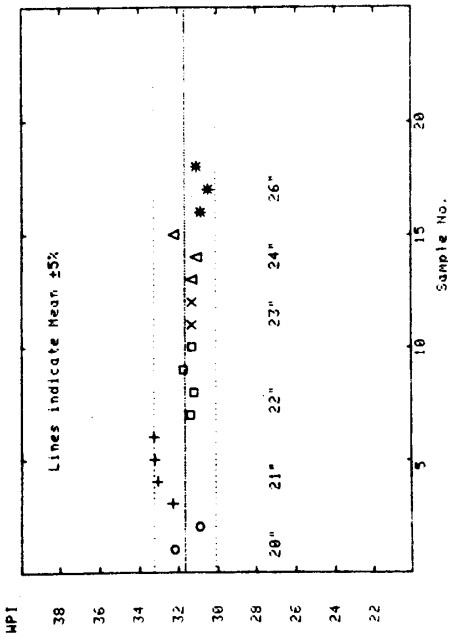

WIDTH SHRINKAGE ; QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±2
%WS

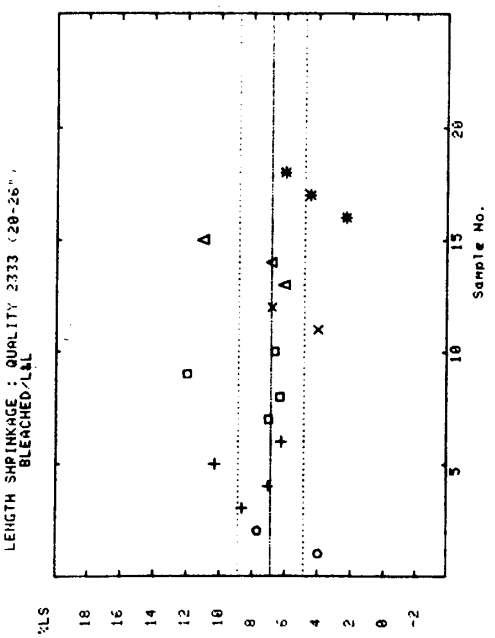

RELAXED WEIGHT ; QUALITY 2333 (13-19")
BLEACHED/L&L
Lines indicate Mean ±5%
Weight

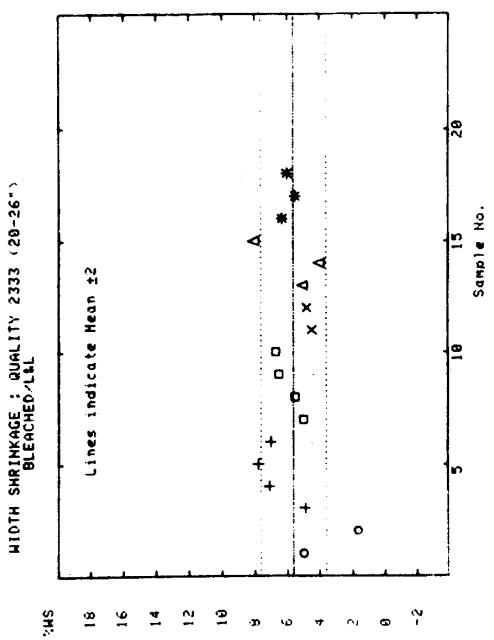

COURSES/IN AS DELIVERED : QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
CPI
Sample No.
20"
21"
22"
23"
24"
26"

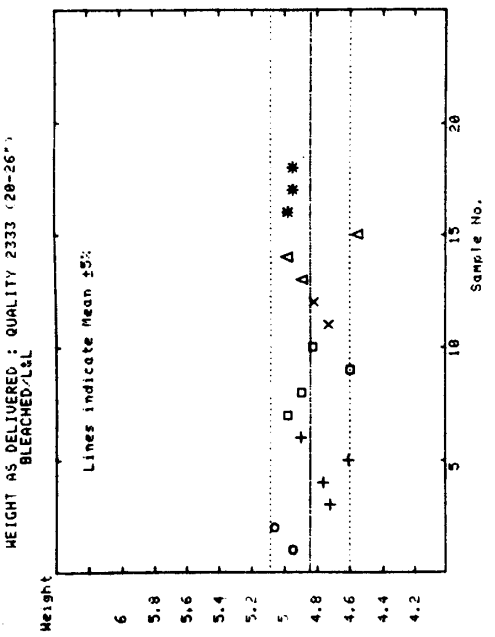

WALES/IN AS DELIVERED : QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
20"
21"
22"
23"
24"
26"

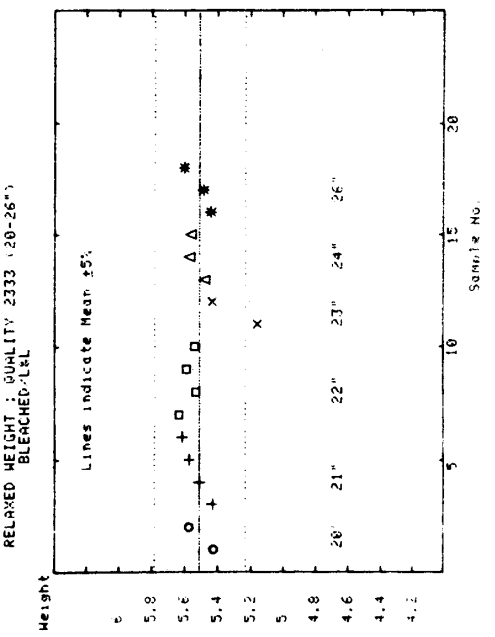

RELAXED COURSES/IN : QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
CPI
Sample No.
20"
21"
22"
23"
24"
26"

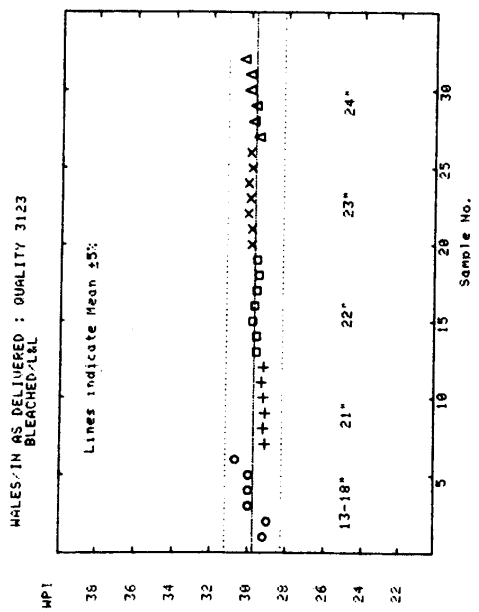

RELAXED WALES/IN : QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
20"
21"
22"
23"
24"
26"

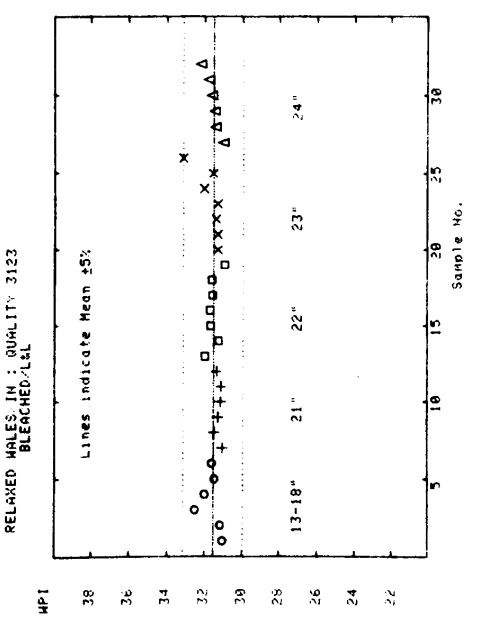

LENGTH SHRINKAGE ; QUALITY 2333 (20-26")
BLEACHED/L&L
%LS
Sample No.

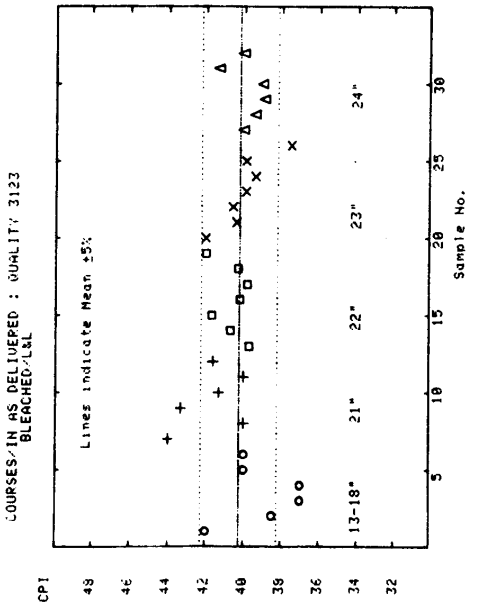

WIDTH SHRINKAGE ; QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±2
%WS
Sample No.

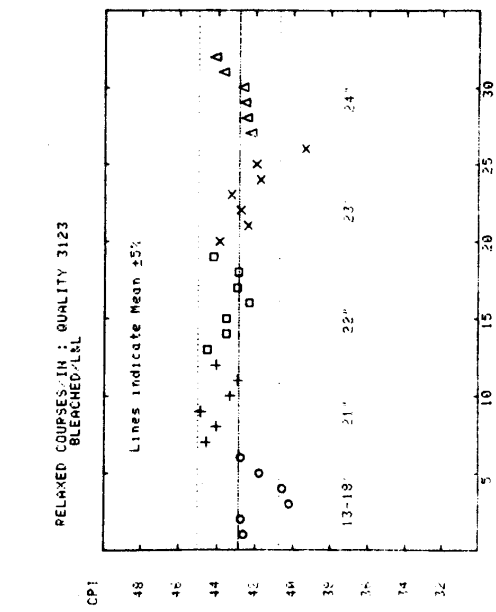

WEIGHT AS DELIVERED ; QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
Weight
Sample No.

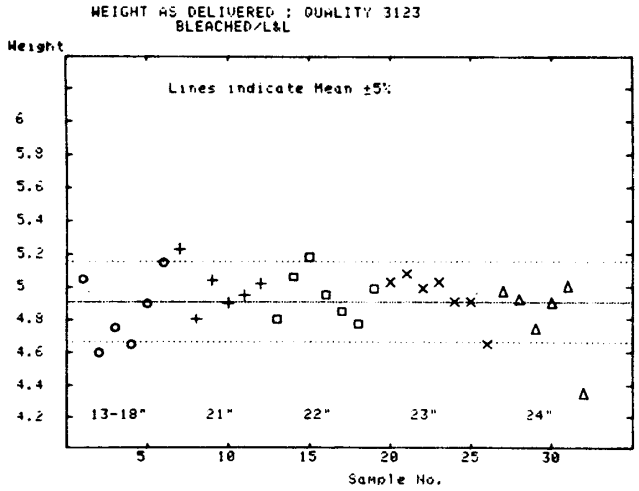

RELAXED WEIGHT ; QUALITY 2333 (20-26")
BLEACHED/L&L
Lines indicate Mean ±5%
Weight
Sample No.

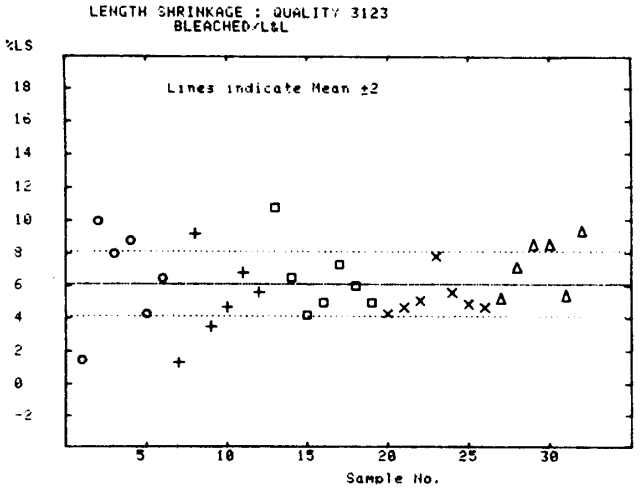

WALES-IN AS DELIVERED : QUALITY 3123
BLEACHED-L&L
Lines indicate Mean ±5%
WPI
Sample No.
13-18"
21"
22"
23"
24"

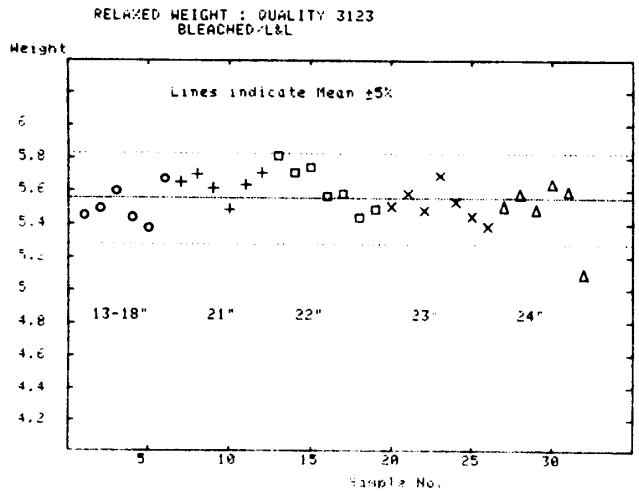

RELAXED WALES IN : QUALITY 3123
BLEACHED-L&L
Lines indicate Mean ±5%
WPI
Sample No.
13-18"
21"
22"
23"
24"

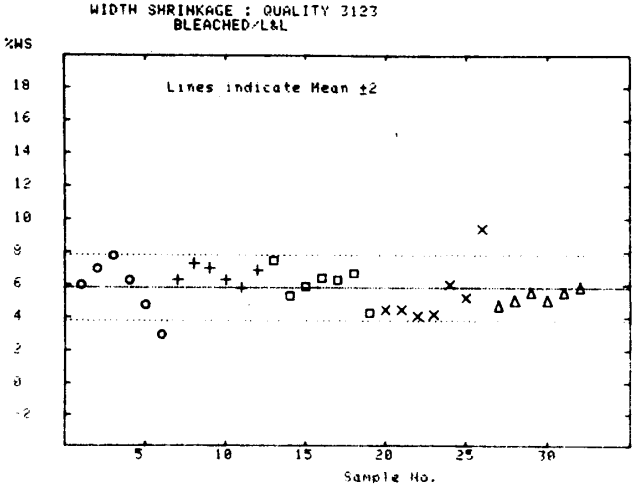

COURSES-IN AS DELIVERED : QUALITY 3123
BLEACHED-L&L
Lines indicate Mean ±5%
CPI
Sample No.
13-18"
21"
22"
23"
24"


RELAXED COURSES-IN : QUALITY 3123
BLEACHED-L&L
Lines indicate Mean ±5%
CPI
Sample No.

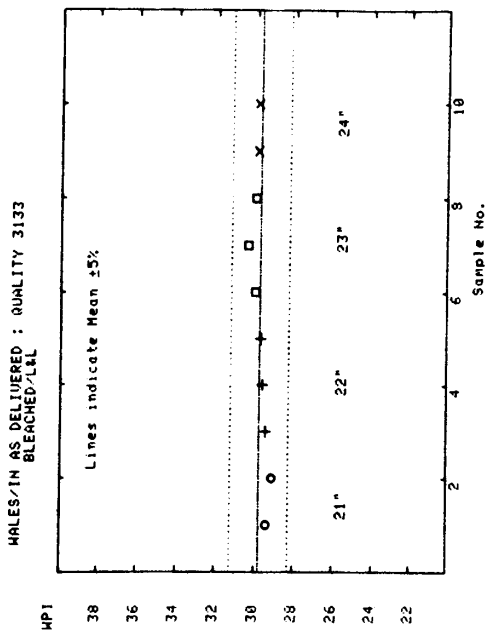

WEIGHT AS DELIVERED : QUALITY 3123
BLEACHED/L&L
Weight
Lines indicate Mean ±5%
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
13-18"
21"
22"
23"
24"
5
10
15
20
25
30
Sample No.

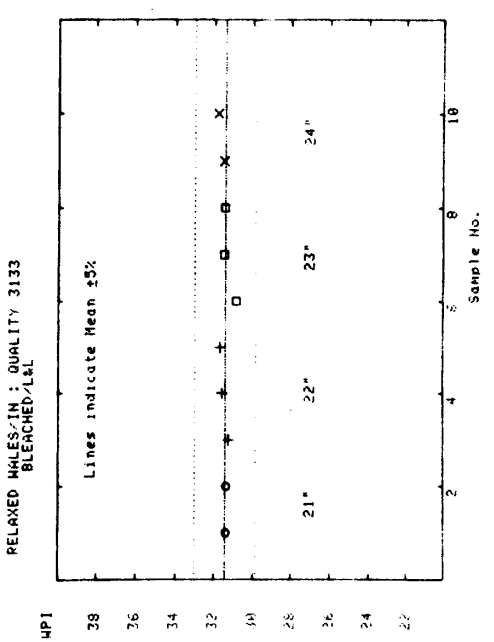

LENGTH SHRINKAGE : QUALITY 3123
BLEACHED/L&L
%LS
Lines indicate Mean ±2
18
16
14
12
10
8
6
4
2
0
-2
5
10
15
20
25
30
Sample No.

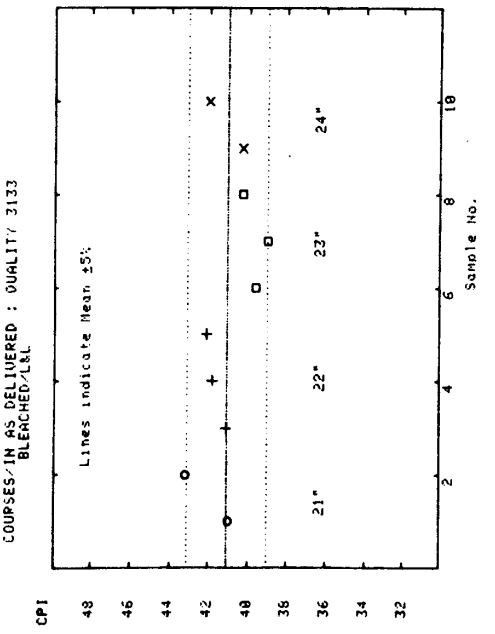

RELAXED WEIGHT : QUALITY 3123
BLEACHED/L&L
Weight
Lines indicate Mean ±5%
6
5.8
5.6
5.4
5
4.8
4.6
4.4
4.2
13-18"
21"
22"
23"
24"
5
10
15
20
25
30
Sample No.

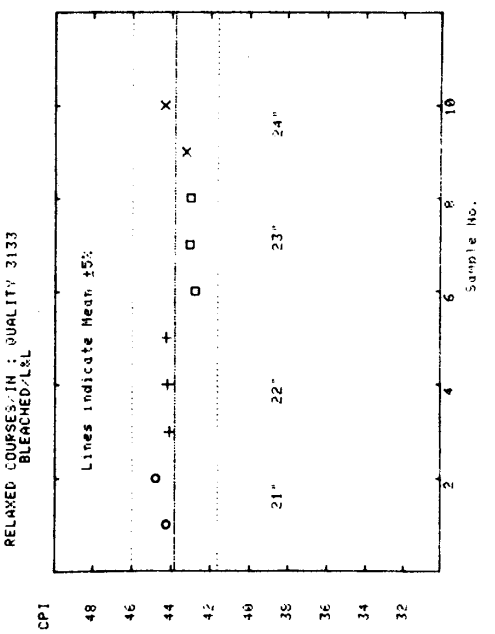

WIDTH SHRINKAGE : QUALITY 3123
BLEACHED/L&L
%WS
Lines indicate Mean ±2
18
16
14
12
10
8
6
4
2
0
-2
5
10
15
20
25
30
Sample No.

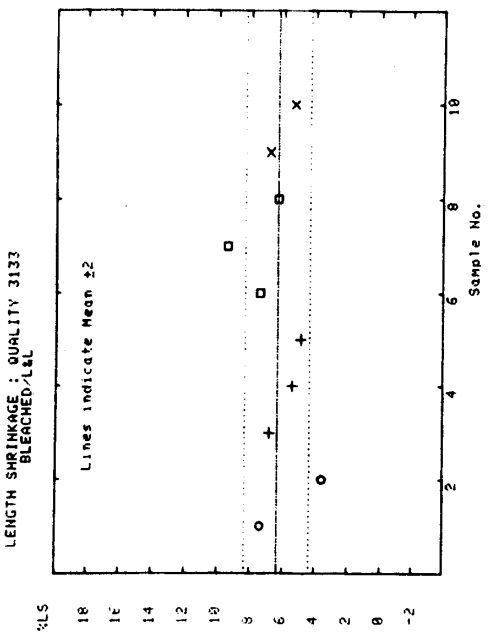
Appendix 1

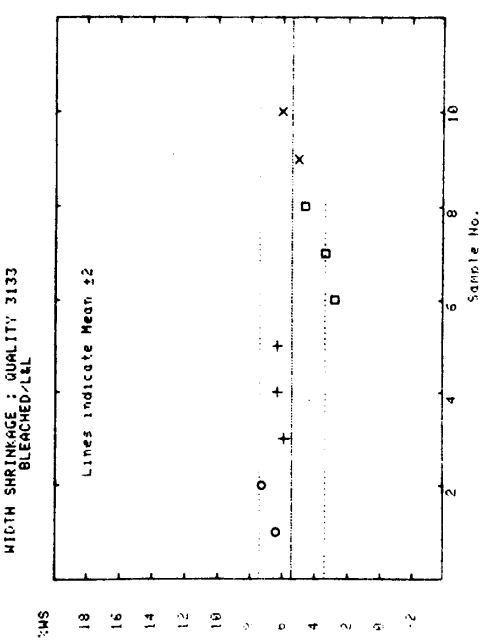

WALES/IN AS DELIVERED : QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
21"
22"
23"
24"

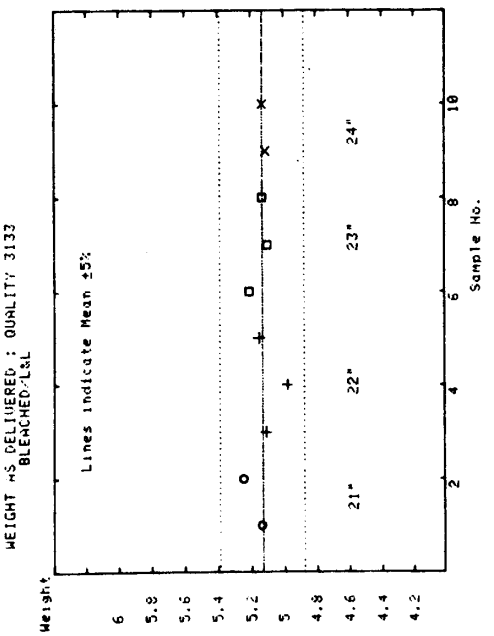

RELAXED WALES/IN : QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
WPI
Sample No.
21"
22"
23"
24"

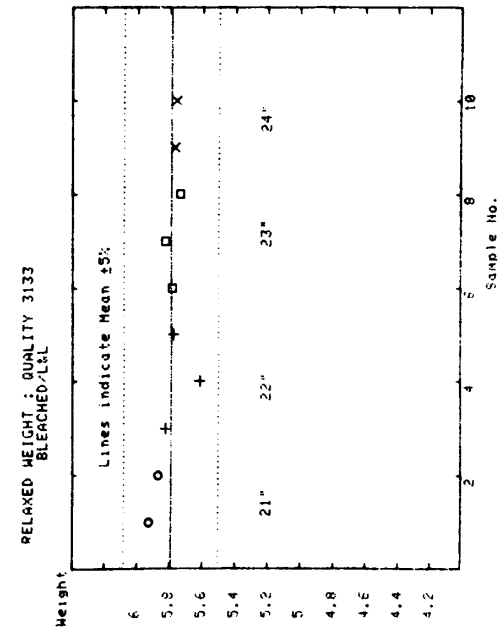

COURSES/IN AS DELIVERED : QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
CPI
Sample No.
21"
22"
23"
24"


RELAXED COURSES/IN : QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
CPI
Sample No.
21"
22"
23"
24"


LENGTH SHRINKAGE ; QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±2
%LS
Sample No.


WIDTH SHRINKAGE ; QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±2
%WS
Sample No.


WEIGHT AS DELIVERED ; QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
Weight
21"
22"
23"
24"
Sample No.


RELAXED WEIGHT ; QUALITY 3133
BLEACHED/L&L
Lines indicate Mean ±5%
Weight
21"
22"
23"
24"
Sample No.

APPENDIX 2

Conventional STARFISH Analysis

Relaxed dimensions averaged over months within sizes - metric units

- Continuous bleach / Compact
- Continuous bleach / L&L

Plots of the STARFISH predictive equations derived from QC data against measured relaxed courses and wales.

- 21 tex qualities
- 23 tex qualities
- 25 tex qualities
- 29 tex qualities
- 32 tex qualities

Courses and wales calculated from the STARFISH / QC equations compared against measured courses and wales.

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CONTINUOUS BLEACH/COMPACT - RELAXED DIMENSIONS
Averaged within sizes per quality

	Size in	No Rcrds	No Spls	Yarn Ne	StLen in	CPI	WPI	Weight oz	Yarn tex	StLen cm	C/cm	W/cm	Weight gsm
QUALITY 2223													
1	15	2	4	18.3	0.1377	40.6	29.36	6.1	32.27	0.3498	15.98	11.56	207.2
2	17	1	3	18.3	0.1385	40.5	30.1	6.1	32.27	0.3518	15.94	11.85	207.2
3	18	1	8	18.3	0.1382	39.96	29.75	5.94	32.27	0.351	15.73	11.71	201.7
QUALITY 2233													
4	17	1	2	20.3	0.1385	41.4	28.96	5.38	29.09	0.3518	16.3	11.4	182.7
5	19	2	6	20.3	0.1404	38.58	29.46	5.23	29.09	0.3566	15.19	11.6	177.6
6	21	2	8	20.3	0.1397	39.69	30.39	5.35	29.09	0.3548	15.63	11.96	181.7
7	22	2	8	20.3	0.1348	41.06	29.98	5.42	29.09	0.3424	16.17	11.8	184.1
8	23	2	4	20.3	0.1366	40.57	29.98	5.41	29.09	0.347	15.97	11.8	183.7
QUALITY 4893													
9	16	6	125	24.1	0.1375	39.61	31.16	4.62	24.5	0.3492	15.59	12.27	156.9
10	17	7	111	24.1	0.1373	39.9	30.98	4.64	24.5	0.3487	15.71	12.2	157.6
11	18	7	106	24.1	0.1343	41.39	30.85	4.74	24.5	0.3411	16.3	12.15	161
12	19	7	145	24.1	0.1368	39.82	30.89	4.62	24.5	0.3475	15.68	12.16	156.9
13	20	7	186	24.1	0.1372	40.1	30.57	4.62	24.5	0.3485	15.79	12.04	156.9
14	21	7	116	24.1	0.1373	40.09	30.72	4.65	24.5	0.3487	15.78	12.09	157.9
15	22	7	122	24.1	0.1366	39.88	30.84	4.69	24.5	0.347	15.7	12.14	159.3
16	23	5	11	24.1	0.1362	39.72	31.06	4.71	24.5	0.3459	15.64	12.23	160
17	24	7	74	24.1	0.1373	39.23	31.04	4.57	24.5	0.3487	15.44	12.22	155.2
18	25	4	12	24.1	0.1389	39.22	30.86	4.55	24.5	0.3528	15.44	12.15	154.5
19	26	4	41	24.1	0.1369	39.38	30.7	4.6	24.5	0.3477	15.5	12.09	156.2
20	26	3	16	24.1	0.1329	41.23	31.35	4.77	24.5	0.3376	16.23	12.34	162
21	27	4	11	24.1	0.1385	39.07	30.91	4.55	24.5	0.3518	15.38	12.17	154.5
22	27	1	1	24.1	0.1342	42.11	31.47	4.88	24.5	0.3409	16.58	12.39	165.7
23	28	4	20	24.1	0.1385	39.28	30.69	4.68	24.5	0.3518	15.46	12.08	158.9
QUALITY 1273													
24	10	5	20	26	0.133	39.48	32.45	4.27	22.71	0.3378	15.54	12.78	145
25	11	6	24	26	0.133	39.75	31.64	4.25	22.71	0.3378	15.65	12.46	144.3
26	12	6	37	26	0.1333	39.85	31.63	4.18	22.71	0.3386	15.69	12.45	142
27	13	5	31	26	0.1329	39.75	32.07	4.28	22.71	0.3376	15.65	12.63	145.3
28	14	4	14	26	0.1329	40.43	31.62	4.26	22.71	0.3376	15.92	12.45	144.7
29	15	4	10	26	0.1333	40.62	31.46	4.23	22.71	0.3386	15.99	12.39	143.7
30	16	3	6	26	0.1333	40.01	31.7	4.31	22.71	0.3386	15.75	12.48	146.4
QUALITY 1373													
31	16	1	5	26	0.1344	38.78	31.82	4.22	22.71	0.3414	15.27	12.53	143.3
32	18	5	35	26	0.1341	40.04	31.47	4.21	22.71	0.3406	15.76	12.39	143
33	20	6	57	26	0.134	40.64	31.75	4.32	22.71	0.3404	16	12.5	146.7
34	22	5	71	26	0.1335	40.81	31.37	4.34	22.71	0.3391	16.07	12.35	147.4
35	24	6	45	26	0.1338	40.34	31.67	4.26	22.71	0.3399	15.88	12.47	144.7
QUALITY 2843													
36	16	3	8	28.2	0.1219	43.89	32.31	4.34	20.94	0.3096	17.28	12.72	147.4
37	17	1	1	28.2	0.1241	44.79	33.33	4.41	20.94	0.3152	17.63	13.12	149.8
38	18	4	21	28.2	0.1224	44.29	33.73	4.36	20.94	0.3109	17.44	13.28	148.1
39	20	4	29	28.2	0.1235	44.24	33.92	4.25	20.94	0.3137	17.42	13.35	144.3
40	21	1	2	28.2	0.1239	43.43	34.03	4.44	20.94	0.3147	17.1	13.4	150.8
41	22	4	43	28.2	0.1239	43.76	34.06	4.33	20.94	0.3147	17.23	13.41	147

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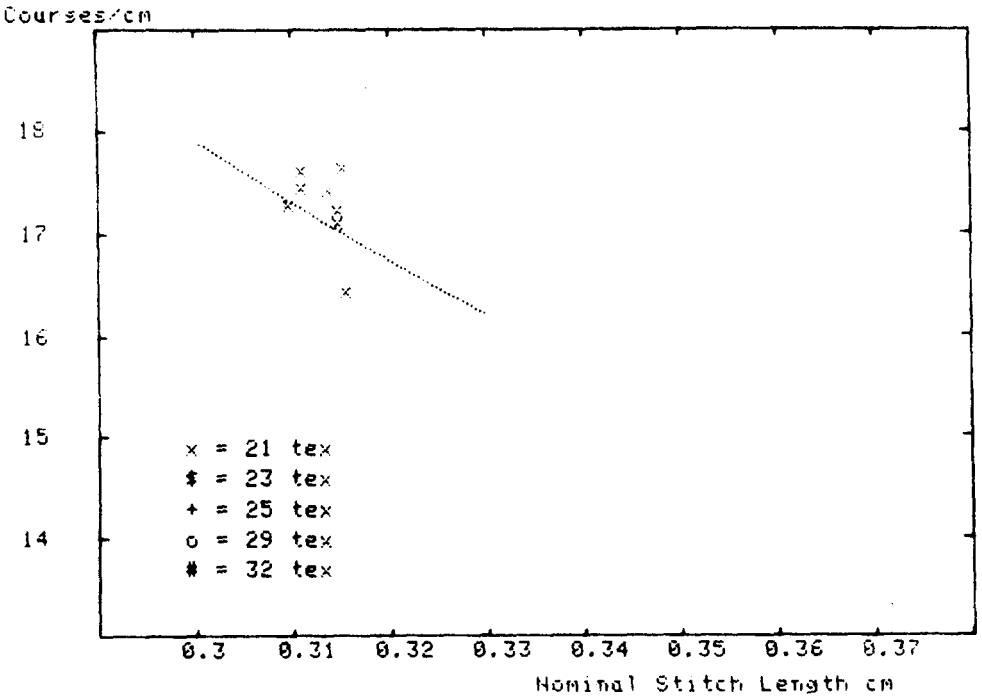
CONTINUOUS BLEACH/L&L - RELAXED DIMENSIONS
Averaged within sizes per quality

	Size in	No Rcrds	No Spls	Yarn Ne	StLen in	CPI	WPI	Weight oz	Yarn tex	StLen cm	C/cm	W/cm	Weight gsm
QUALITY 2333													
1	13	3	9	20.3	0.1316	41.39	30.94	5.6	29.09	0.3343	16.3	12.18	190.2
2	14	3	4	20.3	0.1329	41.5	31.65	5.54	29.09	0.3376	16.34	12.46	188.1
3	15	3	7	20.3	0.1322	40.69	31.42	5.52	29.09	0.3358	16.02	12.37	187.5
4	16	5	17	20.3	0.1323	41.19	31.18	5.4	29.09	0.336	16.22	12.28	183.4
5	17	3	15	20.3	0.1324	41.58	31.18	5.62	29.09	0.3363	16.37	12.28	190.9
6	18	3	6	20.3	0.1331	41.9	30.78	5.51	29.09	0.3381	16.5	12.12	187.1
7	19	4	24	20.3	0.1328	41.3	31.08	5.36	29.09	0.3373	16.26	12.24	182
8	20	2	7	20.3	0.1332	42.29	31.57	5.5	29.09	0.3383	16.65	12.43	186.8
9	21	4	35	20.3	0.1327	42.51	32.94	5.53	29.09	0.3371	16.74	12.97	187.8
10	22	4	43	20.3	0.1296	43.06	31.41	5.58	29.09	0.3292	16.95	12.37	189.5
11	23	2	8	20.3	0.1326	41.24	31.31	5.3	29.09	0.3368	16.24	12.33	180
12	24	3	13	20.3	0.1317	41.8	31.49	5.53	29.09	0.3345	16.46	12.4	187.8
13	26	3	10	20.3	0.131	43.01	30.79	5.51	29.09	0.3327	16.93	12.12	187.1
QUALITY 3123													
14	13	1	2	20.3	0.1303	42.64	31.06	5.45	29.09	0.331	16.79	12.23	185.1
15	14	1	2	20.3	0.1316	42.78	31.18	5.5	29.09	0.3343	16.84	12.28	186.8
16	15	1	2	20.3	0.13	40.22	32.54	5.6	29.09	0.3302	15.83	12.81	190.2
17	16	1	2	20.3	0.1302	40.57	32.02	5.44	29.09	0.3307	15.97	12.61	184.7
18	17	1	2	20.3	0.1294	41.8	31.51	5.38	29.09	0.3287	16.46	12.41	182.7
19	18	1	2	20.3	0.1304	42.78	31.65	5.68	29.09	0.3312	16.84	12.46	192.9
20	21	6	25	20.3	0.1266	43.97	31.25	5.64	29.09	0.3216	17.31	12.3	191.5
21	22	7	65	20.3	0.1273	43.41	31.54	5.62	29.09	0.3233	17.09	12.42	190.9
22	23	7	71	20.3	0.1297	42.2	31.71	5.52	29.09	0.3294	16.61	12.48	187.5
23	24	6	43	20.3	0.1296	42.92	31.54	5.48	29.09	0.3292	16.9	12.42	186.1
QUALITY 3133													
24	21	2	11	20.3	0.1307	44.54	31.4	5.9	29.09	0.332	17.54	12.36	200.4
25	22	3	35	20.3	0.1273	44.18	31.51	5.74	29.09	0.3233	17.39	12.41	194.9
26	23	3	36	20.3	0.1297	42.94	31.26	5.78	29.09	0.3294	16.91	12.31	196.3
27	24	2	14	20.3	0.1296	43.8	31.64	5.77	29.09	0.3292	17.24	12.46	195.9
QUALITY 2553													
28	22	1	2	18.3	0.1358	41.88	29.75	5.9	32.27	0.3449	16.49	11.71	200.4
29	23	1	3	18.3	0.1358	40.63	30	6.02	32.27	0.3449	16	11.81	204.4
30	24	1	3	18.3	0.1355	42.55	30.06	5.89	32.27	0.3442	16.75	11.83	200
31	25	1	2	18.3	0.1359	41.05	29.33	6.1	32.27	0.3452	16.16	11.55	207.2
QUALITY 2533													
32	28	1	2	20.3	0.1299	41.88	31.46	5.72	29.09	0.3299	16.49	12.39	194.3
QUALITY 3043													
33	18	1	1	28.2	0.1224	44.71	35.76	4.35	20.94	0.3109	17.6	14.08	147.7
QUALITY 3883													
34	21	1	1	28.2	0.1242	41.76	34.53	4.3	20.94	0.3155	16.44	13.59	146

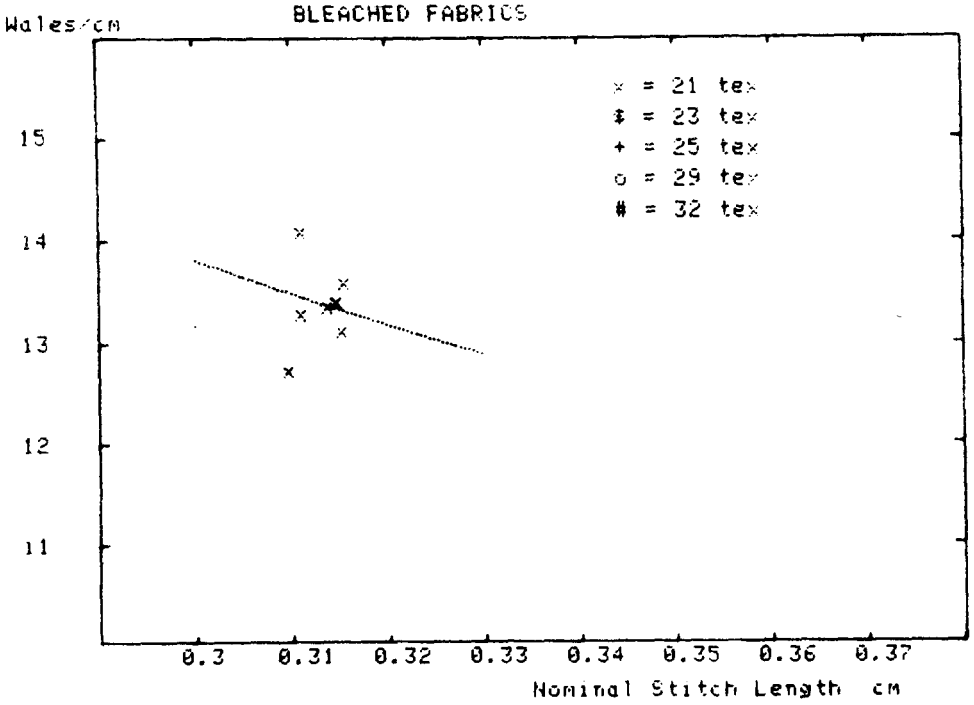
NB : Quality 3883 is CB/Calender

SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

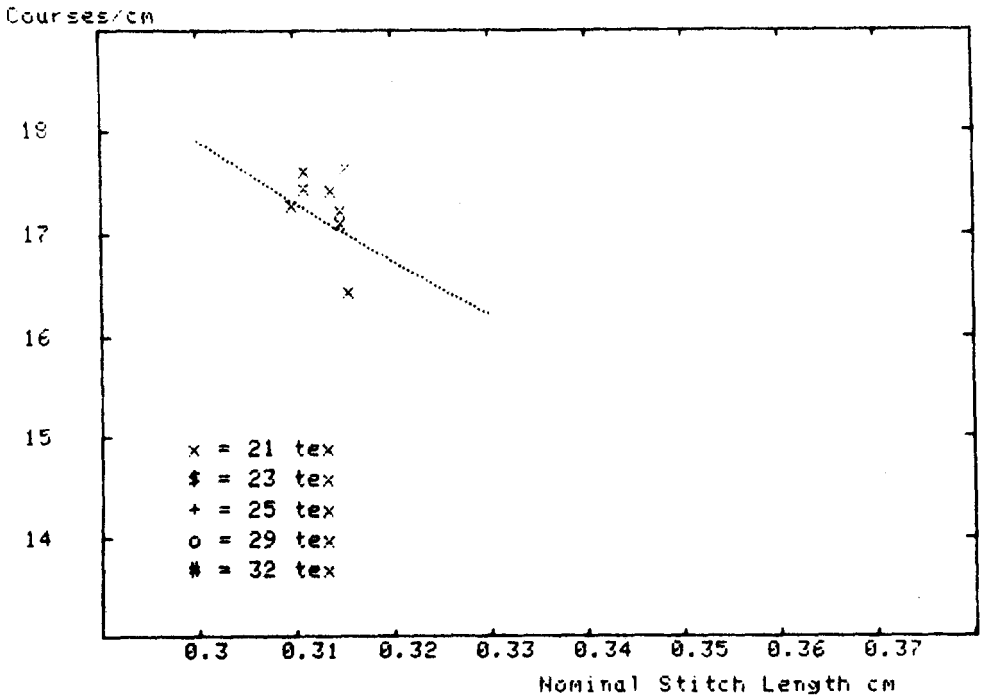


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

BLEACHED FABRICS

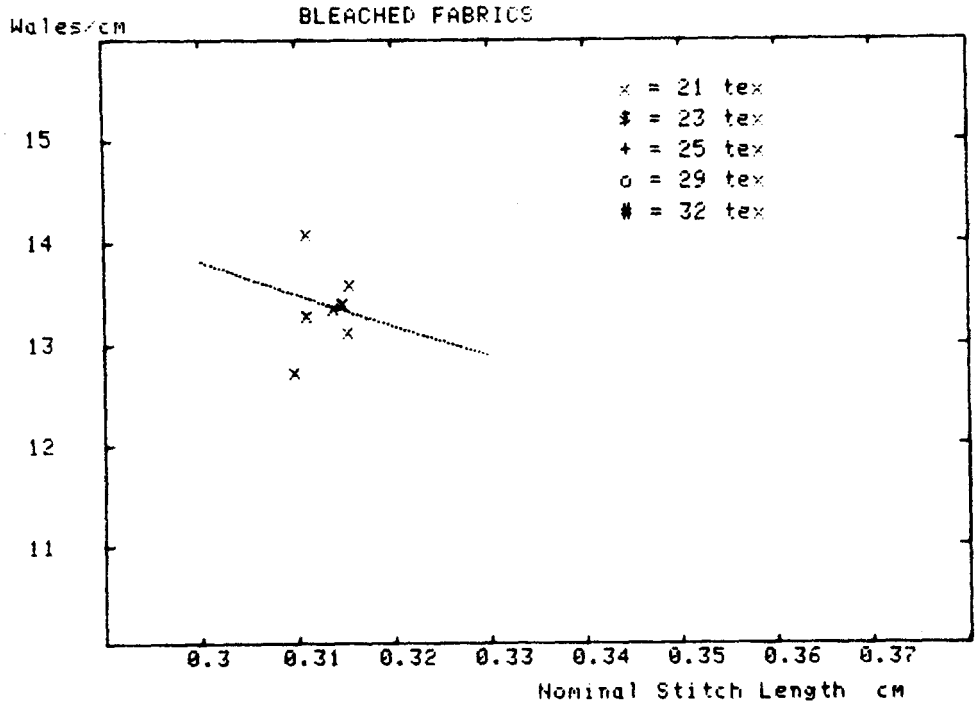


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

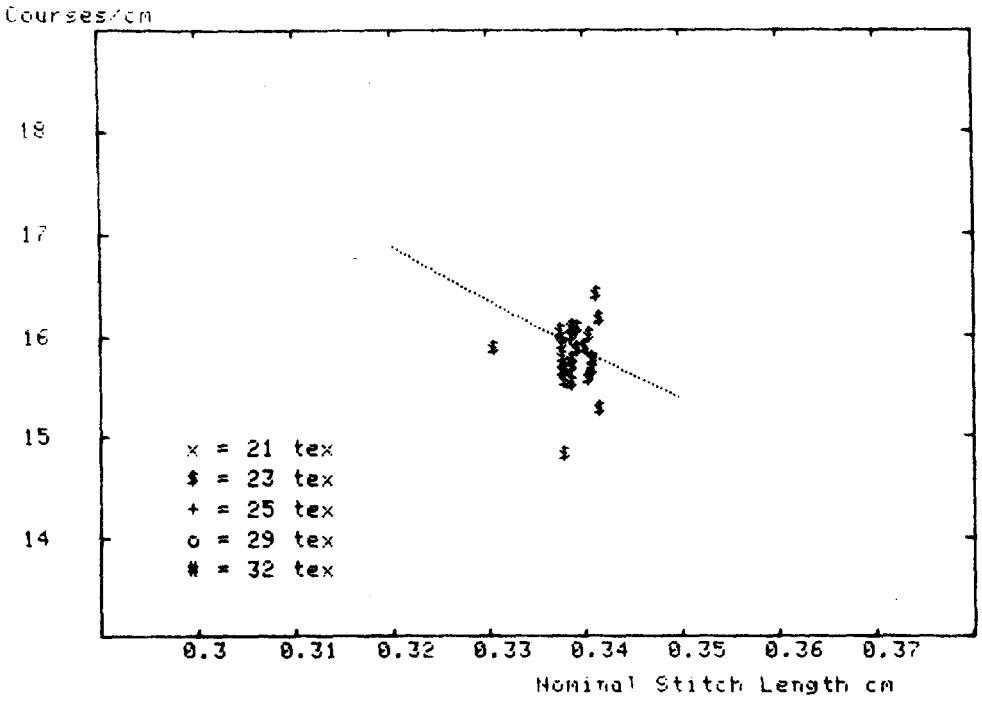


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

BLEACHED FABRICS

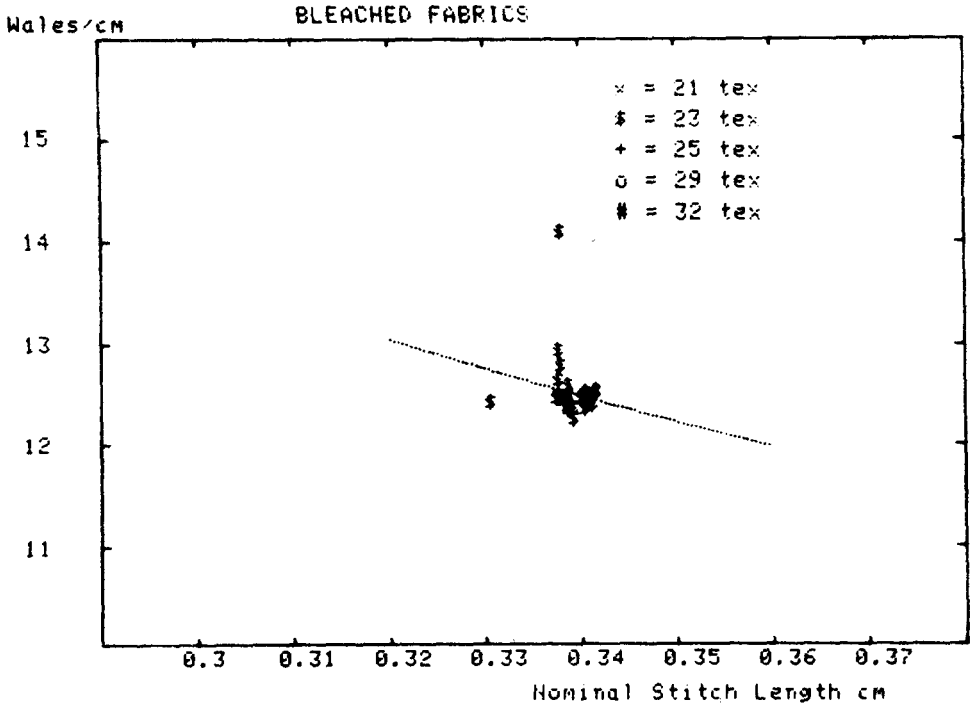


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

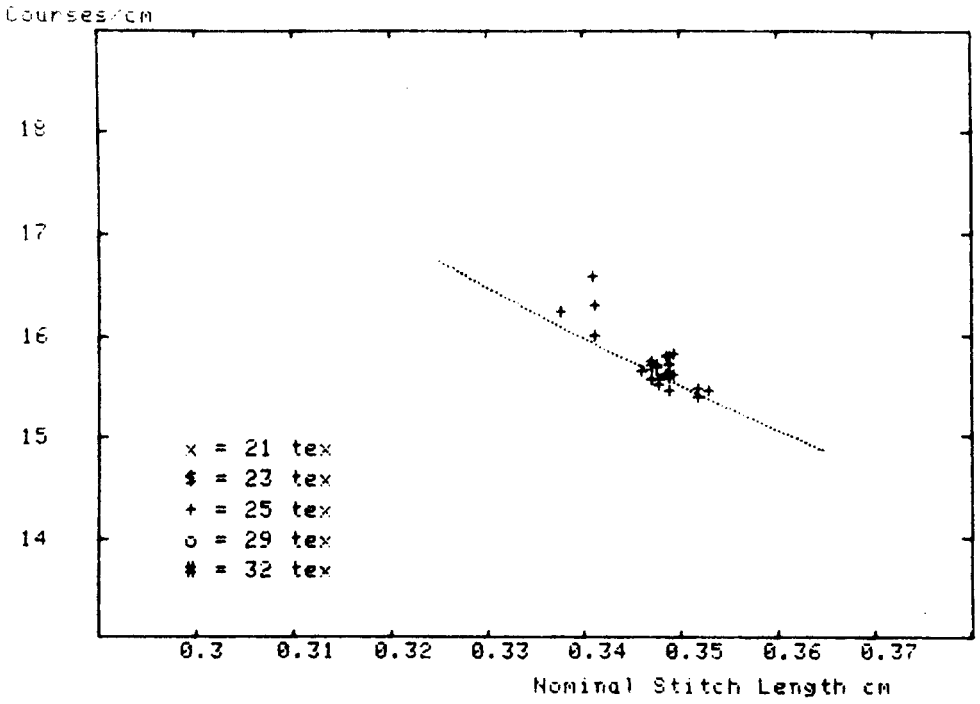


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

BLEACHED FABRICS

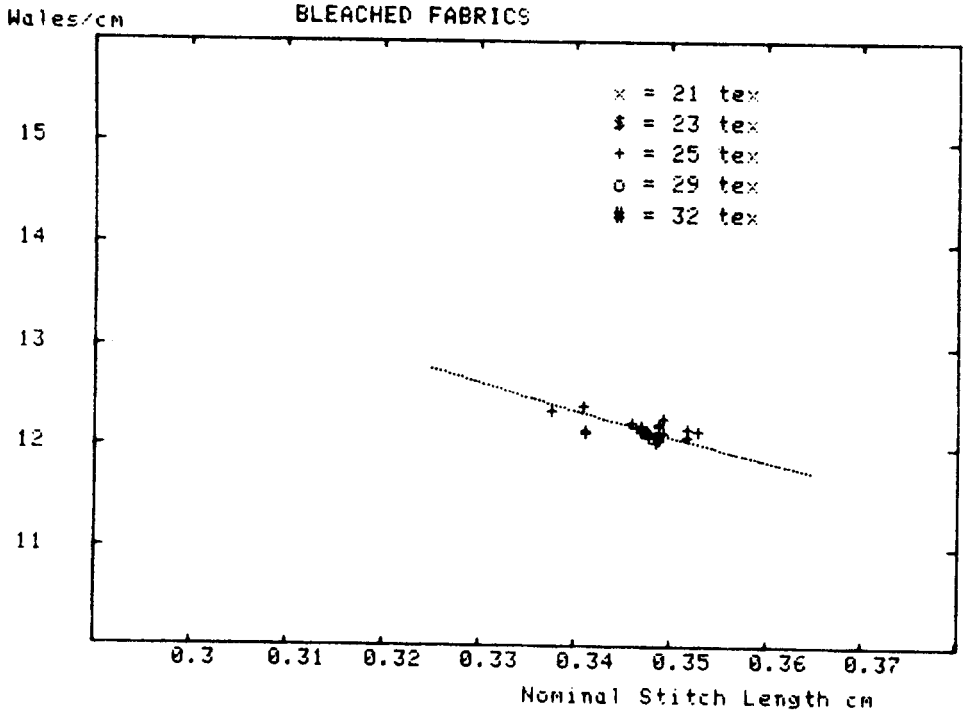


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

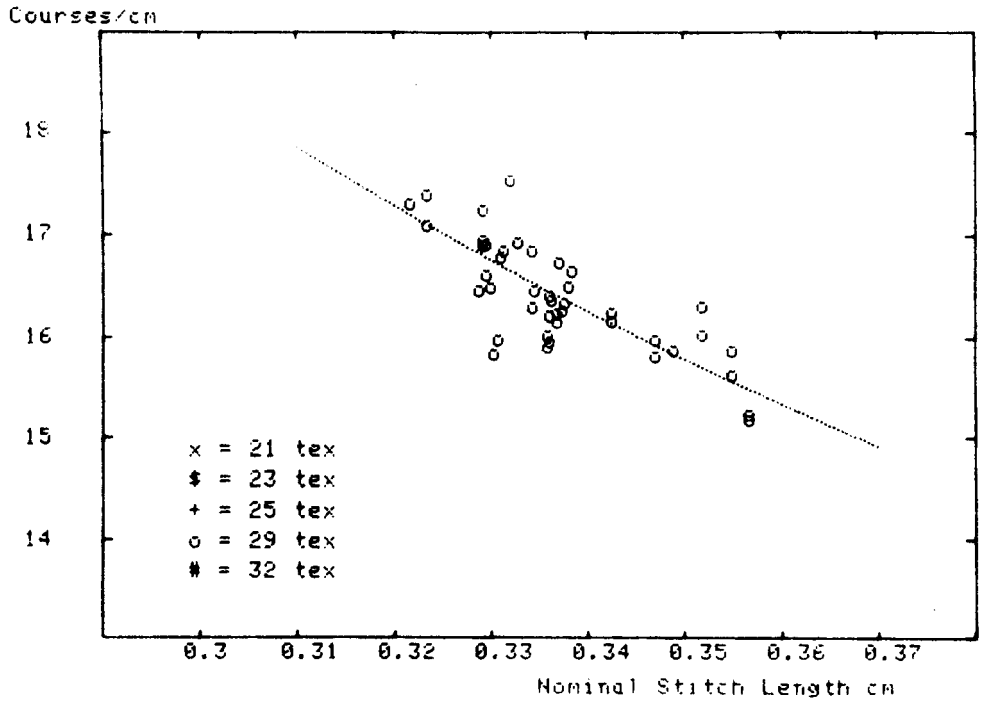


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

BLEACHED FABRICS

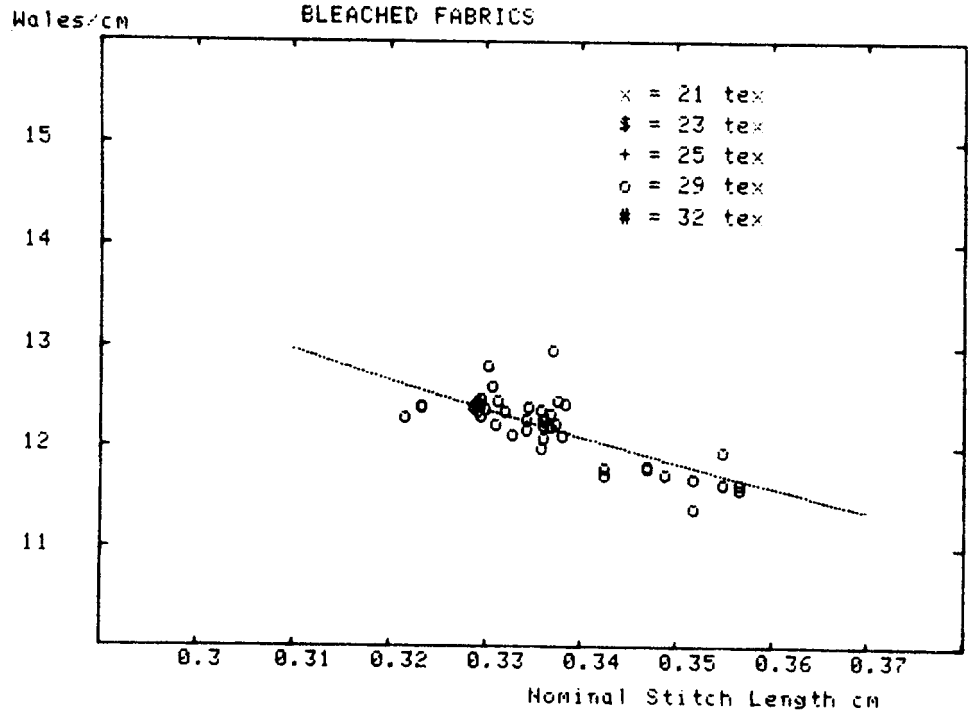


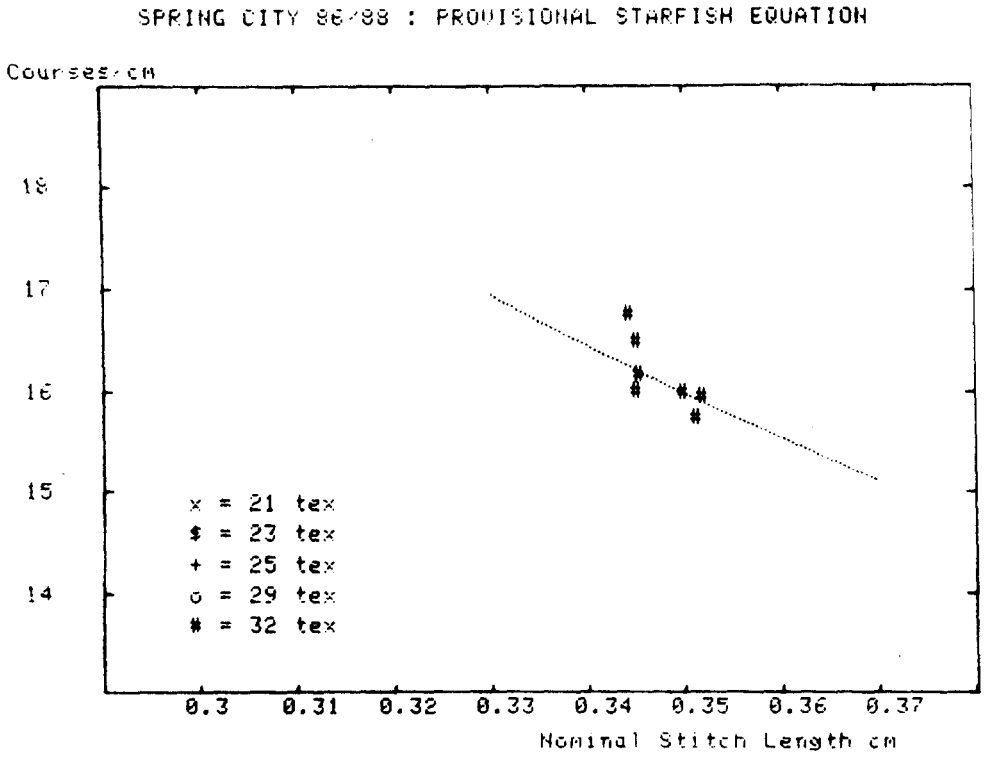
SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

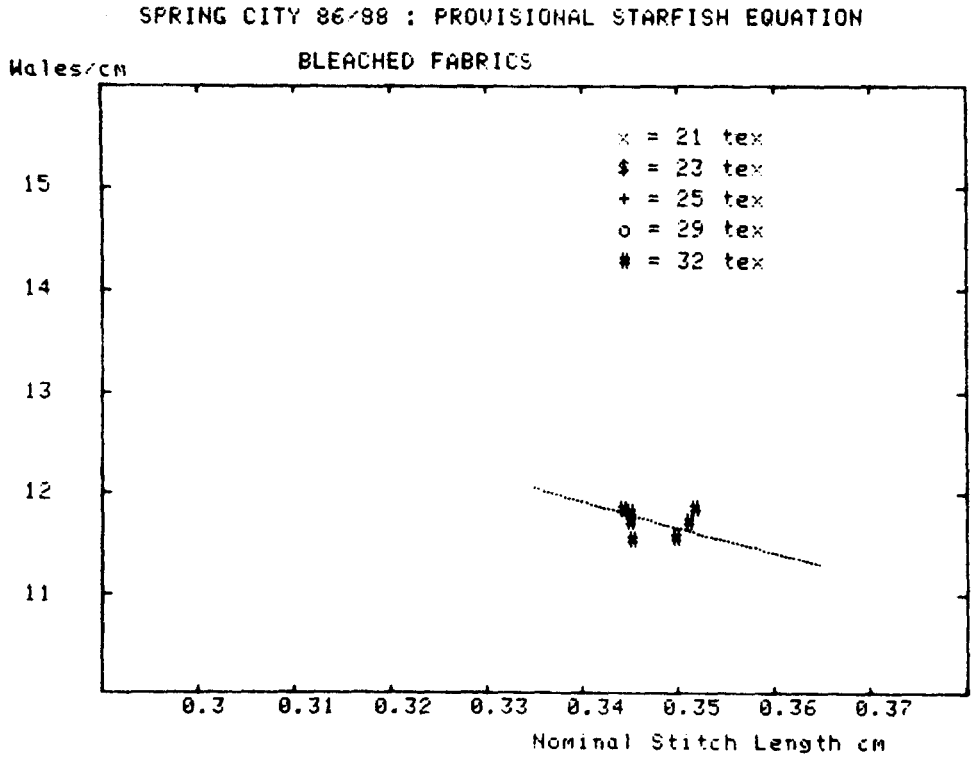


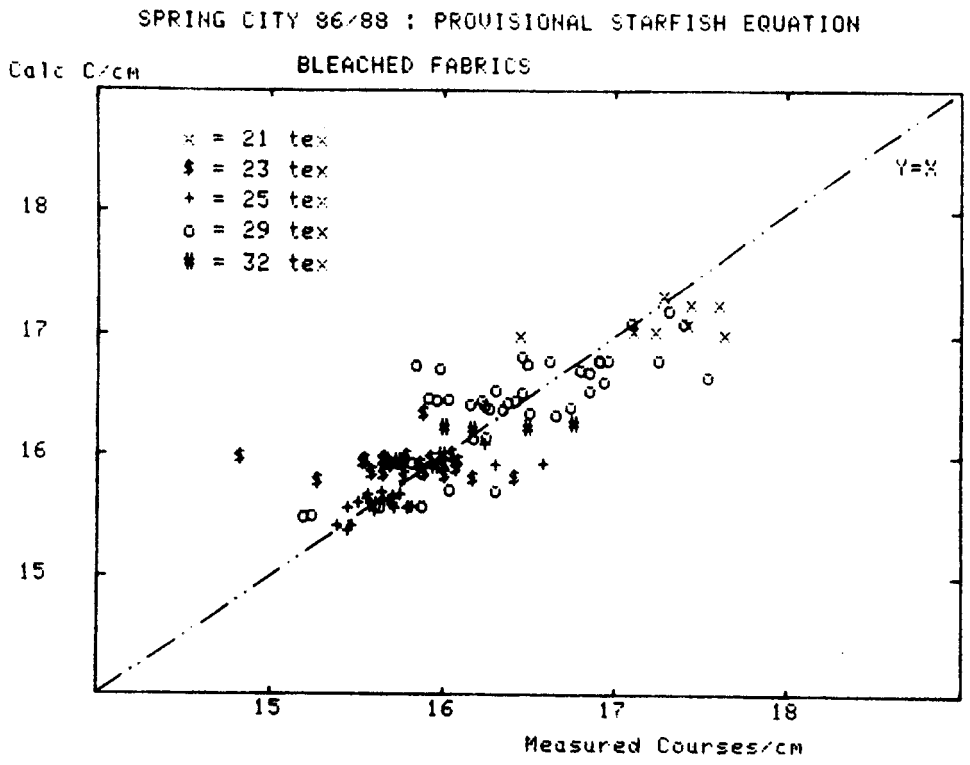
SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION

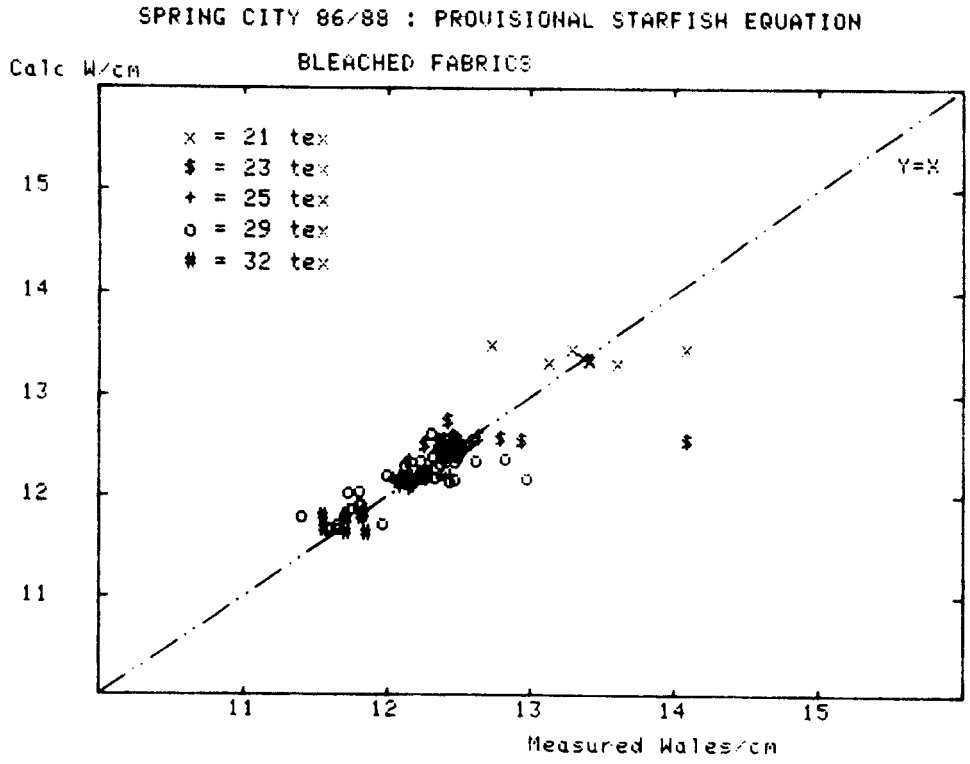
BLEACHED FABRICS




SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION
Courses/cm
18
17
16
15
14
x = 21 tex
$ = 23 tex
+ = 25 tex
o = 29 tex
# = 32 tex
0.3
0.31
0.32
0.33
0.34
0.35
0.36
0.37
Nominal Stitch Length cm


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION
BLEACHED FABRICS
Wales/cm
15
14
13
12
11
x = 21 tex
$ = 23 tex
+ = 25 tex
o = 29 tex
# = 32 tex
0.3
0.31
0.32
0.33
0.34
0.35
0.36
0.37
Nominal Stitch Length cm


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION
BLEACHED FABRICS
Calc C/cm
x = 21 tex
$ = 23 tex
+ = 25 tex
o = 29 tex
# = 32 tex
Y=X
18
17
16
15
15
16
17
18
Measured Courses/cm


SPRING CITY 86/88 : PROVISIONAL STARFISH EQUATION
BLEACHED FABRICS
Calc W/cm
x = 21 tex
$ = 23 tex
+ = 25 tex
o = 29 tex
# = 32 tex
Y=X
15
14
13
12
11
11
12
13
14
15
Measured Wales/cm

APPENDIX 3

Phase 3 STARFISH Analysis

Relaxed dimensions (metric) averaged over months within sizes. Calculated weight, Ic and Iw

- Continuous bleach / Compact 1988.
- Continuous bleach / L&L 1988
- 1986 data - CB/C and CB/L

Plot of Calculated vs. measured weight - estimation of the Cl coefficient for Step 1.

Plots of Ic and Iw against reciprocal tex for all 1988 qualities showing dispersion about the average regression line.

Mean and standard deviation for Ic and Iw within all white qualities 1986 and 1988.

Plot of Ic and Iw averaged within qualities for all white fabrics 1986 and 1988.

Plots of Fc vs. Yc and Fw vs. Yw for the various different data sets.

SPRING CITY 1988

CONTINUOUS BLEACH/COMPACT - RELAXED DIMENSIONS
Averaged within sizes per quality

	Yarn tex	St Len cm	C/cm	W/cm	Meas Weight	Calc Weight	Weight Ratio	Ic	Iw	1000/ Rtex
QUALITY 2223										
15 1	32.27	0.3498	15.98	11.56	207.2	208.5	1.007	-3.23	5.15	32.15
17	32.27	0.3518	15.94	11.85	207.2	214.5	1.035	-3.16	5.48	32.15
18 5	32.27	0.351	15.73	11.71	201.7	208.7	1.035	-3.41	5.33	32.15
QUALITY 2233										
17 4	29.09	0.3518	16.3	11.4	182.7	190.2	1.041	-2.81	5.03	35.66
19	29.09	0.3566	15.19	11.6	177.6	182.8	1.029	-3.66	5.32	35.66
21	29.09	0.3548	15.63	11.96	181.7	193	1.062	-3.31	5.65	35.66
22	29.09	0.3424	16.17	11.8	184.1	190	1.033	-3.46	5.26	35.66
23 8	29.09	0.347	15.97	11.8	183.7	190.3	1.036	-3.4	5.35	35.66
QUALITY 4893										
16 9	24.5	0.3492	15.59	12.27	156.9	163.7	1.044	-3.65	5.85	42.33
17	24.5	0.3487	15.71	12.2	157.6	163.7	1.039	-3.56	5.77	42.33
18	24.5	0.3411	16.3	12.15	161	165.4	1.028	-3.41	5.58	42.33
19	24.5	0.3475	15.68	12.16	156.9	162.3	1.035	-3.67	5.71	42.33
20	24.5	0.3485	15.79	12.04	156.9	162.3	1.034	-3.5	5.61	42.33
21	24.5	0.3487	15.78	12.09	157.9	163.1	1.033	-3.49	5.67	42.33
22	24.5	0.347	15.7	12.14	159.3	162.1	1.018	-3.67	5.68	42.33
23	24.5	0.3459	15.64	12.23	160	162.1	1.013	-3.79	5.75	42.33
24	24.5	0.3487	15.44	12.22	155.2	161.3	1.039	-3.83	5.8	42.33
25	24.5	0.3528	15.44	12.15	154.5	162.2	1.05	-3.61	5.8	42.33
26/1	24.5	0.3477	15.5	12.09	156.2	159.7	1.022	-3.82	5.64	42.33
26/2	24.5	0.3376	16.23	12.34	162	165.7	1.023	-3.68	5.71	42.33
27/1	24.5	0.3518	15.38	12.17	154.5	161.4	1.044	-3.72	5.8	42.33
27/2	24.5	0.3409	16.58	12.39	165.7	171.6	1.035	-3.14	5.82	42.33
28 23	24.5	0.3518	15.46	12.08	158.9	161.1	1.013	-3.64	5.71	42.33
QUALITY 1273										
10 24	22.71	0.3378	15.54	12.78	145	152.4	1.051	-4.35	6.14	45.67
11	22.71	0.3378	15.65	12.46	144.3	149.6	1.036	-4.25	5.82	45.67
12	22.71	0.3386	15.69	12.45	142	150.2	1.058	-4.16	5.84	45.67
13	22.71	0.3376	15.65	12.63	145.3	151.5	1.042	-4.26	5.99	45.67
14	22.71	0.3376	15.92	12.45	144.7	151.9	1.05	-3.99	5.81	45.67
15	22.71	0.3386	15.99	12.39	143.7	152.3	1.06	-3.86	5.77	45.67
16 30	22.71	0.3386	15.75	12.48	146.4	151.2	1.033	-4.1	5.86	45.67
QUALITY 1373										
16 31	22.71	0.3414	15.27	12.53	143.3	148.3	1.035	-4.42	5.96	45.67
18	22.71	0.3406	15.76	12.39	143	151.1	1.057	-3.97	5.81	45.67
20	22.71	0.3404	16	12.5	146.7	154.6	1.054	-3.75	5.92	45.67
22	22.71	0.3391	16.07	12.35	147.4	152.8	1.037	-3.75	5.74	45.67
24 35	22.71	0.3399	15.88	12.47	144.7	152.9	1.057	-3.89	5.88	45.67
QUALITY 2843										
16 36	20.94	0.3096	17.28	12.72	147.4	142.5	0.967	-4.43	5.48	49.54
17	20.94	0.3152	17.63	13.12	149.8	152.7	1.02	-3.69	6.01	49.54
18	20.94	0.3109	17.44	13.28	148.1	150.8	1.018	-4.18	6.07	49.54
20	20.94	0.3137	17.42	13.35	144.3	152.8	1.059	-4.01	6.21	49.54
21	20.94	0.3147	17.1	13.4	150.8	151	1.001	-4.26	6.28	49.54
22 41	20.94	0.3147	17.23	13.41	147	152.3	1.035	-4.13	6.29	49.54

SPRING CITY 88 : CONT.BLEACH/L&L

RELAXED DIMENSIONS AVERAGED WITHIN SIZES

	Yarn tex	St Len cm	C/cm	W/cm	Meas Wt	Calc Wt	Wt Ratio	Ic	Iw	1000/ Rtex
QUALITY 2333										
13 1	29.09	0.3343	16.3	12.18	190.2	193	1.015	-3.81	5.48	35.66
14	29.09	0.3376	16.34	12.46	188.1	199.9	1.063	-3.57	5.82	35.66
15	29.09	0.3358	16.02	12.37	187.5	193.6	1.033	-4	5.7	35.66
16	29.09	0.336	16.22	12.28	183.4	194.6	1.061	-3.78	5.61	35.66
17	29.09	0.3363	16.37	12.28	190.9	196.6	1.03	-3.62	5.61	35.66
18	29.09	0.3381	16.5	12.12	187.1	196.6	1.051	-3.38	5.49	35.66
19	29.09	0.3373	16.26	12.24	182	195.2	1.073	-3.67	5.59	35.66
20	29.09	0.3383	16.65	12.43	186.8	203.7	1.09	-3.22	5.81	35.66
21	29.09	0.3371	16.74	12.97	187.8	212.8	1.133	-3.2	6.32	35.66
22	29.09	0.3292	16.95	12.37	189.5	200.8	1.059	-3.46	5.56	35.66
23	29.09	0.3368	16.24	12.33	180	196.1	1.089	-3.72	5.68	35.66
24	29.09	0.3345	16.46	12.4	187.8	198.5	1.057	-3.63	5.7	35.66
26 13	29.09	0.3327	16.93	12.12	187.1	198.7	1.062	-3.27	5.39	35.66
QUALITY 3123										
13 14	29.09	0.331	16.79	12.23	185.1	197.6	1.068	-3.52	5.46	35.66
14	29.09	0.3343	16.84	12.28	186.8	201	1.076	-3.26	5.57	35.66
15	29.09	0.3302	15.83	12.81	190.2	194.9	1.025	-4.52	6.03	35.66
16	29.09	0.3307	15.97	12.61	184.7	193.7	1.049	-4.35	5.83	35.66
17	29.09	0.3287	16.46	12.41	182.7	195.2	1.068	-3.99	5.59	35.66
18	29.09	0.3312	16.84	12.46	192.9	202.2	1.048	-3.45	5.7	35.66
21	29.09	0.3216	17.31	12.3	191.5	199.2	1.04	-3.59	5.34	35.66
22	29.09	0.3233	17.09	12.42	190.9	199.6	1.046	-3.7	5.49	35.66
23	29.09	0.3294	16.61	12.48	187.5	198.8	1.06	-3.79	5.68	35.66
24 23	29.09	0.3292	16.9	12.42	186.1	200.9	1.08	-3.52	5.61	35.66
QUALITY 3133										
21 24	29.09	0.332	17.54	12.36	200.4	209.4	1.045	-2.71	5.61	35.66
22	29.09	0.3233	17.39	12.41	194.9	203	1.041	-3.39	5.48	35.66
23	29.09	0.3294	16.91	12.31	196.3	199.4	1.016	-3.5	5.51	35.66
24 27	29.09	0.3292	17.24	12.46	195.9	205.7	1.05	-3.17	5.65	35.66
QUALITY 2553										
22 28	32.27	0.3449	16.49	11.71	200.4	215	1.073	-3	5.22	32.15
23	32.27	0.3449	16	11.81	204.4	210.3	1.029	-3.49	5.32	32.15
24	32.27	0.3442	16.75	11.83	200	220.2	1.101	-2.78	5.33	32.15
25 31	32.27	0.3452	16.16	11.55	207.2	207.9	1.003	-3.31	5.06	32.15
QUALITY 2533										
28 32	29.09	0.3294	16.49	12.39	194.3	196	1.009	-3.88	5.6	35.66
QUALITY 3043										
19 33	20.94	0.3189	17.6	14.08	147.7	161.3	1.092	-4.02	6.87	49.54
QUALITY 3883										
21 34	20.94	0.3155	16.44	13.59	146	147.7	1.011	-4.86	6.49	49.54

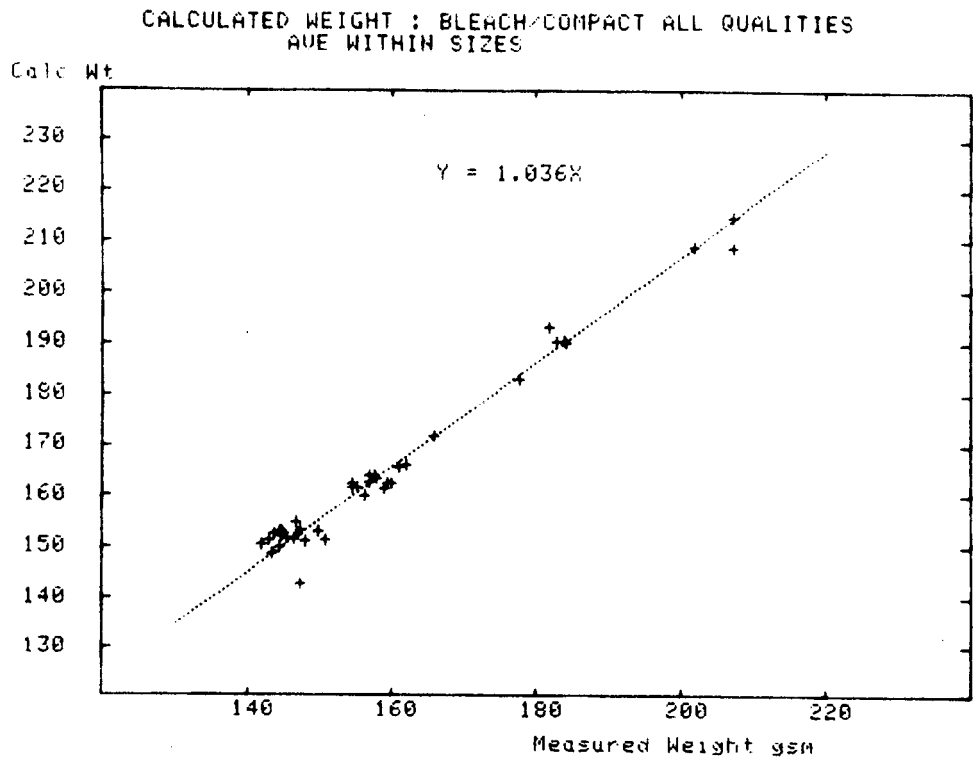
NB : Quality 3883 is CB/Calender

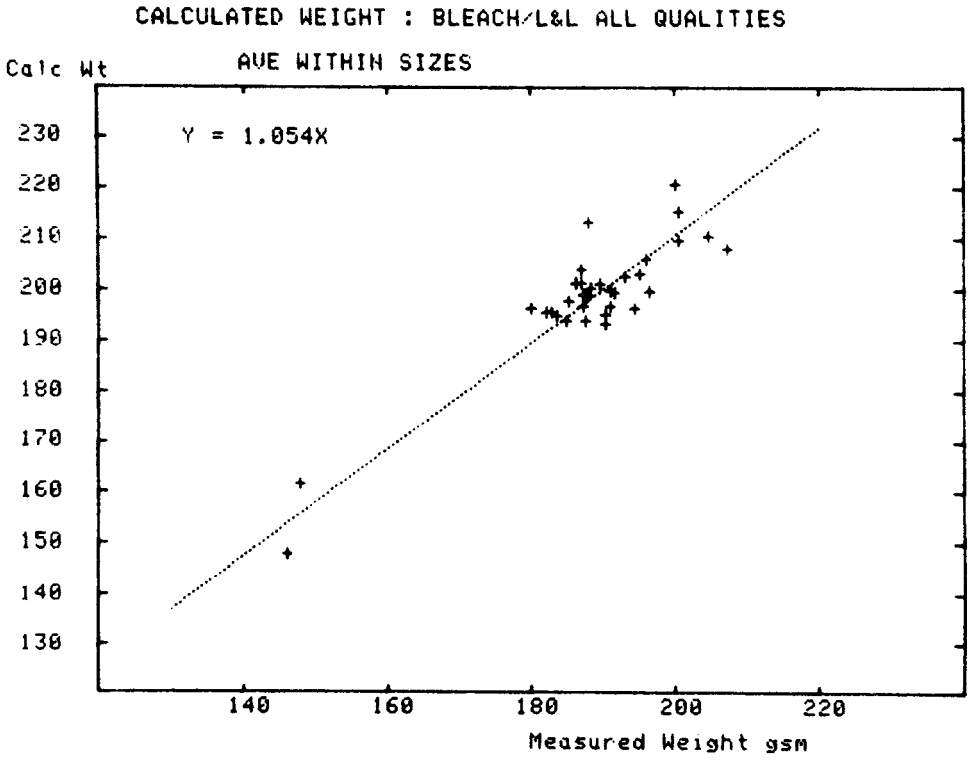
SPRING CITY 86 : BLEACHED QUALITIES

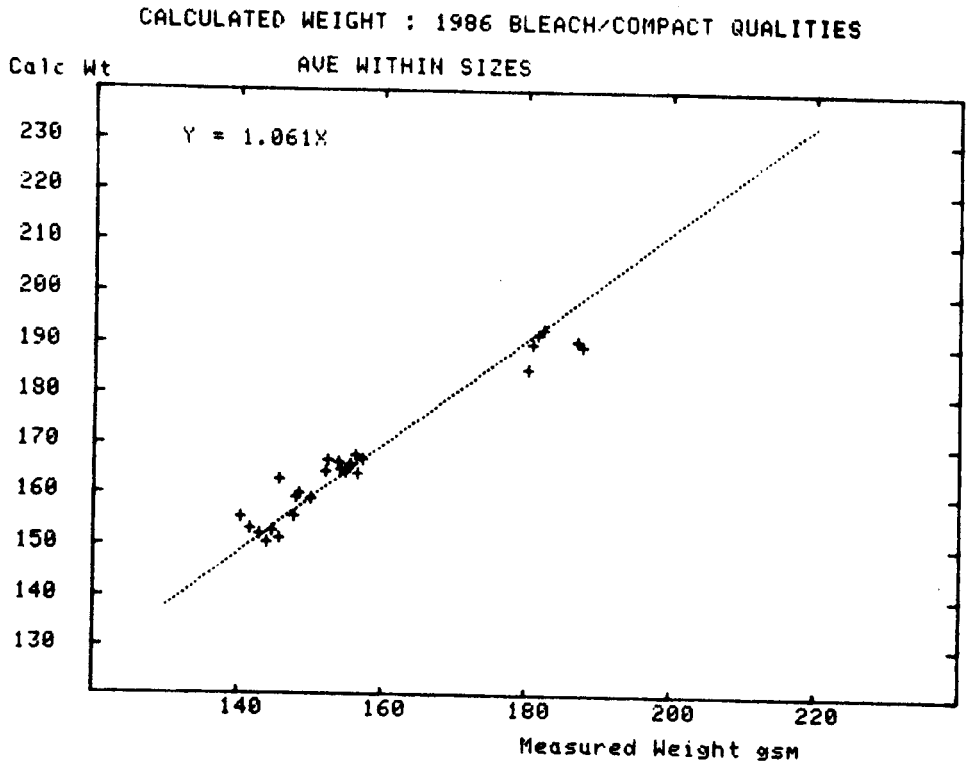
RELAXED DIMENSIONS AVERAGED WITHIN SIZES

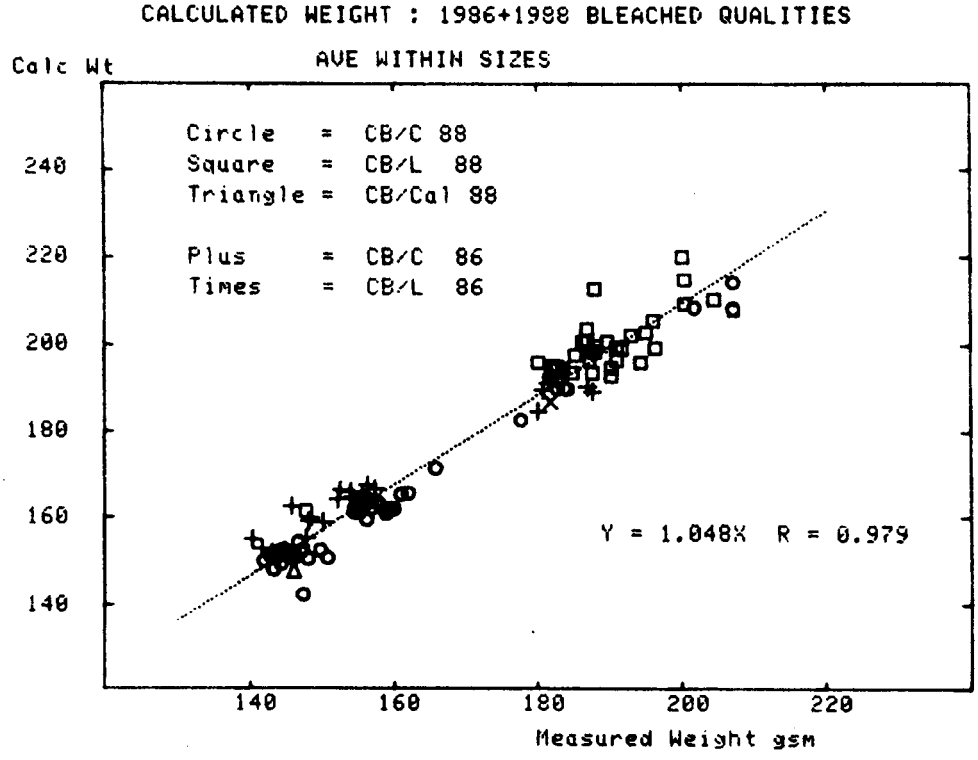
	Yarn tex	StLen cm	C/cm	W/cm	Meas Wt	Calc Wt	Wt Ratio	Ic	Iw	1000/ RelTex
QUALITY 2233										
Size 17	29.19	0.3518	16.03	11.7	182.1	192.6	1.058	-3.08	5.33	35.54
18	29.19	0.3487	15.87	11.74	180.7	189.7	1.05	-3.4	5.32	35.54
19	29.19	0.3566	15.24	11.65	180	184.7	1.026	-3.61	5.36	35.54
21	29.19	0.3548	15.87	11.65	181.4	191.5	1.056	-3.87	5.34	35.54
22	29.19	0.3424	16.24	11.72	186.8	190.4	1.019	-3.39	5.18	35.54
23	29.19	0.347	15.81	11.82	187.5	189.3	1.009	-3.56	5.36	35.54
QUALITY 4893										
Size 16	25.02	0.3492	15.81	12.12	156.2	167.5	1.072	-3.43	5.71	41.46
17	25.02	0.3487	15.63	12.2	152.5	166.3	1.091	-3.65	5.77	41.46
18	25.02	0.3411	16	12.13	155.6	165.7	1.065	-3.7	5.56	41.46
19	25.02	0.3475	15.7	12.15	153.9	165.9	1.078	-3.64	5.71	41.46
20	25.02	0.3485	15.6	12.09	154.2	164.6	1.067	-3.68	5.67	41.46
21	25.02	0.3487	15.7	12.07	155.6	165.3	1.063	-3.58	5.65	41.46
22	25.02	0.347	15.74	12.19	157.3	166.6	1.06	-3.63	5.74	41.46
24	25.02	0.3487	15.58	12.05	156.6	163.8	1.046	-3.69	5.63	41.46
26	25.02	0.3477	15.56	12.12	152.2	164.1	1.078	-3.77	5.68	41.46
28	25.02	0.347	15.56	12.14	154.9	164	1.059	-3.81	5.68	41.46
QUALITY 1273										
Size 10	23.07	0.3378	14.81	14.08	145.7	162.6	1.116	-5.08	7.45	44.97
11	23.07	0.3385	15.87	12.41	144	150.2	1.043	-4.46	5.63	44.97
12	23.07	0.3386	15.53	12.57	144.7	152.5	1.054	-4.32	5.96	44.97
13	23.07	0.3376	15.78	12.93	150.1	158.9	1.058	-4.13	6.29	44.97
14	23.07	0.3373	16.04	12.45	147.8	155.4	1.052	-3.89	5.81	44.97
15	23.07	0.3386	16.08	12.35	140.3	155.1	1.106	-3.77	5.73	44.97
QUALITY 1373										
Size 16	23.07	0.3414	16.16	12.5	148.1	159.1	1.075	-3.53	5.94	44.97
17	23.07	0.3411	16.41	12.39	148.4	159.9	1.078	-3.3	5.82	44.97
18	23.07	0.3406	15.65	12.44	141.6	152.9	1.08	-4.09	5.86	44.97
20	23.07	0.3404	15.57	12.35	145.7	151.1	1.037	-4.17	5.77	44.97
22	23.07	0.3391	15.86	12.25	143	151.9	1.062	-3.96	5.64	44.97
QUALITY 1723										
Size 19	29.19	0.3358	15.91	12	181.7	187	1.029	-4.11	5.32	35.54
16	29.19	0.336	15.96	12.22	182.1	191.2	1.05	-4.04	5.55	35.54
21	29.19	0.336	16.41	12.09	183.1	194.7	1.063	-3.59	5.43	35.54
23	29.19	0.3368	16.15	12.2	182.4	193.8	1.062	-3.81	5.55	35.54

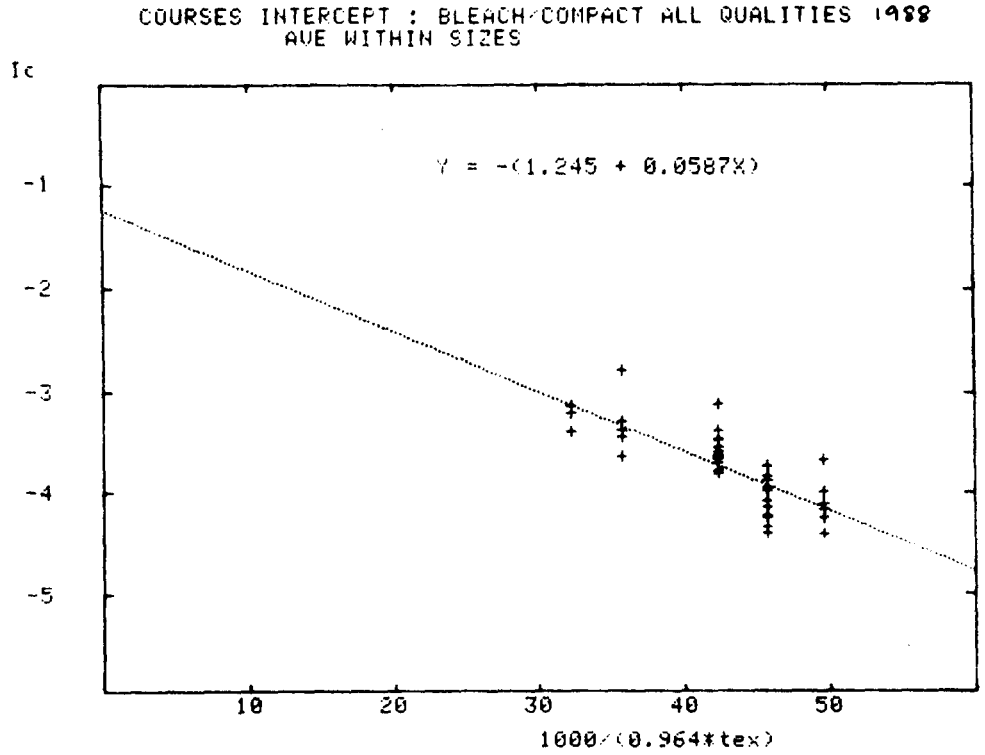
1723 is CB/L&L, others are CB/Compact

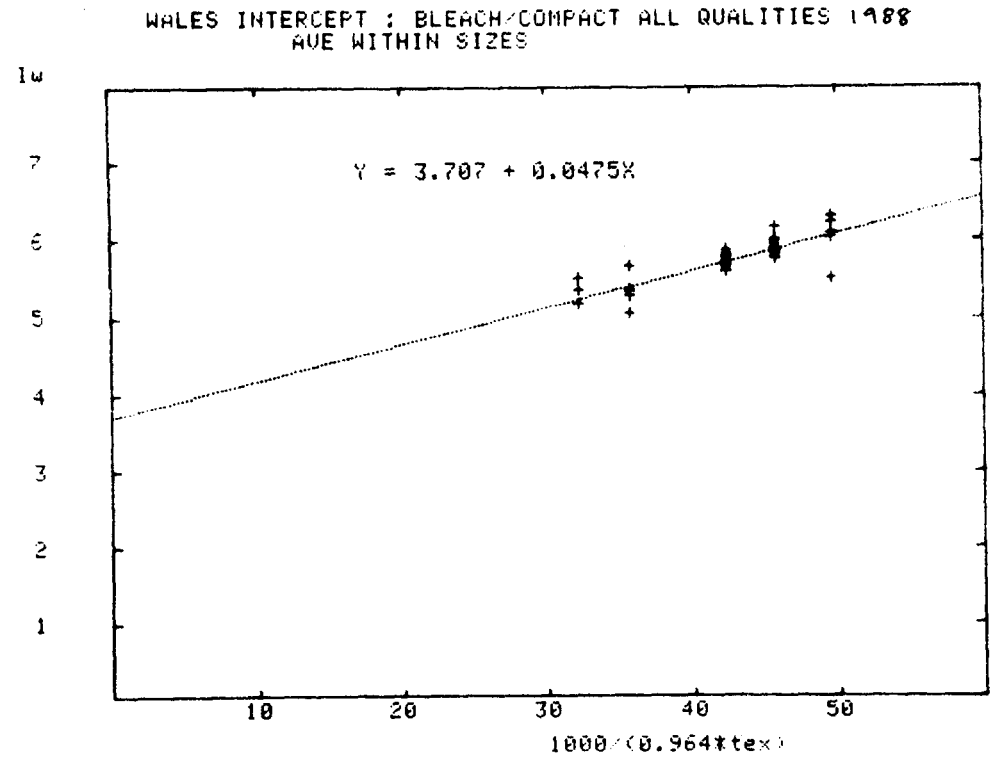

CALCULATED WEIGHT : BLEACH/COMPACT ALL QUALITIES
AVE WITHIN SIZES
Calc Wt
Y = 1.036X
230
220
210
200
190
180
170
160
150
140
130
140
160
180
200
220
Measured Weight gsm

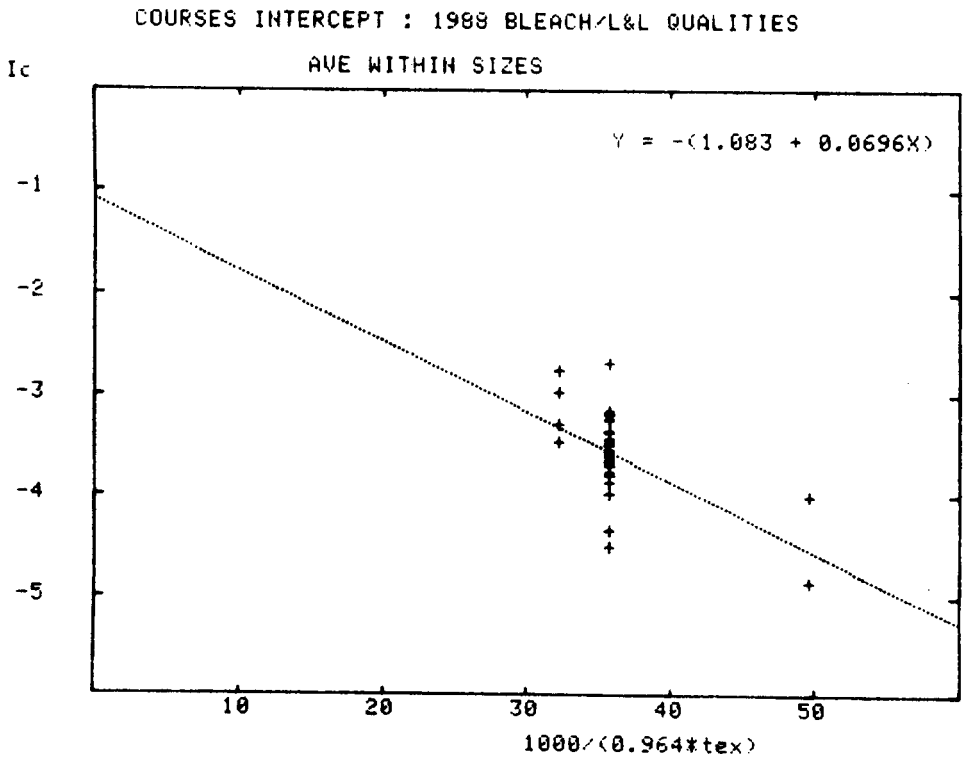

CALCULATED WEIGHT : BLEACH/L&L ALL QUALITIES
AVE WITHIN SIZES
Calc Wt
Y = 1.054X
230
220
210
200
190
180
170
160
150
140
130
140
160
180
200
220
Measured Weight gsm

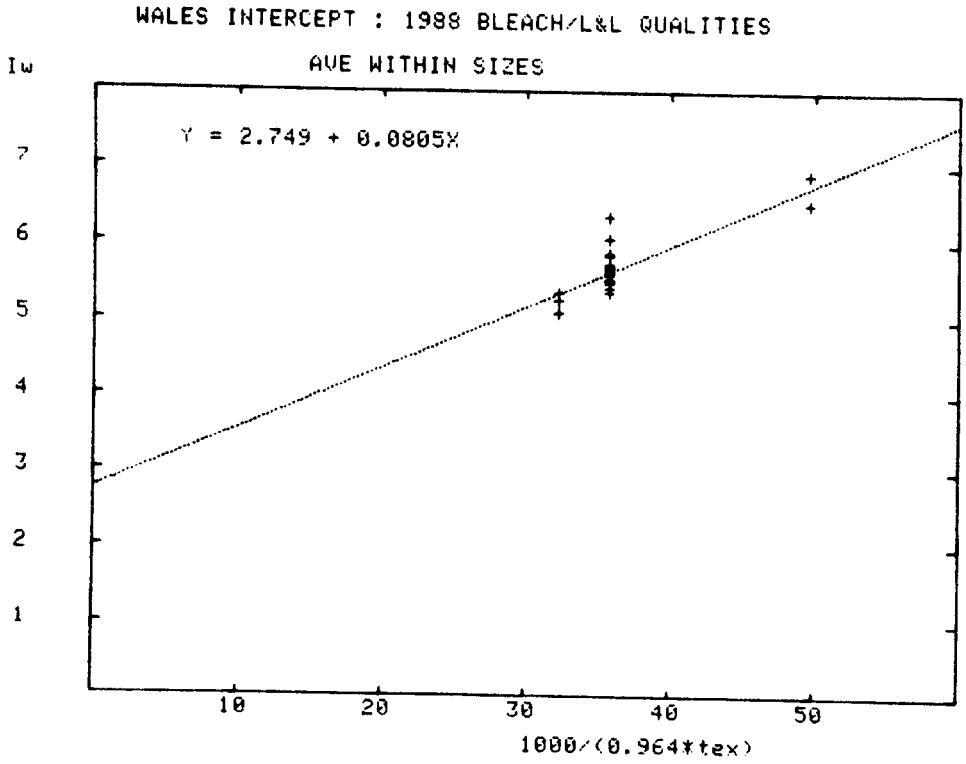

CALCULATED WEIGHT : 1986 BLEACH/COMPACT QUALITIES
AVE WITHIN SIZES
Calc Wt
Y = 1.061X
230
220
210
200
190
180
170
160
150
140
130
140
160
180
200
220
Measured Weight gsm

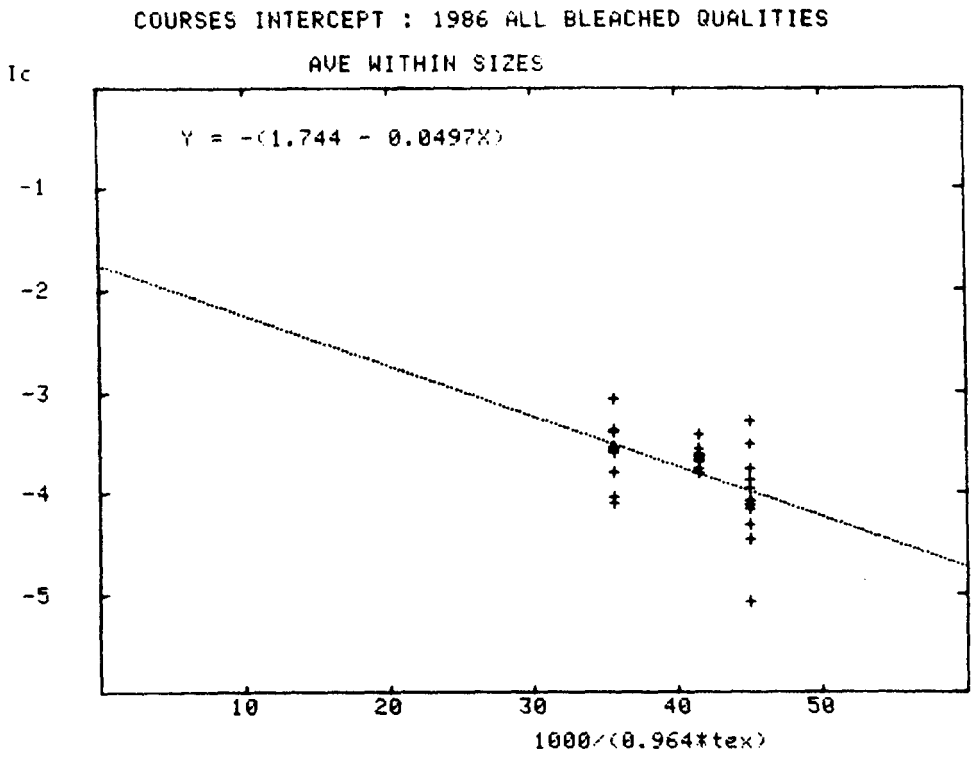

CALCULATED WEIGHT : 1986+1988 BLEACHED QUALITIES
AVE WITHIN SIZES
Calc Wt
Circle = CB/C 88
Square = CB/L 88
Triangle = CB/Cal 88
Plus = CB/C 86
Times = CB/L 86
Y = 1.048X R = 0.979
240
220
200
180
160
140
140
160
180
200
220
Measured Weight gsm

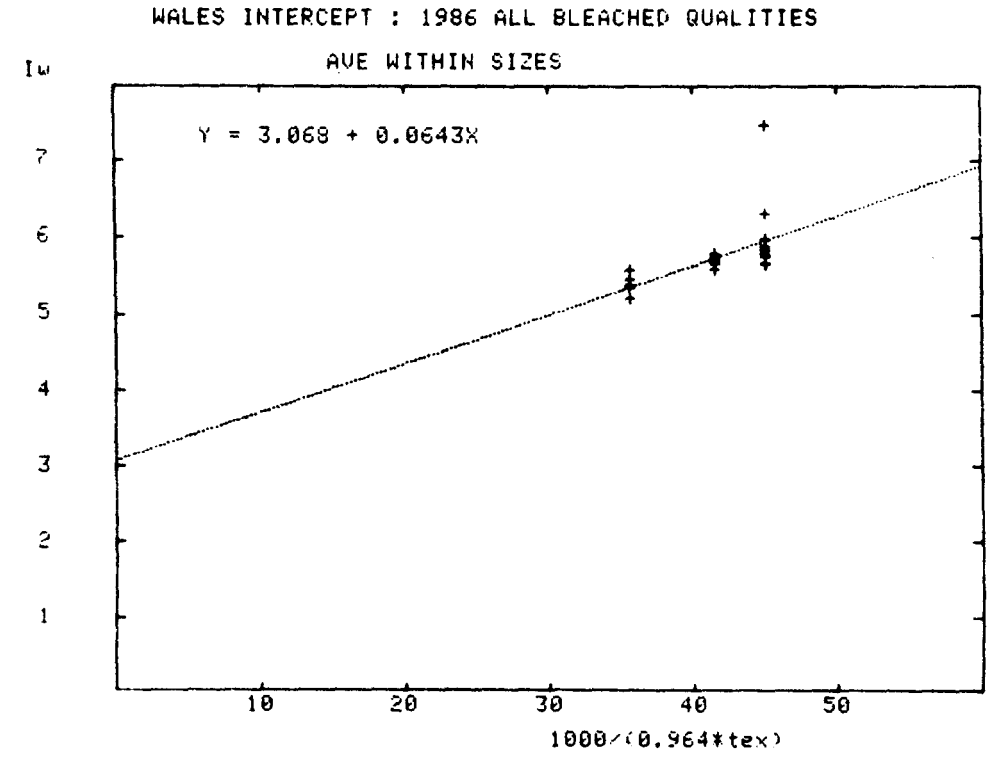

COURSES INTERCEPT : BLEACH/COMPACT ALL QUALITIES 1988
AVE WITHIN SIZES
Ic
Y = -(1.245 + 0.0587X)
-1
-2
-3
-4
-5
10
20
30
40
50
1000/(0.964*tex)


WALES INTERCEPT : BLEACH/COMPACT ALL QUALITIES 1988
AVE WITHIN SIZES
Iw
Y = 3.707 + 0.0475X
7
6
5
4
3
2
1
10
20
30
40
50
1000/(0.964*tex)


COURSES INTERCEPT : 1988 BLEACH/L&L QUALITIES
AVE WITHIN SIZES
Ic
Y = -(1.083 + 0.0696X)
-1
-2
-3
-4
-5
10
20
30
40
50
1000/(0.964*tex)


WALES INTERCEPT : 1988 BLEACH/L&L QUALITIES
AVE WITHIN SIZES
Iw
Y = 2.749 + 0.0805X
7
6
5
4
3
2
1
10
20
30
40
50
1000/(0.964*tex)


COURSES INTERCEPT : 1986 ALL BLEACHED QUALITIES
AVE WITHIN SIZES
Ic
Y = -(1.744 - 0.0497X)
-1
-2
-3
-4
-5
10
20
30
40
50
1000/(0.964*tex)

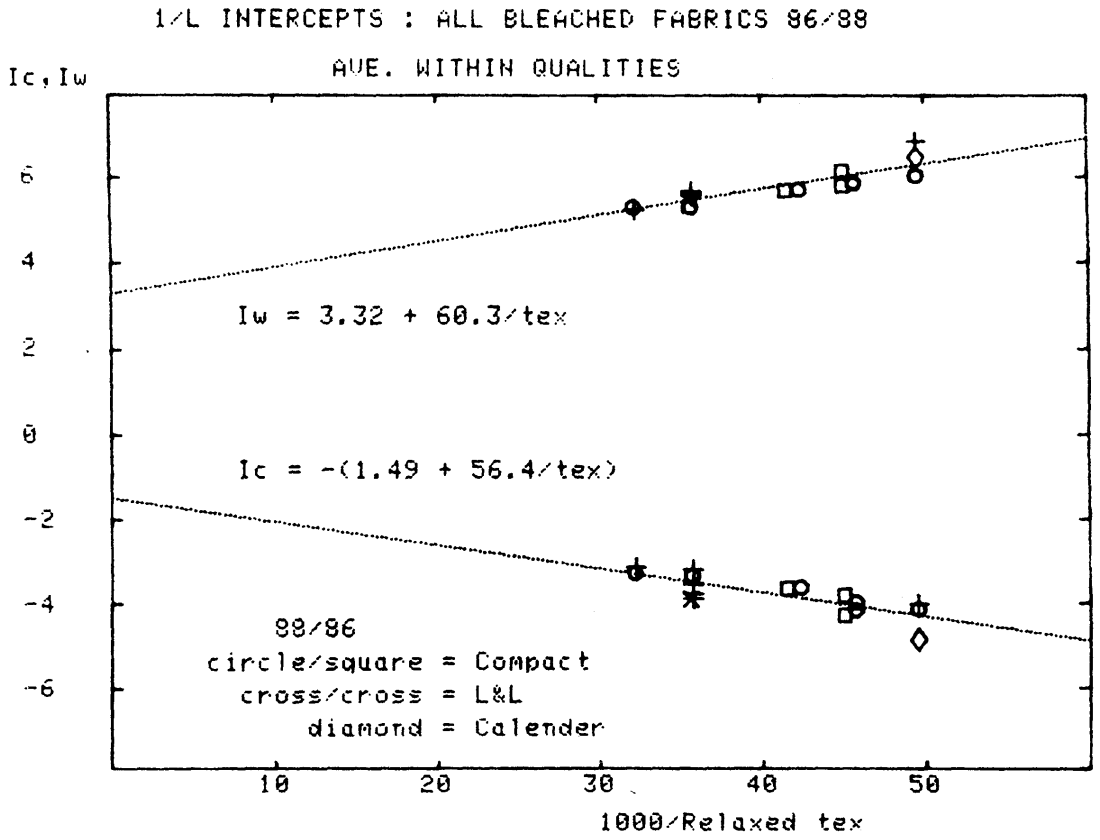

WALES INTERCEPT : 1986 ALL BLEACHED QUALITIES
AVE WITHIN SIZES
Iw
Y = 3.068 + 0.0643X
7
6
5
4
3
2
1
10
20
30
40
50
1000/(0.964*tex)

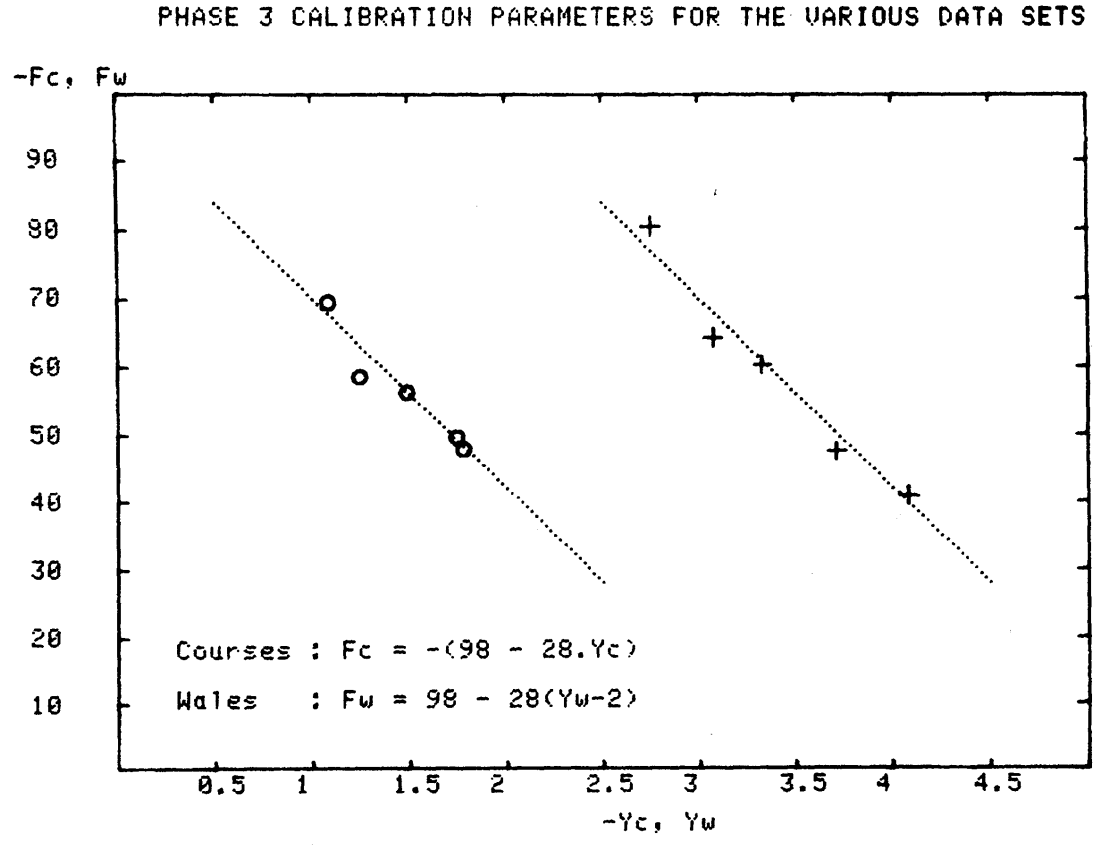
SPRING CITY 1986/1988

BLEACHED FABRICS AVERAGED WITHIN QUALITIES

	No Sizes	Yarn Ne	1000/ tex	Mean St Len	Ic mean	Ic sd	Iw mean	Iw sd
1988 CB/Compact								
2223	3	18	32.15	0.3509	-3.27	0.13	5.32	0.16
2233	5	20	35.66	0.3505	-3.33	0.32	5.32	0.22
4893	15	24	42.33	0.3472	-3.61	0.18	5.73	0.08
1273	7	26	45.67	0.3381	-4.14	0.17	5.89	0.13
1373	5	26	45.67	0.3403	-3.96	0.28	5.86	0.09
2843	6	28	49.54	0.3131	-4.12	0.25	6.06	0.3
1988 CB/L&L								
2553	4	18	32.15	0.3448	-3.14	0.32	5.23	0.12
2333	13	20	35.66	0.3357	-3.56	0.24	5.67	0.23
2533	1	20	35.66	0.3299	-3.88	n.a.	5.6	n.a.
3123	10	20	35.66	0.329	-3.77	0.4	5.63	0.2
3133	4	20	35.66	0.3285	-3.19	0.35	5.56	0.08
3043	1	28	49.54	0.3109	-4.02	n.a.	6.87	n.a.
1988 CB/Calender								
3883	1	28	49.54	0.3155	-4.86	n.a.	6.49	n.a.
1986 CB/Compact								
2233	6	20	35.54	0.3502	-3.35	0.23	5.32	0.07
4893	10	24	41.46	0.3474	-3.66	0.11	5.68	0.06
1273	6	26	44.97	0.3367	-4.28	0.47	6.15	0.68
1373	5	26	44.97	0.3405	-3.81	0.38	5.81	0.11
1986 CB/L&L								
1723	4	20	35.54	0.3362	-3.89	0.24	5.46	0.11

NB : Quality 1273 is carded yarn
Ne is nominal
tex is 0.964 x mean measured value


1/L INTERCEPTS : ALL BLEACHED FABRICS 86/88
AVE. WITHIN QUALITIES
Ic, Iw
6
4
2
0
-2
-4
-6
Iw = 3.32 + 60.3/tex
Ic = -(1.49 + 56.4/tex)
88/86
circle/square = Compact
cross/cross = L&L
diamond = Calender
10
20
30
40
50
1000/Relaxed tex


PHASE 3 CALIBRATION PARAMETERS FOR THE VARIOUS DATA SETS
-Fc, Fw
90
80
70
60
50
40
30
20
10
Courses : Fc = -(98 - 28.Yc)
Wales : Fw = 98 - 28(Yw-2)
0.5
1
1.5
2
2.5
3
3.5
4
4.5
-Yc, Yw

APPENDIX 4

Single Quality Calibration Exercise

Quality 4893 (16-21) basic data, Ic and Iw, monthly Ic and Iw, estimated courses, wales, and weight.

Plots of Ic and Iw over time.

Plots of estimated courses and wales against measured values

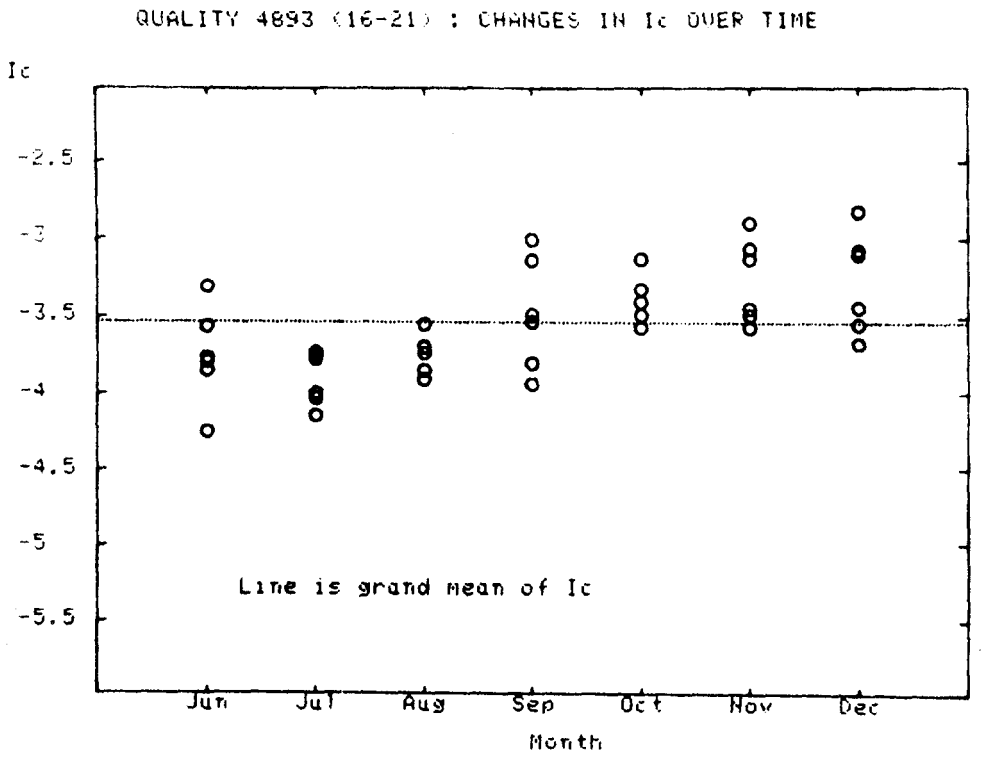
Plots of estimated weight against measured weight and calculated weight.

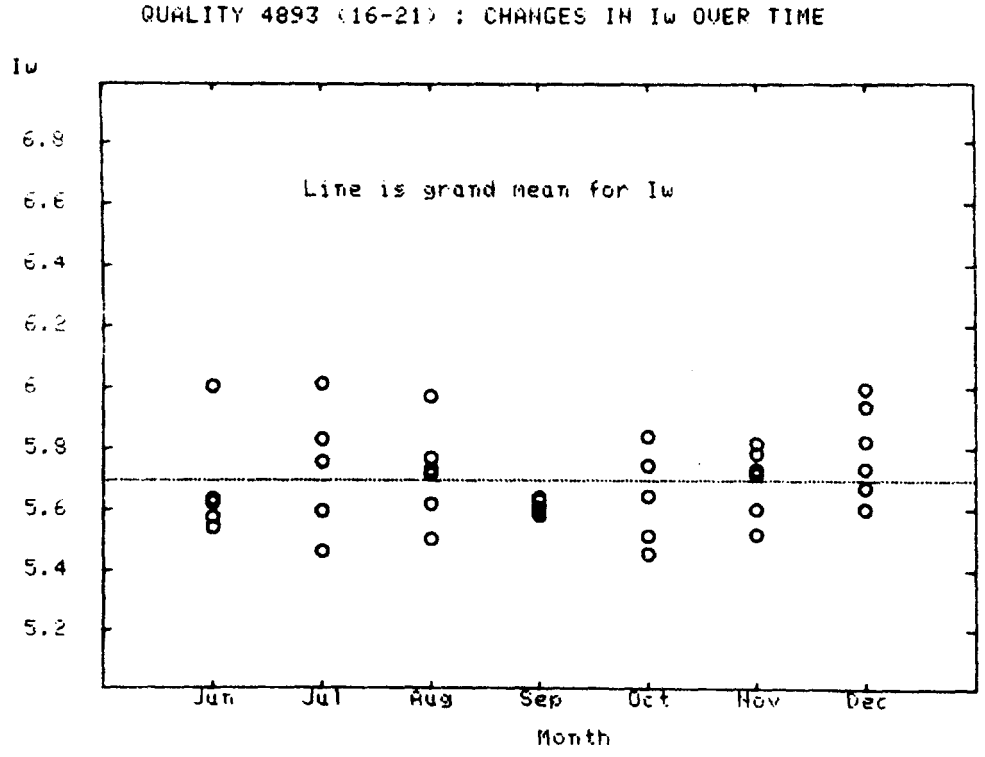
Monthly averages and updated monthly averages for Ic and Iw

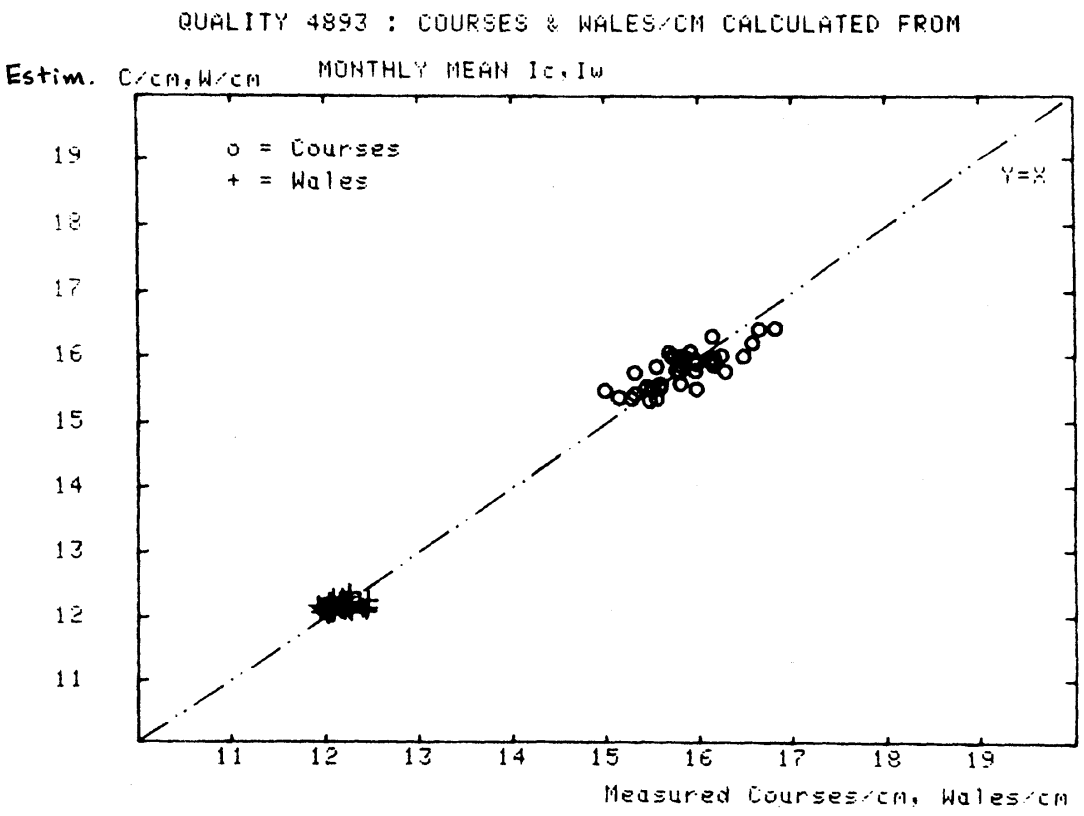
SPRING CITY 1988 : QUALITY 4893 (16-21)

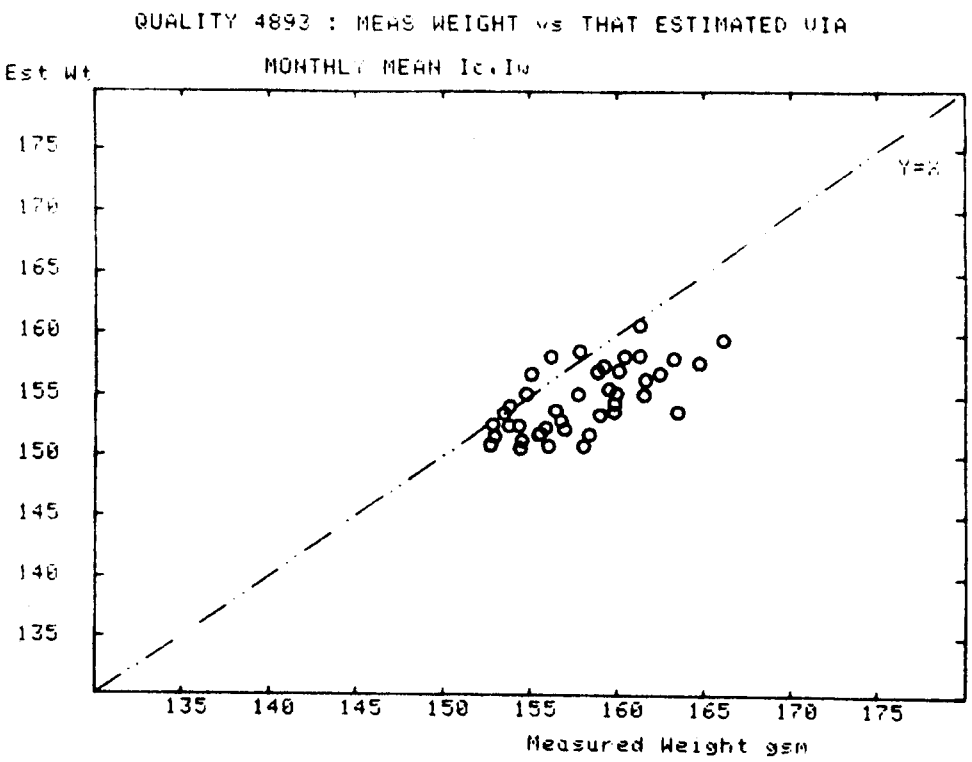
SINGLE QUALITY CALIBRATION EXERCISE

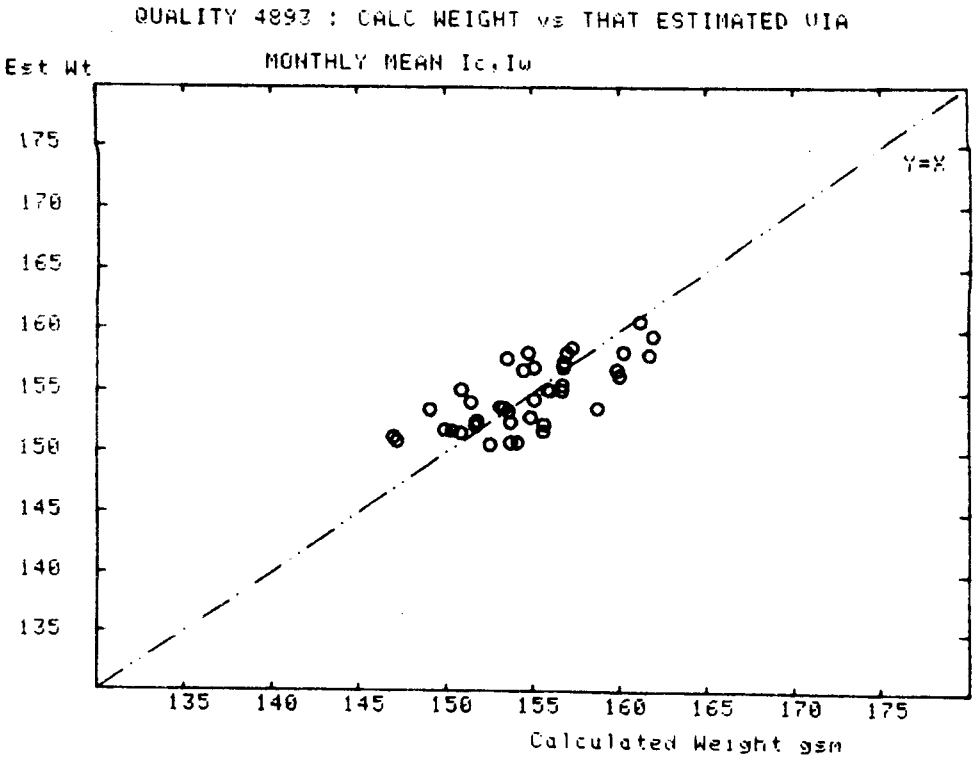
	Nom tex	Nom St Len	Relax C/cm	Relax W/cm	Relax Weight	Ic	Iw	Month Ic	Month Iw	Est C/cm	Est W/cm	Est Weight	Calc Weight	Month Code
SIZE 16														
Jun	24.5	0.3492	14.99	12.42	153	-4.25	6.01	-3.75	5.67	15.49	12.08	151.6	150.8	1
Jul	24.5	0.3492	15.47	12.17	154.5	-3.78	5.76	-3.9	5.71	15.34	12.13	150.7	152.5	2
Aug	24.5	0.3492	15.51	12.39	155.9	-3.73	5.97	-3.74	5.72	15.51	12.13	152.4	155.6	3
Sep	24.5	0.3492	15.31	12.02	153.5	-3.94	5.61	-3.48	5.61	15.76	12.03	153.6	149.1	4
Nov	24.5	0.3492	16.13	12.24	162.5	-3.12	5.82	-3.26	5.7	15.99	12.11	156.8	159.8	6
Dec	24.5	0.3492	16.16	12.36	163.3	-3.09	5.94	-3.27	5.8	15.98	12.21	158	161.7	7
SIZE 17														
Jun	24.5	0.3487	15.97	12.05	158.4	-3.3	5.62	-3.75	5.67	15.52	12.09	151.8	155.6	1
Jul	24.5	0.3487	15.28	12.44	158.1	-4	6.02	-3.9	5.71	15.37	12.14	150.9	153.7	2
Aug	24.5	0.3487	15.58	12.2	154.4	-3.69	5.77	-3.74	5.72	15.53	12.14	152.6	153.7	3
Sep	24.5	0.3487	15.79	12.01	159.8	-3.48	5.58	-3.48	5.61	15.79	12.04	153.8	153.3	4
Oct	24.5	0.3487	15.79	12.27	157.8	-3.48	5.84	-3.38	5.64	15.89	12.07	155.1	156.7	5
Nov	24.5	0.3487	15.71	12.16	155.1	-3.56	5.73	-3.26	5.68	16.02	12.1	156.8	154.5	6
Dec	24.5	0.3487	15.84	12.25	160.4	-3.43	5.83	-3.27	5.8	16.01	12.22	158.2	157	7
SIZE 18														
Jun	24.5	0.3411	16.14	12.14	159.8	-3.56	5.58	-3.75	5.67	15.95	12.24	154.4	155.1	1
Jul	24.5	0.3411	15.96	12.16	159	-3.74	5.6	-3.9	5.71	15.8	12.28	153.5	153.6	2
Aug	24.5	0.3411	15.8	12.07	154.8	-3.91	5.5	-3.74	5.72	15.96	12.29	155.2	150.9	3
Sep	24.5	0.3411	16.57	12.2	161.6	-3.13	5.63	-3.48	5.61	16.22	12.18	156.3	160	4
Oct	24.5	0.3411	16.14	12.02	164.7	-3.57	5.46	-3.38	5.64	16.32	12.21	157.7	153.5	5
Nov	24.5	0.3411	16.82	12.17	166.1	-2.89	5.6	-3.26	5.7	16.45	12.26	159.6	161.9	6
Dec	24.5	0.3411	16.64	12.24	161.3	-3.06	5.67	-3.27	5.8	16.44	12.36	160.8	161.2	7
SIZE 19														
Jun	24.5	0.3475	15.58	12.08	157	-3.77	5.64	-3.75	5.67	15.59	12.12	152.2	151.7	1
Jul	24.5	0.3475	15.31	11.91	154.5	-4.03	5.46	-3.9	5.71	15.44	12.16	151.3	147	2
Aug	24.5	0.3475	15.8	12.17	156.8	-3.55	5.72	-3.74	5.72	15.6	12.17	153	154.9	3
Sep	24.5	0.3475	15.54	12.09	153.8	-3.8	5.64	-3.48	5.61	15.86	12.06	154.2	151.4	4
Oct	24.5	0.3475	15.94	12.2	159.5	-3.4	5.75	-3.38	5.64	15.96	12.09	155.6	156.7	5
Nov	24.5	0.3475	15.9	12.23	159.2	-3.44	5.79	-3.26	5.7	16.09	12.14	157.4	156.8	6
Dec	24.5	0.3475	15.68	12.45	157.9	-3.67	6	-3.27	5.8	16.08	12.24	158.6	157.3	7
SIZE 20														
Jun	24.5	0.3485	15.49	11.97	155.6	-3.79	5.54	-3.75	5.67	15.53	12.1	151.9	149.9	1
Jul	24.5	0.3485	15.14	12.03	152.7	-4.14	5.6	-3.9	5.71	15.38	12.14	150.9	147.2	2
Aug	24.5	0.3485	15.44	12.16	152.8	-3.85	5.73	-3.74	5.72	15.55	12.15	152.6	151.8	3
Sep	24.5	0.3485	15.76	12.02	156.5	-3.53	5.59	-3.48	5.61	15.81	12.04	153.6	153.1	4
Oct	24.5	0.3485	15.97	12.07	159.9	-3.32	5.65	-3.38	5.64	15.91	12.07	155.2	155.9	5
Nov	24.5	0.3485	16.23	11.95	160.1	-3.05	5.52	-3.26	5.7	16.03	12.13	157.1	156.8	6
Dec	24.5	0.3485	16.47	12.03	161.3	-2.81	5.6	-3.27	5.8	16.02	12.23	158.3	160.2	7
SIZE 21														
Jun	24.5	0.3487	15.42	12.05	155.5	-3.85	5.63	-3.75	5.67	15.52	12.09	151.8	150.3	1
Jul	24.5	0.3487	15.54	12.26	156.1	-3.73	5.83	-3.9	5.71	15.37	12.14	150.9	154.1	2
Aug	24.5	0.3487	15.57	12.04	153.8	-3.7	5.62	-3.74	5.72	15.53	12.14	152.6	151.7	3
Sep	24.5	0.3487	16.28	12.06	163.5	-3	5.63	-3.48	5.61	15.79	12.04	153.8	158.7	4
Oct	24.5	0.3487	16.15	11.94	161.6	-3.12	5.52	-3.38	5.64	15.89	12.07	155.1	156	5
Nov	24.5	0.3487	15.79	12.14	158.9	-3.48	5.72	-3.26	5.7	16.02	12.12	157	155.1	6
Dec	24.5	0.3487	15.73	12.16	156.2	-3.54	5.74	-3.27	5.8	16.01	12.22	158.2	154.8	7

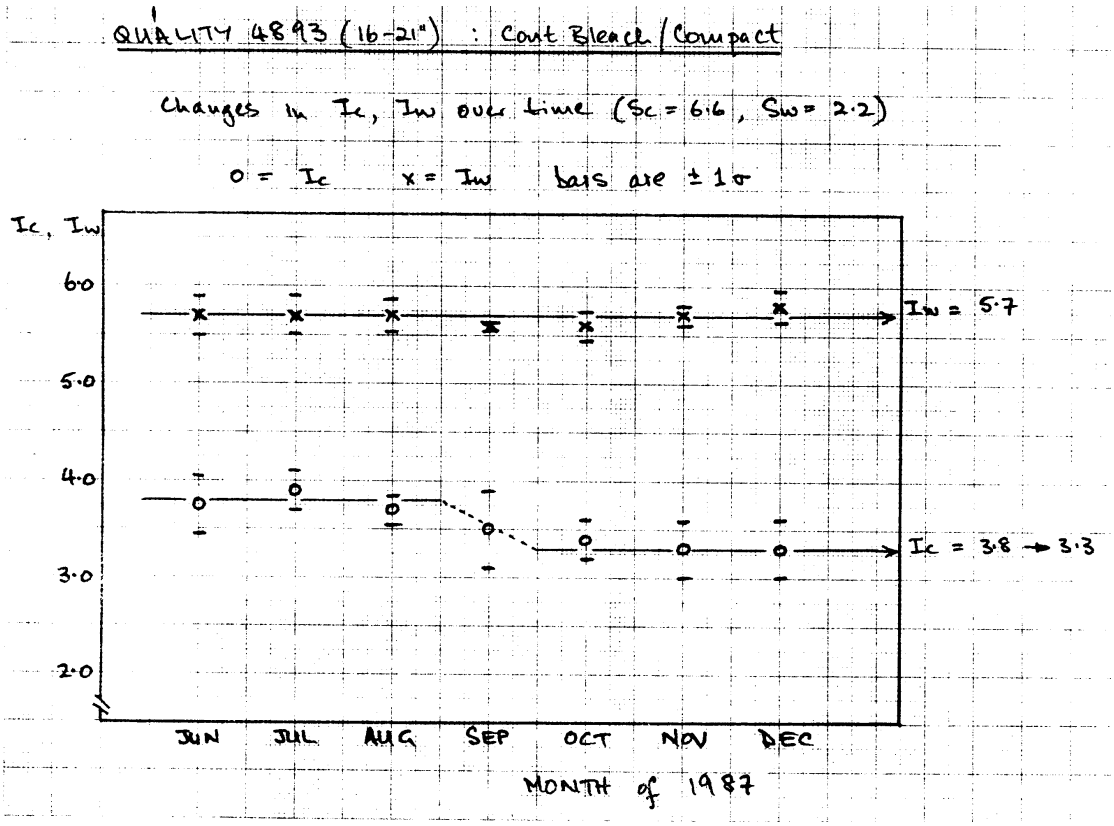

QUALITY 4893 (16-21) : CHANGES IN Ic OVER TIME
Ic
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
Line is grand mean of Ic
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


QUALITY 4893 (16-21) : CHANGES IN Iw OVER TIME
Iw
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
Line is grand mean for Iw
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


QUALITY 4893 : COURSES & WALES/CM CALCULATED FROM
MONTHLY MEAN Ic, Iw
Estim. C/cm, W/cm
o = Courses
+ = Wales
Y=X
19
18
17
16
15
14
13
12
11
11 12 13 14 15 16 17 18 19
Measured Courses/cm, Wales/cm


QUALITY 4893 : MEAS WEIGHT vs THAT ESTIMATED VIA
MONTHLY MEAN Ic,Iw
Est Wt
175
170
165
160
155
150
145
140
135
Y=X
135 140 145 150 155 160 165 170 175
Measured Weight gsm


QUALITY 4893 : CALC WEIGHT vs THAT ESTIMATED VIA
MONTHLY MEAN Ic,Iw
Est Wt
175
170
165
160
155
150
145
140
135
Y=X
135 140 145 150 155 160 165 170 175
Calculated Weight gsm



SPRING CITY 1988

SINGLE QUALITY CALIBRATION EXERCISE
Monthly averages for Ic and Iw

QUALITY 4893 (16-21)

	No Rcrds	Ic Mean	Ic sd	Iw Mean	Iw sd	Updated Ic	Mean Iw
JUN	6	-3.753	0.32	5.67	0.17	-3.753	5.67
JUL	6	-3.903	0.18	5.712	0.2	-3.828	5.691
AUG	6	-3.738	0.13	5.718	0.16	-3.783	5.704
SEP	6	-3.48	0.37	5.613	0.02	-3.631	5.659
OCT	5	-3.378	0.17	5.644	0.16	-3.504	5.651
NOV	6	-3.257	0.27	5.697	0.11	-3.381	5.674
DEC	6	-3.267	0.33	5.797	0.15	-3.324	5.735
mean		-3.539		5.693			
sd		0.258		0.059			