NOV 2 1945

✓ Project 1108

STUDY OF PAPER BOARD QUALITY
AS RELATED TO
FIBER BOX PERFORMANCE

REPORT NUMBER I

Baseline Studies 1. The Evaluation of Current Kraft Liners and Corrugating Mediums

INSTITUTE OF PAPER CHEMISTRY
Appleton Wisconsin

REPORT TO

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

STUDY OF PAPER BOARD QUALITY

AS RELATED TO

FIBER BOX PERFORMANCE

REPORT NUMBER I

Baseline Studies 1. The Evaluation of Current Kraft Liners and Corrugating Mediums

REPORT TO

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

Appleton, Wisconsin

THE INSTITUTE OF PAPER CHEMISTRY

OCTOBER, 1945

TABLE OF CONTENTS

A STUDY OF PAPERBOARD QUALITY AS RELATED TO BOX PERFORMANCE

BASELINE STUDIES. I. THE EVALUATION OF CURRENT KRAFT LINERS AND CORRUGATING MEDIUMS

GENERAL INTRODUCTION

Project 1108 of The Institute of Paper Chemistry is a long range program of research and development, which has as its objective the development of the basic information needed for improving the measurement and control of the quality of box components and box performance. It was apparent that an objective scientific approach to this problem would require the development of more adequate means of evaluating the quality of boxes and box components. In other words, it is necessary to create reliable "yardsticks" for the selection of raw materials, for the control of manufacturing and converting variables, for the facilitation of design, and for the measurement and prediction of performance.

The broad outline of procedure for the development of basic information was as follows:

I. Review of literature and previous experience
II. Review of existing test methods
III. Review of available box performance data
IV. Instrumentation or improvement of present testing methods and the development of new methods
V. Research, testing and development (*including field observation of performance and analysis of field hazards*) on materials and methods of fabrication related to physical properties and design of
   A. Paperboard
   B. Combined board
   C. Boxes
VI. Interpretation and application of results

This study was undertaken in 1944 in co-operation with the Fourdrinier Kraft Board Institute, whose membership was composed of the following organizations:

The Brown Paper Mill Company, Inc.
The Chesapeake Corporation
Hummel-Ross Fibre Corporation
International Paper Company, Southern Kraft Division
National Container Corporation
St. Joe Paper Company
Union Bag & Paper Corporation
West Virginia Pulp & Paper Company

These mills produce a substantial percentage of the kraft liner and corrugating board made in this country.

INTRODUCTION TO BASELINE STUDY

Essential to any long-range program of this nature is the establishment of a baseline for reference throughout the course of the study. It was decided, therefore, that an index of the quality of the current production of the co-operating mills should be established as a baseline. This baseline was to be determined as accurately as was feasible within the limitations imposed by existing testing techniques and by wartime operating conditions in the paperboard industry. The baseline study was to be undertaken as early as possible. However, some of the work under Sections I, II, III, and IV outlined above was to be pursued concurrently with the baseline study. The procedure for the establishment of the baseline was divided into two phases.

The first phase of the baseline study was concerned with the problem of sampling, in a truly impartial cross-sectional manner, the current routine production of the co-operating mills and evaluating these samples as completely as possible by means of existing board testing methods. *It is with this phase of the baseline study that the present report is primarily concerned.*

As it would have been almost impossible to determine the quality index for each grade currently manufactured by the various mills, it was decided to base the index on 42-lb. D.F.B.S. (dry finish both sides) kraft liner and .009/26-lb. corrugating medium production.

The selection of sample rolls was to be done by representatives of The Institute of Paper Chemistry from converters' warehouse stocks, rather than at the producing mills. The producing mills had no previous knowledge or control of the time or place of sampling or of the identity or quantity of their product sampled. Samples from the selected rolls were evaluated in the laboratories of The Institute of Paper Chemistry. The rolls thus sampled were set aside for subsequent use by The Institute of Paper Chemistry in the second phase of the baseline study.

Phase two of the baseline study involved (*1*) the selection of the most representative rolls of each mill's sampled production, and (*2*) the fabrication of these representative rolls into corrugated combined boards and their conversion into boxes. The corrugating operation and the conversion into boxes were to be carried out by an impartial boxmaker under carefully controlled, but normal, conditions of manufacture and according to a predetermined schedule of component combinations. Evaluation of the combined board and boxes produced was then to be carried out at The Institute of Paper Chemistry by means of conventional board and box testing methods.

The purpose of this phase of the baseline study was threefold. First, it would provide information concerning the deviation in test values which may be obtained with a given group of component parts under closely controlled conditions of corrugating and box making. Second, it would provide a further means of comparing the quality of board from the various mills. Third, it would provide additional data required for the establishment of the current quality index—namely, data on combined board and boxes.

In order to complete the baseline study within a reasonable period of time, it was necessary to limit the variables of combination and box design. Accordingly, it was decided that the corrugated board should be "B" flute with starch adhesive and that the combined board should be converted into R.S.C. 24 No. $2\frac{1}{2}$ can size domestic can boxes with stitched joints.

SUMMARY

This report covers the first phase of a baseline study which, in turn, is a part of a long-range investigation of paperboard and fiber-box performance.

The results of this phase of the study indicate that the average quality of the sampled 42-lb. D.F.B.S. Fourdrinier kraft liner and of .009/26-lb. kraft and bogus corrugating mediums were as follows:

	Liner	Corrugating Medium
Basis weight, lb./1000 sq. ft.	42.1	26.8
Caliper, in.	0.015	0.010
Apparent density, lb./cu. ft.	33.7	32.3
Bursting strength, points	98	62
G. E. puncture, units	36	18
Moisture, %	8.1	9.4
Riehle compression, lb.		
In	29.0	17.6
Across	22.5	13.0
Elmendorf tear, g./sheet		
In	354	223
Across	304	251
Amthor tensile, lb./in.		
In	77.8	49.5
Across	37.8	24.8
Amthor stretch, %		
In	2.1	1.9
Across	3.7	4.3

It should be remembered that these data are based on the actual rolls sampled and on conventional test methods.

For those tests in which orientation of the specimen is specified, the approximate ratios observed in the in-machine direction and in the across-machine direction were as follows:

	Ratio In:Across
Riehle compression	4:3
Elmendorf tear	0.9:1
Amthor tensile	2:1
Amthor stretch	1:2

The ratio of the bursting strength to the G. E. puncture test on 42-lb. D.F.B.S. Fourdrinier kraft liner was of the order of 2.7:1.

The ratio was not computed for the .009/26-lb. corrugating medium since the relatively high capacity of the G. E. puncture tester did not allow sufficient subdivision of the scale to permit distinguishing between the low values obtained with any degree of accuracy.

SAMPLING AND TESTING PROCEDURES

SAMPLING PROCEDURE

The materials tested were 42-lb. D.F.B.S. (dry finish both sides) Fourdrinier kraft liners and .009/26-lb. kraft and bogus Fourdrinier corrugating mediums. All the component rolls from which the samples were obtained were manufactured by member mills of the Fourdrinier Kraft Board Institute. Inasmuch as some of the members of the Fourdrinier Kraft Board Institute operate more than one mill, it was decided to establish the baseline of current production by giving equal representation to each mill, rather than to each parent company, in the cross-sectional sampling. In this way, the coverage of the field was substantially complete in respect to the quality of board produced by individual mills, as well as within a given company.

The component samples were obtained by three members of the staff of The Institute of Paper Chemistry from full rolls selected at random in a large number of converters' warehouses. An attempt was made to secure sample rolls produced during the first quarter of 1945. Wherever possible, the production period covered by this sampling was narrow enough to be considered current, yet broad enough to eliminate the day-to-day variation in each mill's operation.

At the beginning of this program, each Fourdrinier Kraft Board Institute member submitted a complete list of customers to The Institute of Paper Chemistry. The co-operating converters were chosen by The Institute of Paper Chemistry from these customer lists, partly on the basis of geographic location and partly by the necessity of adequately sampling grades of each mill's production.

The collection of random rolls of liner and corrugating medium proved to be a difficult and laborious task. The hand-to-mouth supply of most converters, caused by the shortage of materials, made it necessary to search more widely and more diligently than had been anticipated. The sampling program was started on March 19, 1945 and completed on May 26, 1945, during which time a total of 280 rolls had been sampled and set aside in 41 converters' warehouses.

The original program called for the sampling of five rolls, selected at random, of each grade of each mill's production in each of four converters' warehouses. The samples from each of the 20 rolls per mill per grade would give a cross-sectional view of the current production for each mill for the grades selected. As may be observed from Table I, it was necessary in some cases to modify the number of rolls sampled because of the scarcity of materials. This was especially true with respect to the corrugating mediums, as additional government restrictions regarding the use of .009/26-lb. kraft corrugating medium went into effect soon after this program of sampling was initiated.

TABLE I

NUMBER OF ROLLS SELECTED PER MILL

42-lb. D.F.B.S. Liner		.009/26-lb. Corrugating Medium	
Mill	Roll Samples	Mill	Roll Samples
A	28	S	10
B	21	T	10
C	15	U	21
D	21	V	13*
E	11	W	13
F	10	X	14
G	15	Y	10
H	14	Z	11
I	22		
J	21		
Total	178		102

* Bogus medium.

Throughout the roll-sampling program, three samples were taken from each roll. These were designated by the terms right, left, and center, and corresponded to the samples taken from the two sides and center of the roll, respectively. These terms were applied to the roll in the following manner: When the observer faced the roll and the board was unwinding over the top of the roll towards the observer, the right of the roll was on the observer's right and the left on the observer's left. The side samples, rights and lefts, were taken near but always slightly removed from the edge of the roll. The complete identity of each roll was maintained throughout.

The actual sampling technique was as follows: After selecting at random a roll of the desired grade and manufacturer, the outer laps of the roll were removed to a depth of approximately one fourth of an inch until the undamaged portion of the roll was exposed. Three full laps, or their equivalent, of undamaged board were then removed the full width of the roll for test purposes. From the innermost lap selected, a strip approximately one foot long was cut the full width of the roll and three moisture samples were taken from the strip, corresponding to the right, center, and left of the roll. Each moisture sample was cut to approximately one square foot and weighed immediately to obtain the airdry weight. Each of the laps and each of the moisture samples were carefully marked with all the necessary roll identification as to the manufacturer, date manufactured, roll number, width, weight, grade, left and right side, and the name of converter in whose warehouse the rolls were sampled. The materials were carefully wrapped and shipped by Railway Express to The Institute of Paper Chemistry at Appleton, Wisconsin.

Upon their arrival at The Institute of Paper Chemistry, the laps were cut into three sample lots of at least 20 specimens each. The specimens in each sample lot were cut to approximately 13 by 13 inches, thoroughly shuffled, and arranged in two groups of 10 each by alternate selection. One of the groups was used for subsequent testing and the other was stored for future reference. The 10-specimen group selected for testing was again shuffled, and arranged in two groups of five specimens each by alternate selection. One group was used for bursting strength and G. E. puncture test and the other group was used for basis weight, caliper, tear, tensile, stretch, and Riehle compression tests.

MATERIALS SAMPLED

As previously mentioned, the materials tested consisted of three lots of specimens taken from the outer laps of rolls sampled in a large number of converters' warehouses. The following summarizes the samples taken:

178 rolls of 42-lb. D.F.B.S. Fourdrinier kraft liner
89 rolls of .009/26-lb. Fourdrinier kraft corrugating medium
13 rolls of .009/26-lb. Fourdrinier bogus corrugating medium

The rolls listed above were obtained from 11 different mills. Some mills manufactured both liner and corrugating, whereas others made only liner or corrugating. The breakdown of the rolls as to manufacturers and the number sampled may be seen in Table I.

A list of the converters and the number of rolls sampled in each converter's warehouse is shown in Table II. It should be mentioned that, without the converter's co-operation, this study could not have been made and we wish to acknowledge their co-operation in this work.

TABLE II

LIST OF CONVERTERS

Converter		Number of Rolls Sampled	
		Liner	Corrugating
Allcraft Corrugated Co.	Harrison, N. J.	3	3
Allied Container Corp.	Boston, Mass.	0	5
Atlantic Container Corp.	Long Island, N. Y.	4	0
Atlas Corrugated Case Co., Inc.	Brooklyn, N. Y.	6	0
Ball Brothers Co.	Muncie, Ind.	5	0
Baltimore Paper Box Co.	Baltimore, Md.	1	7
Bell Fibre Products Corp.	Marion, Ind.	6	0
Colonial Container Corp.	Brooklyn, N. Y.	1	0
Crescent Box Corporation	Philadelphia, Pa.	5	5
Densen-Banner Co., Inc.	Ridgefield Park, N. J.	6	5
Downing Box Co.	Milwaukee, Wis.	10	6
Federal Container Co.	Philadelphia, Pa.	5	0
Fort Wayne Corrugated Paper Co.	Chicago, Ill.	2	6
Fort Wayne Corrugated Paper Co.	Hartford City, Ind.	0	5
Gaylord Container Corp.	St. Louis, Mo.	6	0
Gibraltar Corrugated Paper Co., Inc.	North Bergen, N. J.	6	3
Grand-City Container Corp.	Brooklyn, N. Y.	2	2
Hankins Container Co.	Cleveland, Ohio	0	5
Hummel & Downing Co.	Milwaukee, Wis.	0	2
Inland Container Corp.	Indianapolis, Ind.	7	0
International Paper Co. (Container Division)	Chicago, Ill.	7	7
International Paper Co. (Container Division)	Whippany, N. J.	5	5
Interstate Container Corp.	Glendale, N. Y.	4	0
Jackson Box Co.	Cincinnati, Ohio	7	2
Keystone Box Co.	Pittsburgh, Pa.	0	5
F. J. Kress Box Co.	Pittsburgh, Pa.	10	0
Lanzit Corrugated Box Co.	Chicago, Ill.	3	3
Liberty Corrugated Container Corp.	Brooklyn, N. Y.	1	0
Light Corrugated Box Corp.	Philadelphia, Pa.	9	0
Manufacturers Corrugated Box Co., Inc.	Brooklyn, N. Y.	3	0
Menasha Wooden Ware Corp.	Menasha, Wis.	6	0
National Box & Specialty Co.	Sheboygan, Wis.	12	4
National Container Corp. (Long Island City Division)	Long Island, N. Y.	10	10
Owens-Illinois Glass Co.	Gas City, Ind.	3	2
Pomeroy Manufacturing Co., Inc.	Vincennes, Ind.	5	5
Scharff-Koken Manufacturing Co.	St. Louis, Mo.	6	0
Schiffenhaus Bros. Corrugated Paper Co.	Newark, N. J.	5	3
Superior Paper Products Co.	Pittsburgh, Pa.	2	0
U. S. Corrugated-Fibre Box Co.	Indianapolis, Ind.	3	0
David Weber & Co.	Philadelphia, Pa.	0	2

TESTING PROCEDURES

As previously mentioned, three samples of at least 20 specimens each were taken from each roll selected. The identity of these three roll samples was maintained throughout the entire testing program. The final roll values are based on the averages of the three sample lots.

Prior to testing, all of these roll samples were preconditioned for at least six hours at a relative humidity of not over 35%. After the designated preconditioning period, the samples were conditioned for at least 48 hours and tested in an atmosphere at $50 \pm 2\%$ relative humidity and a temperature of $73 \pm 3.5°$ F. The tests used in this phase of the work were those currently employed and recognized in the industry. The tests performed, together with the test procedures, were as follows.

Moisture

The airdry weight was determined by the representatives of The Institute of Paper Chemistry in the various converters' warehouses wherein the rolls were sampled. A strip approximately one foot in length, the full width of the roll, was cut from the innermost lap of those obtained from each roll sampled. This cross-sectional strip was then cut into three approximately square foot specimens taken at the center and near each end of the roll, which were weighed immediately. These weighed specimens were then forwarded to The Institute of Paper Chemistry where they were dried to constant weight in an oven equipped with forced circulation and maintained at a temperature of $105 \pm 2°$ C. The percentage moisture for each specimen was calculated on the ovendry basis. The final moisture value for each roll was the average of the moisture values of the three specimens taken from each roll.

Basis Weight

The basis weight, expressed as the weight per thousand square feet, was determined by weighing five 12 by 12-inch conditioned specimens from each sample on a Toledo basis-weight scale.

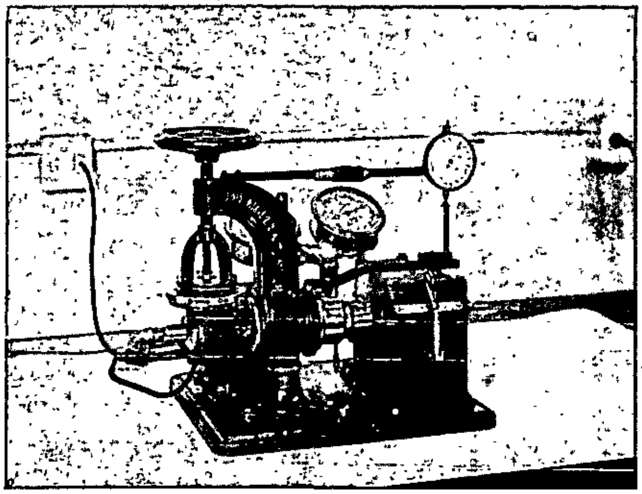

FIGURE 1. Jumbo Mullen tester.

CALIPER

The thickness determinations were made with a Cady micrometer on the specimens previously used for the basis weight determination. The machine direction was noted and care was taken to measure and record the average of the values determined at three different points on a line perpendicular to the machine direction across one end of the specimen sheet. Another series of three readings, taken at the opposite end of the specimen sheet,. was recorded as a second average. In this manner two values (each being the average of three readings) for each of the five specimens per sample resulted in ten recorded values, the average of which was expressed as the caliper value for that particular sample.

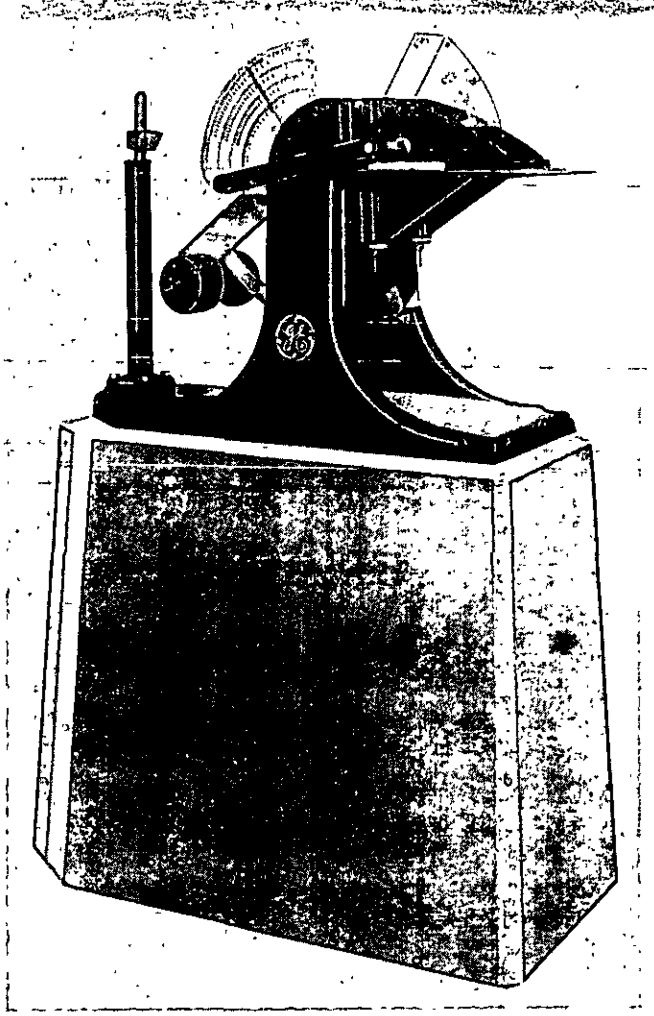

FIGURE 2. General Electric puncture tester.

BURSTING STRENGTH

Bursting strength tests were performed with a motor-driven "Jumbo" Mullen tester equipped with a 300-pound gage and also with a special attachment for controlling the clamping pressure on the specimen. This tester is shown in Figure 1. Two test readings were obtained on each of five specimens per sample. On each specimen one test was obtained with the diaphragm pressure applied to the wire side and one test with the pressure applied to the felt side.

G. E. PUNCTURE TEST

The G. E. puncture tests were carried out with the new model puncture tester shown in Figure 2. TAPPI Method T 803 m-44 was followed, using the same five specimens as were used for determination of bursting strength. Two punctures, one in each direction, were made for each specimen.

TENSILE STRENGTH AND STRETCH

The Amthor tensile tester was used for simultaneously indicating the tensile breaking strength and the stretch of the test specimen. This instrument, as shown in Figure 3, is of the pendulum type, having three independent load-indicating ranges—0 to 15, 0 to 50, and 0 to 200 pounds. At the start of the test the distance between the edges of the jaws of the clamps was equal to 152 mm. (6.0 inches). The width of the test strip was 15 mm. (0.59 inch). Four test strips, two in each direction, were cut from each of the five specimens previously used for basis weight and caliper determinations. The tensile breaking strength per sample was reported as the average of the individual test specimen values expressed in pounds per inch width for each direction.

The stretch value per sample was reported as the average of the individual specimen readings expressed in percentage elongation to failure, based upon an initial test strip length of six inches.

ELMENDORF TEAR

The tear values were obtained using the Elmendorf paper tester shown in Figure 4. Two test strips, one with its long axis in the machine direction and the other with its long axis perpendicular to the machine direction of the sheet, were cut from the unused portion of each of the five specimens originally used for basis weight and caliper determinations. In the text, the term "in-machine direction" tear refers to the tear value obtained when the line of tear was parallel to the machine direction of the sheet. Similarly, the "across-machine direction" tear refers to the tear value obtained when the line of tear was perpendicular to the machine direction of the sheet. Only one liner test strip was torn at a time and only one tear value was recorded for each test strip. It was necessary to test four of the corrugating medium test strips simultaneously in order to obtain scale readings between 20 and 60. In this latter case five tear readings were recorded for the four-strip test specimen. The average values in both directions were reported separately.

Riehle Compression

The compression values were obtained by the use of a Riehle Bros. hydraulic compression tester as shown in Figure 5. Two 0.5 by 2 inch strips, one in each direction, were cut from the unused portion of each of the five specimens originally used for basis weight and caliper determinations. The compression values were reported as the averages of the individual specimen readings.

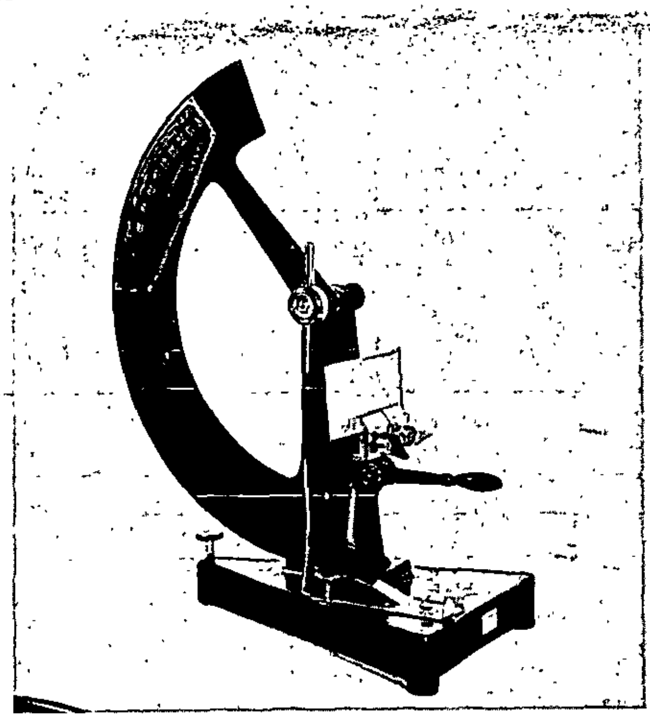

Figure 4. Elmendorf paper tester.

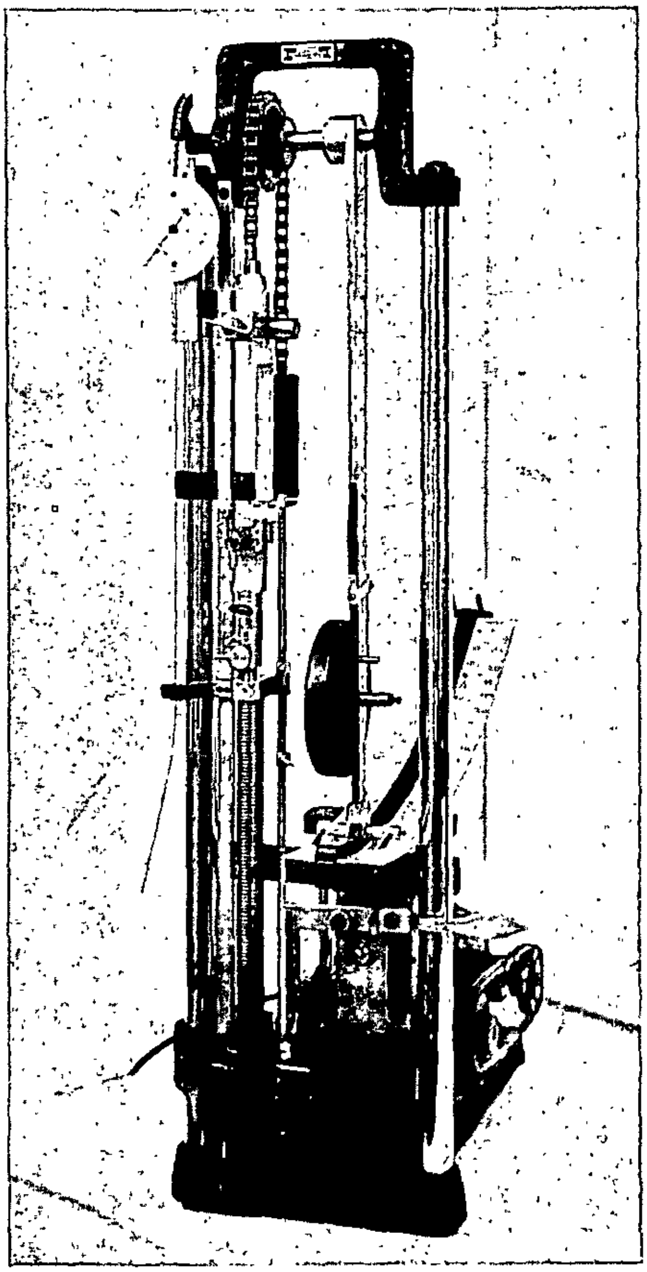

Figure 3. Amthor tensile tester.

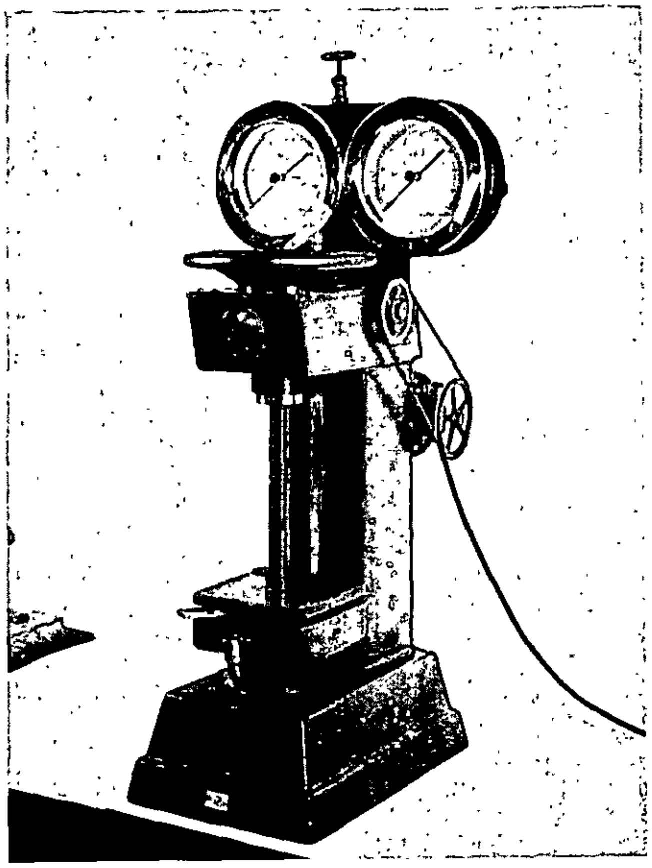

Figure 5. Riehle compression tester.

PROCEDURE

The tests and procedures employed throughout this evaluation study have been described in the previous section. By virtue of the fact that samples could be obtained only from near the outermost portion of each roll, they represent the evaluation of that roll only to the extent that the sampled section was representative of the entire roll and in terms of the methods employed in this evaluation.

For the purpose of comparison of the product within a given mill and also between mills, each Fourdrinier Kraft Board Institute mill making 42-lb. D.F.B.S. Fourdrinier kraft liner has been given an arbitrarily selected code letter. This code identity has been used throughout this report. The Fourdrinier Kraft Board Institute mills producing liner have been identified in this report by the letters A to J, inclusive.

To obtain a more comprehensive and reliable insight into the variation of test values of rolls within a given mill and between mills, as well as to study the uniformity of each mill's product, it was necessary to apply statistical analysis to the test results. The application of statistical methods greatly increases the reliability of any comparison, inasmuch as a measure of the significance of the results is provided.

Statistics is that branch of mathematics which has been designed for the purpose of analyzing numerical results to determine the magnitude and the pattern of one or more of the variable characteristics of the items within the "universe" or group concerned.

The theory of statistics is based on two fundamental concepts: (*1*) There must exist an equality of opportunity for the chance selection of each and every possible item, and (*2*) nature has a precise and orderly plan for variation which is revealed whenever some variable factor is measured and the items are grouped numerically in the order of increasing magnitude. In addition, it is necessary that no secondary attributes shall influence the variable under consideration.

When all the possible items in question are subject to the influence of a large number of independent and purely random causes of variation, it is found that the values of the items tend to vary around a mean or most probable value in a given manner. If the causes of variation are truly random and truly independent, it will be found that there is a most probable or mean value which is characteristic of more items than any other given value; that small deviations from this mean value are more frequent than large deviations; and that positive deviations are as frequent as negative deviations. Such a distribution may be illustrated in an experiment in which the variation in height of a number of men is measured. If a *sufficient* number of men are measured and a record is kept of the distribution of the heights (the number of men in each height class), a graph of the distribution of those heights will follow the normal distribution curve as defined by the following equation:

$$Y = \frac{N}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\frac{(x-\bar{x})^2}{\sigma^2}}$$

in which Y = the number of items at a distance x from the arithmetical mean or average;
$\pi = 3.1416$;
$e = 2.7183$—the base of the Naperian logarithms;
σ = the standard deviation of the array, a measure of variability;
x = the individual observation value;
$\bar{x}$ = the arithmetic mean for all values of x—i.e., the average of all individual observation values; and
N = the total number of observations made.

The *standard deviation* is, by definition, the square root of the mean square of all the individual deviations measured from the mean of the distribution. It may be computed by the following formula:

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}},$$

where σ = the standard deviation,
Σ = the operation of summation,
x = the individual observation value,
$\bar{x}$ = the mean value of the observed results, and
N = the number of observations made in the group considered—i.e., the total number of x values.

This can be converted, by the application of the proper algebraic operation, to the following equation:

$$\sigma^2 = \frac{N\Sigma x^2 - (\Sigma x)^2}{N(N-1)}.$$

This latter equation was used in the computation of the standard deviation throughout this report.

The standard deviation is most readily understood if it is thought of as a measure of the degree of dispersion or variability of the items in the universe, aggregate, or population being considered.

By integration, it is possible to determine the area under any section of the distribution curve. The area between any desired limits of x is to the total area under the distribution curve as the number of items between these same limits is to the total number of items. When the limits are established as one standard deviation ($\pm\sigma$), the limits include 68.3% of the total number of items. If two standard deviations ($\pm 2\sigma$) are used, 95.5% of the items are included, and if three standard deviations ($\pm 3\sigma$) are used, 99.7% of all the items are included.

It should be stressed that the results of the statistical evaluation of the data presented in this report are limited by the small number of rolls which were tested for each mill. It is not to be implied that an exact analysis of a mill's production, over a period of several months, can be obtained by testing only 10 to 30 rolls. However, the results illustrate the application of statistical methods, and also indicate probable trends.

If a greater number of rolls had been included for each mill, the reliability of the statistical methods would have been increased and the results would have had greater significance. As additional surveys of these mills' production are made, a comparison between studies will indicate more reliable trends and facilitate the correlation of results.

COMPARISON OF MILL AVERAGES

The results of the various physical tests performed on the samples of 42-lb. D.F.B.S. Fourdrinier kraft liners have been compiled in Table III on the basis of mill averages. Complete details of the individual tests of the several rolls from each mill are given in Tables LXI–LXX in the Appendix.

The average results obtained for basis weight are shown graphically in Figure 6. The group average basis weight for all the mills participating was 42.1 pounds, which is, for all practical purposes, the same as the specified grade weight. The results indicate that Mills E and I had the highest average basis weight and Mill F the lowest. The average basis weight for all the other mills did not vary from the group average by more than ± 1.0 pound.

The average caliper results are plotted in Figure 7. The average caliper value obtained for the group was 0.0150 inch. A comparison of the test results indicates that Mill H had the highest and Mill F the lowest average caliper. However, all the mill averages, except that for Mill F, were within ± 0.001 inch of the group average.

The average apparent densities in pounds per cubic foot are illustrated graphically in Figure 8. The group average apparent density was 33.7. The highest average apparent density was obtained for Mill F and the lowest for Mills G and H. The average apparent density for all the other mills did not vary from the group average by more than ± 0.5 pound.

From the data presented in Figure 9 it may be observed that the average moisture content for the group was 8.1% on an ovendry basis. The highest average moisture content was obtained for Mill F and the lowest for Mill G. It is interesting to note that Mill F had the lowest average caliper and basis weight but the highest average apparent density and moisture content.

The results obtained for the bursting strength test are presented graphically in Figure 10. The average bursting strength, expressed in points per pound, was 2.33. The group average bursting strength was 98 points. Mills H and I exhibited the highest and Mill F the lowest average bursting strength value.

The averages obtained for the G. E. puncture test are shown in Figure 11. The group average was 36 units, with Mill I possessing the highest and Mill F the lowest average G. E. puncture value. It may be observed that, when the group average for bursting strength is compared with the group average for the G. E. puncture, the ratio is approximately 2.7 to 1. It should be borne in mind, however, that these results were obtained on uncombined liner samples of Fourdrinier kraft board.

The average Riehle compression test results are plotted in Figure 12. The group average of the in-machine direction was 29.0 pounds and of the across-machine direction 22.5 pounds. The ratio of the across-machine direction values to the in-machine direc-

TABLE III

COMPARISON OF PHYSICAL CHARACTERISTICS BETWEEN MILLS

LINER

Mill	Rolls Tested	Basis Weight, lb. (12 x 12/1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength (Mullen), points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
A	28	41.1	14.8	33.2	9.1	99	35	28.5	22.1	343	391	78.5	36.2	2.2	3.4
B	21	42.9	15.4	33.4	8.7	101	37	30.6	23.7	353	397	84.1	38.1	2.2	3.8
C	15	42.7	14.5	35.3	7.1	100	39	29.8	22.2	364	405	85.9	38.9	1.9	4.1
D	21	41.7	14.8	33.8	7.4	98	36	28.1	22.5	360	378	70.4	39.5	2.0	3.5
E	11	43.4	15.7	33.2	7.5	91	35	27.5	20.6	324	365	77.1	34.3	1.8	3.6
F	10	39.7	13.4	35.6	10.0	85	33	23.3	18.7	302	343	66.7	33.0	1.9	3.1
G	15	41.9	15.6	32.2	7.0	91	38	27.4	23.7	380	405	72.3	41.8	1.7	3.6
H	14	42.6	15.9	32 2	8.0	108	37	30.7	24.5	386	407	75.8	42.7	2.2	4.1
I	22	43.5	15.3	34.2	8.4	109	41	30.9	21.8	408	465	85.4	36.8	2.3	4.5
J	21	41.7	14.7	34.2	7.7	93	32	30.4	23.7	301	355	74.8	35.9	2.0	3.2
Average	178	42.1	15.0	33.7	8.1	98	36	29.0	22.5	354	394	77.8	37.8	2.1	3.7

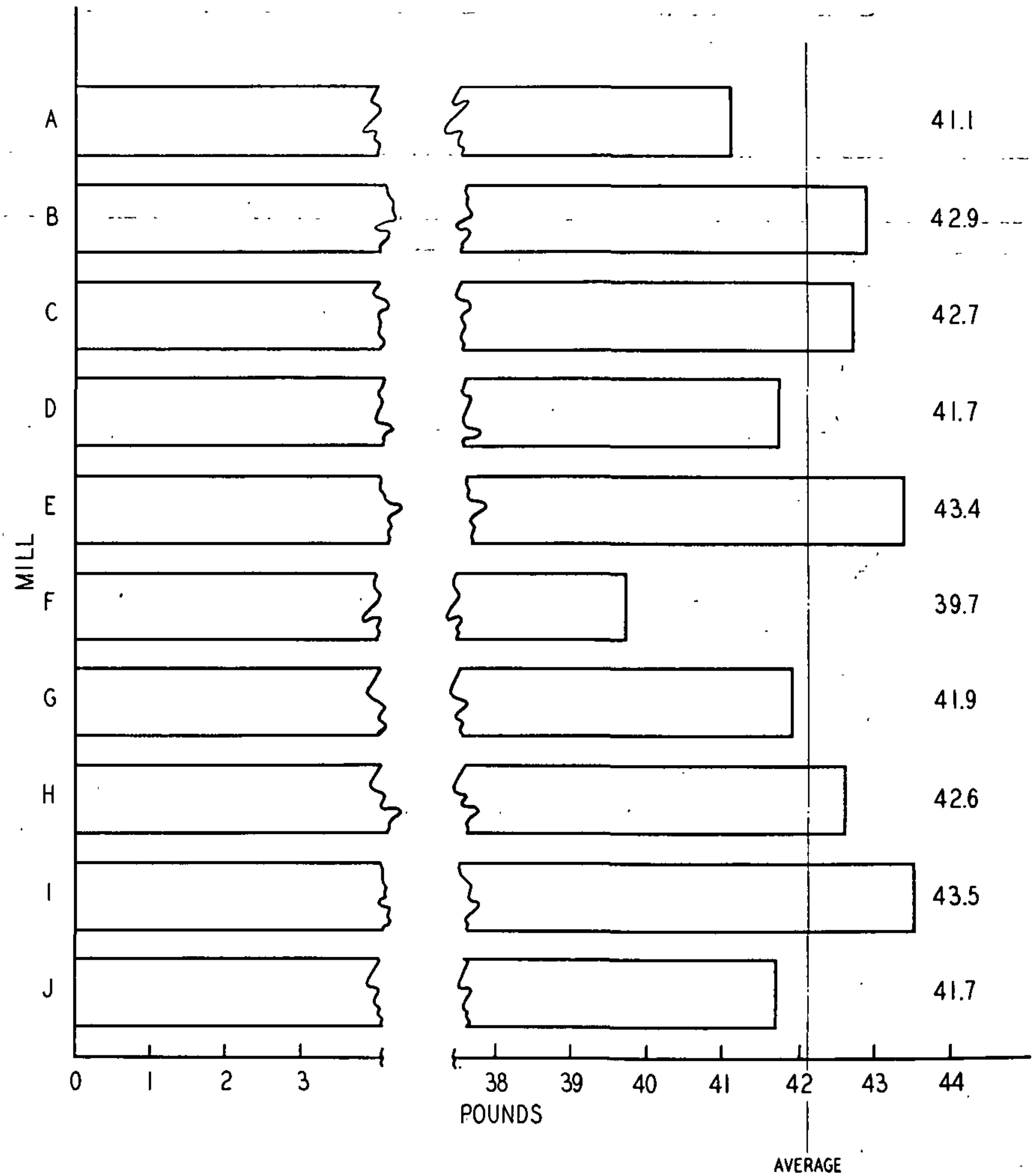

FIGURE 6. Comparison of the average basis weight of 42-lb. Fourdrinier kraft liner among mills.

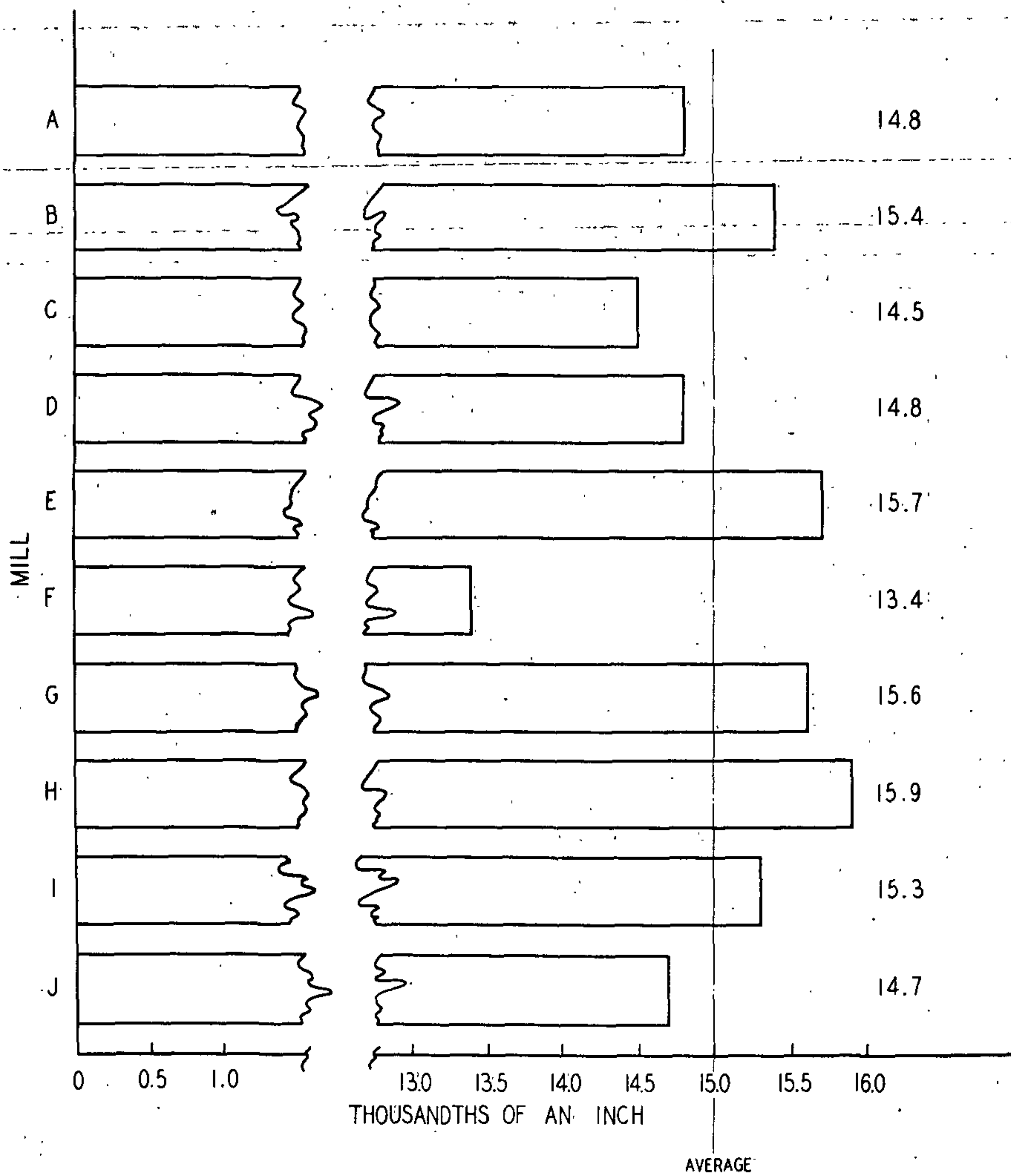

FIGURE 7. Comparison of the average caliper of 42-lb. Fourdr nier kraft liner among mills.

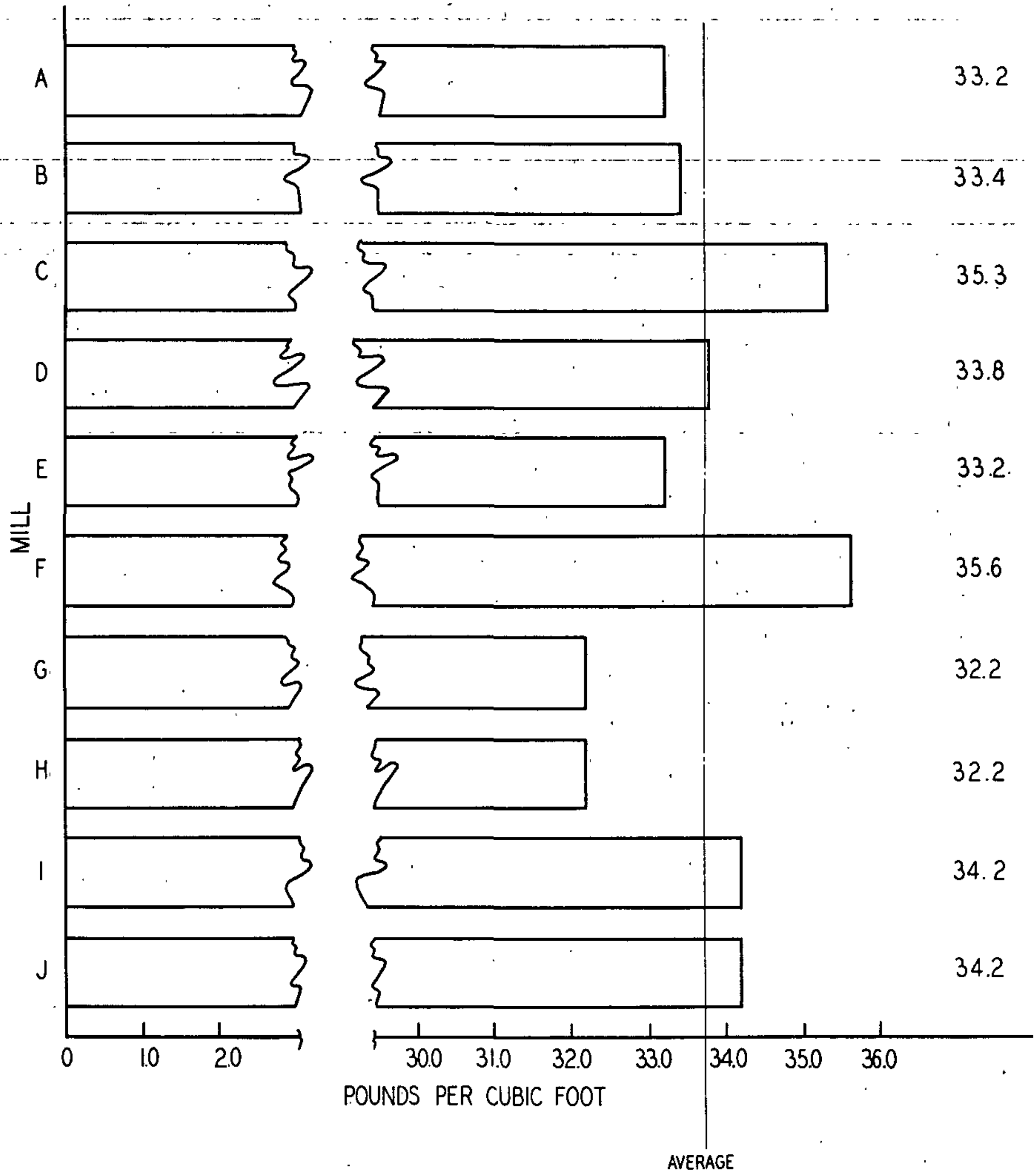

FIGURE 8. Comparison of the average apparent density of 42-lb. Fourdrinier kraft liner among mills.

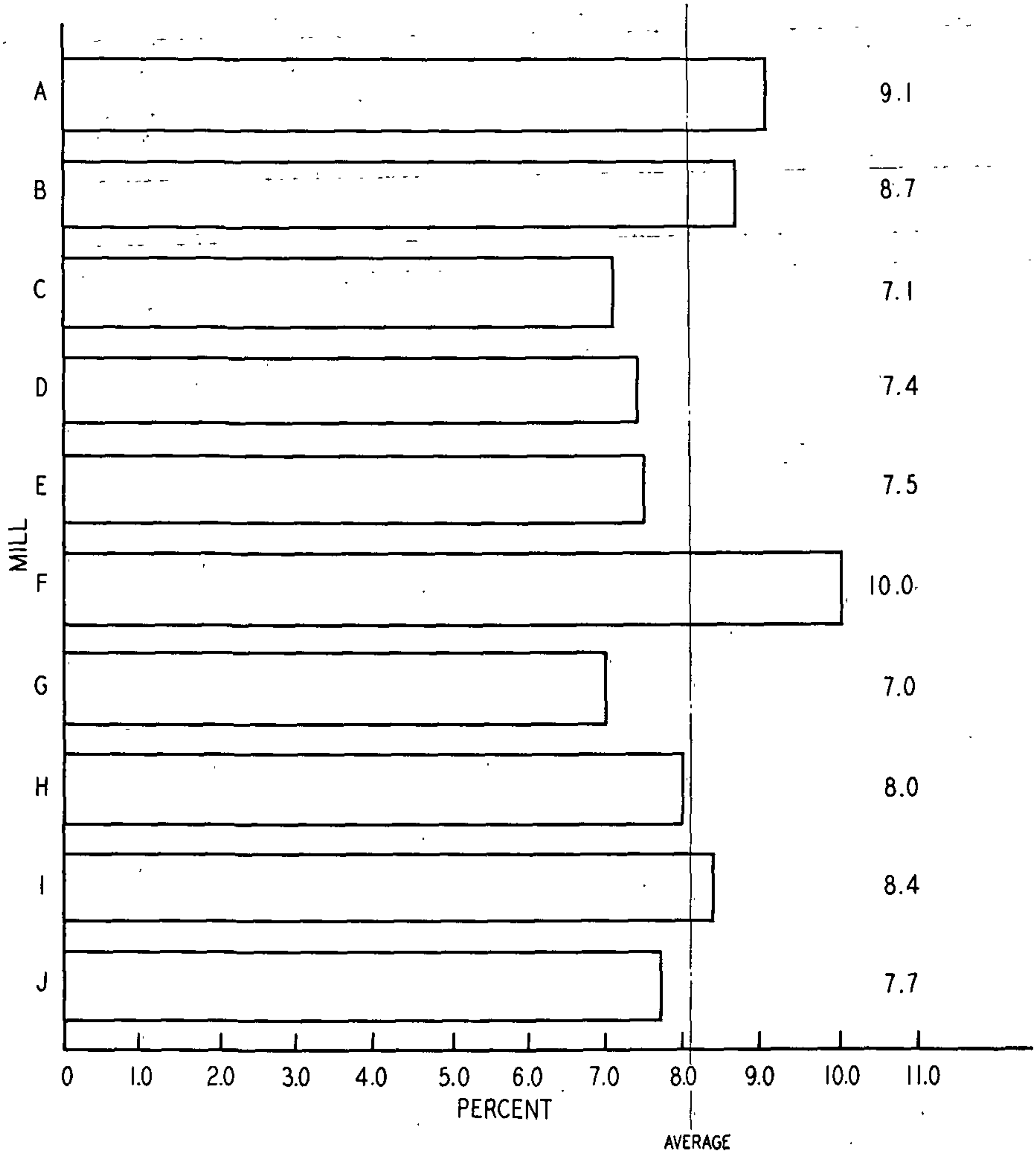

FIGURE 9. Comparison of the average moisture content of 42-lb. Fourdrinier kraft liner among mills.

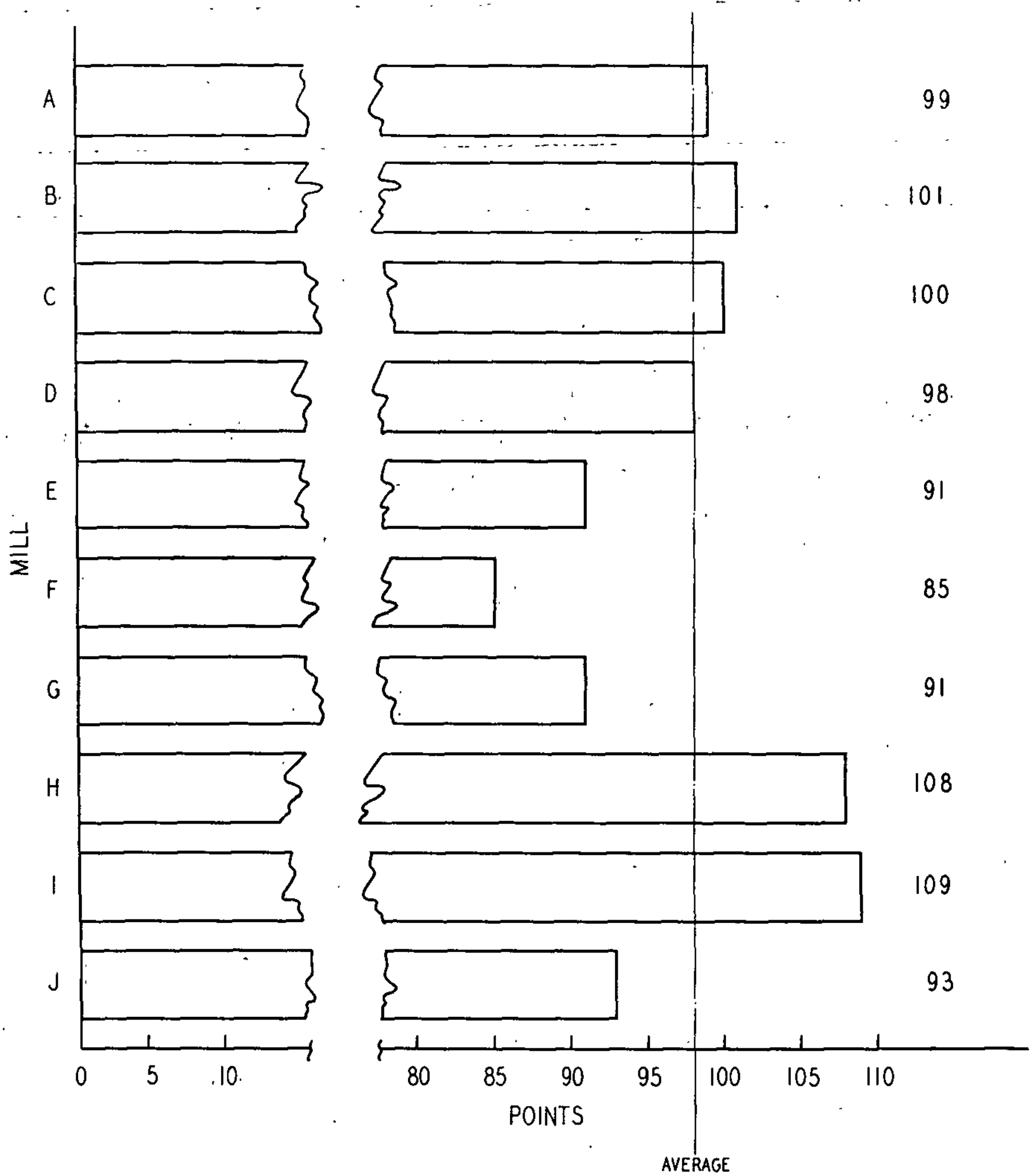

FIGURE 10. Comparison of the average bursting strength of 42-lb. Fourdrinier kraft liner among mills.

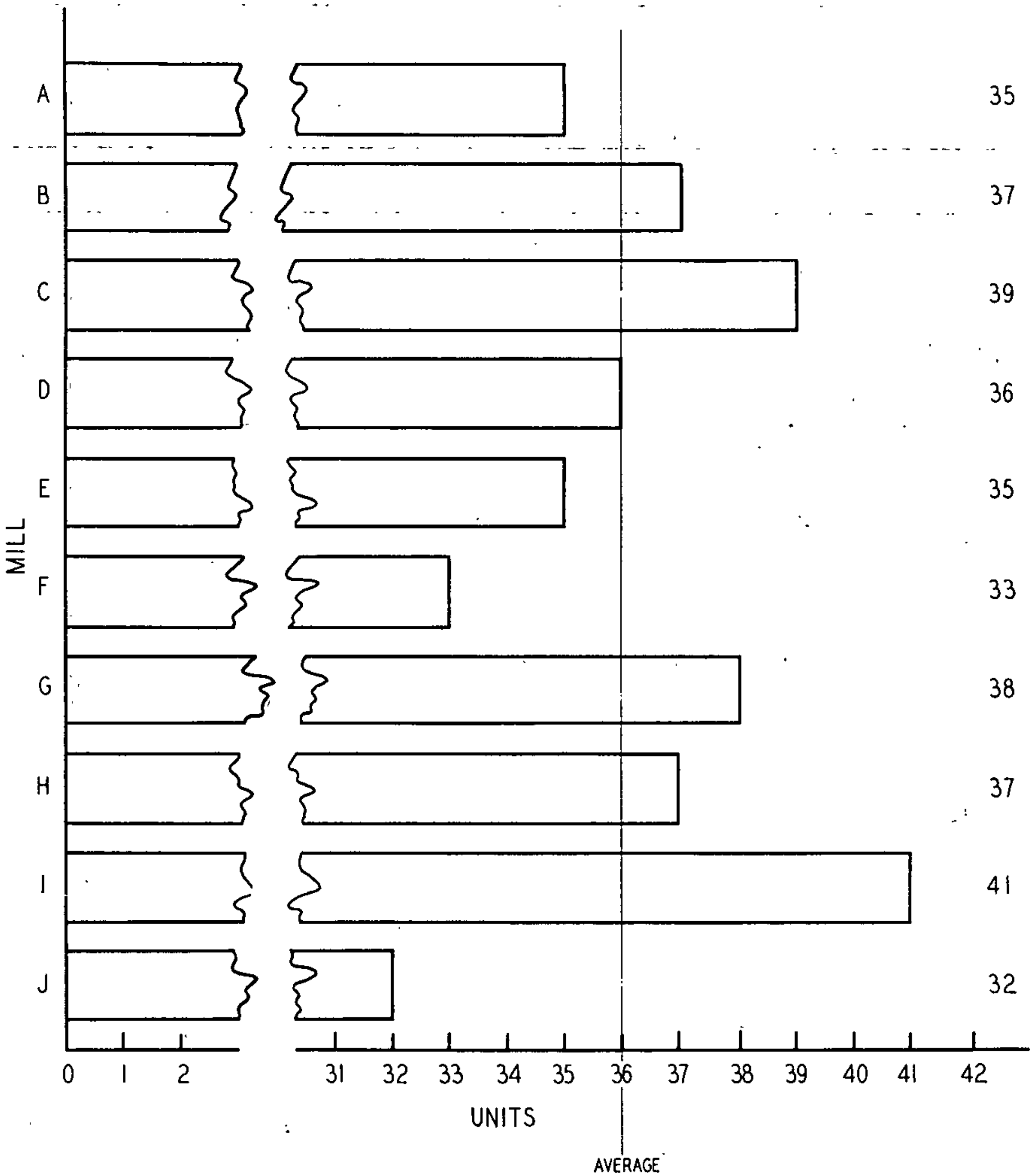

FIGURE 11. Comparison of the average General Electric puncture test of 42-lb. Fourdrinier kraft liner among mills.

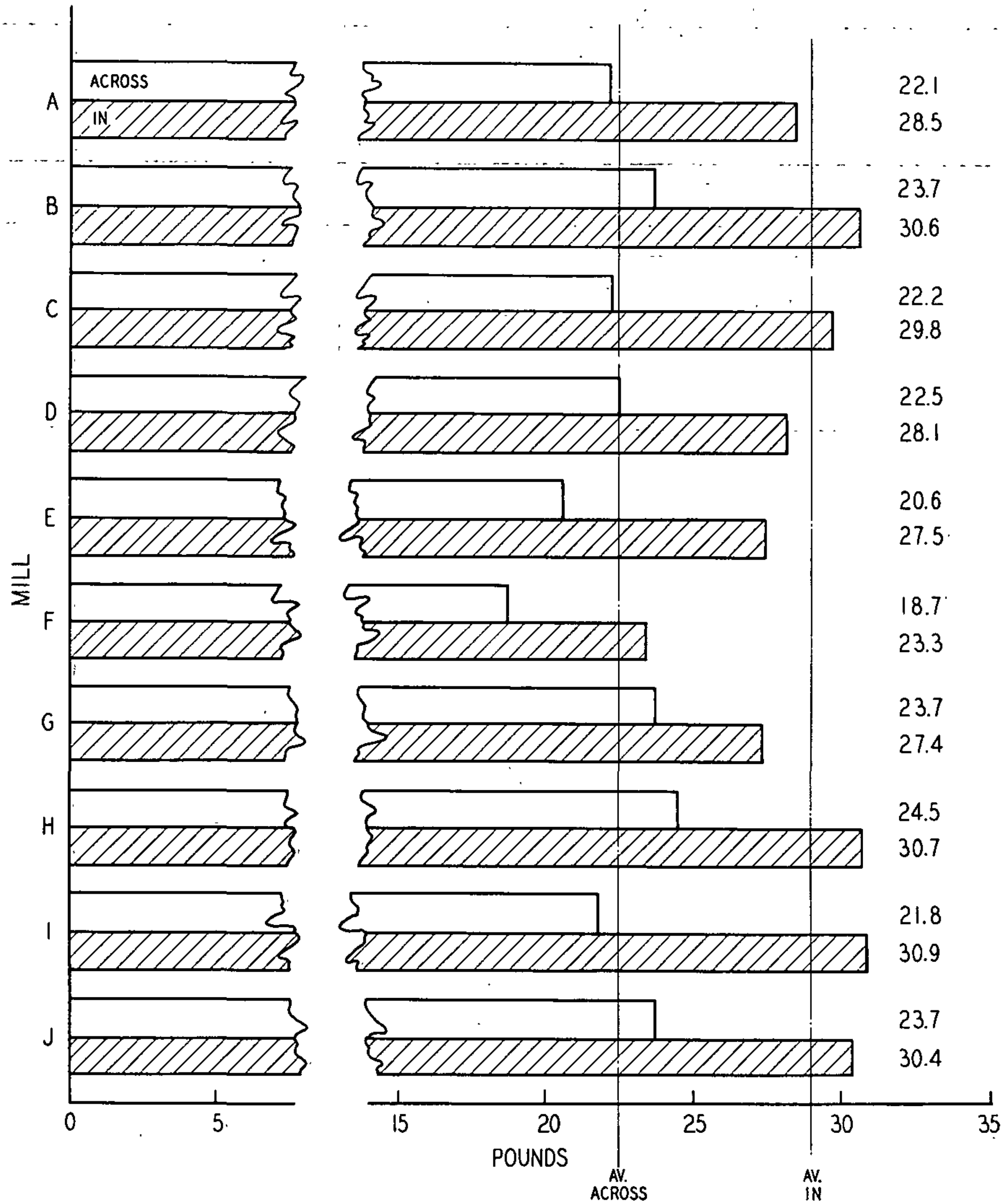

FIGURE 12. Comparison of the average Riehle compression test of 42-lb. Fourdrinier kraft liner among mills.

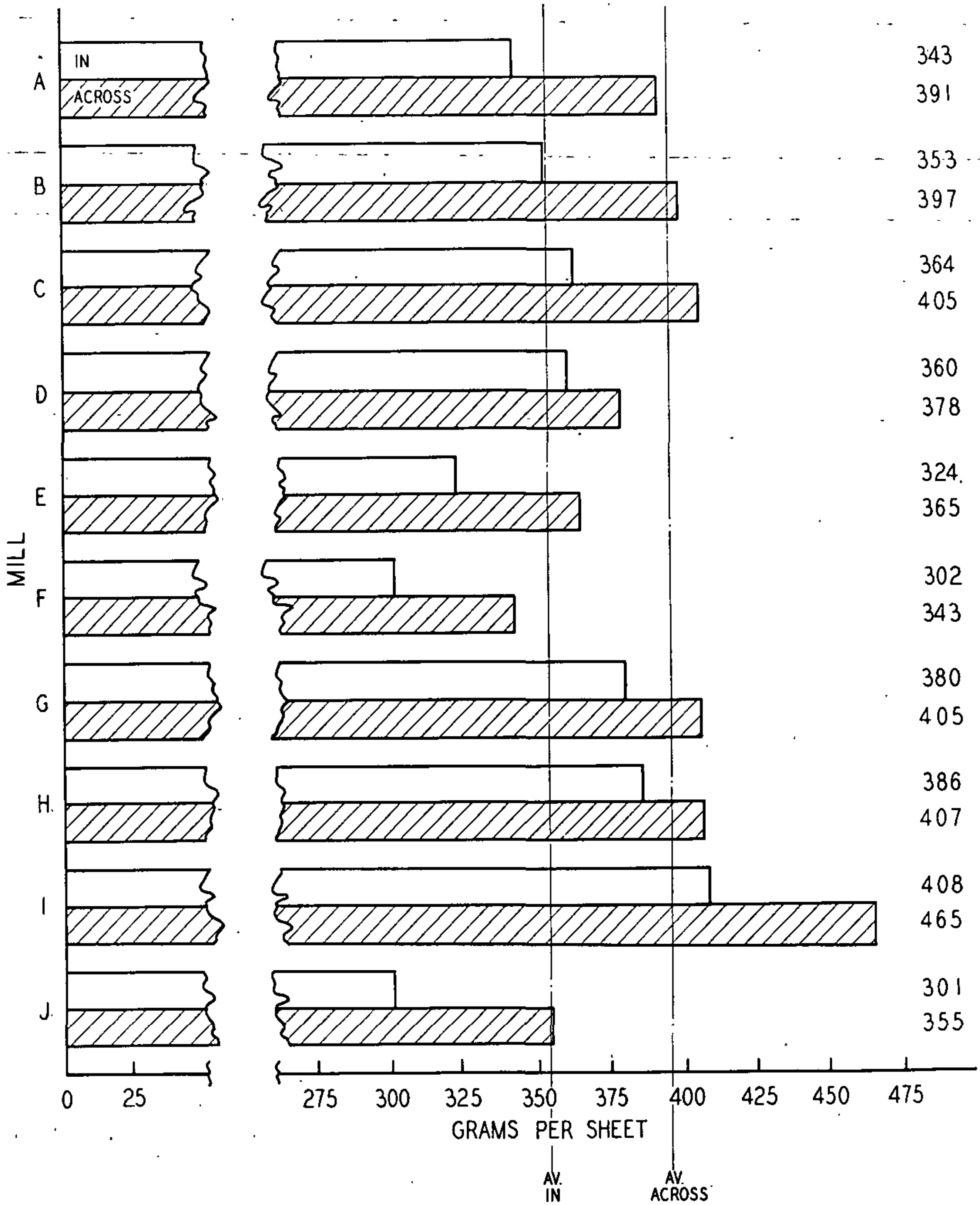

FIGURE 13. Comparison of the average Elmendorf tear of 42-lb. Fourdrinier kraft liner among mills.

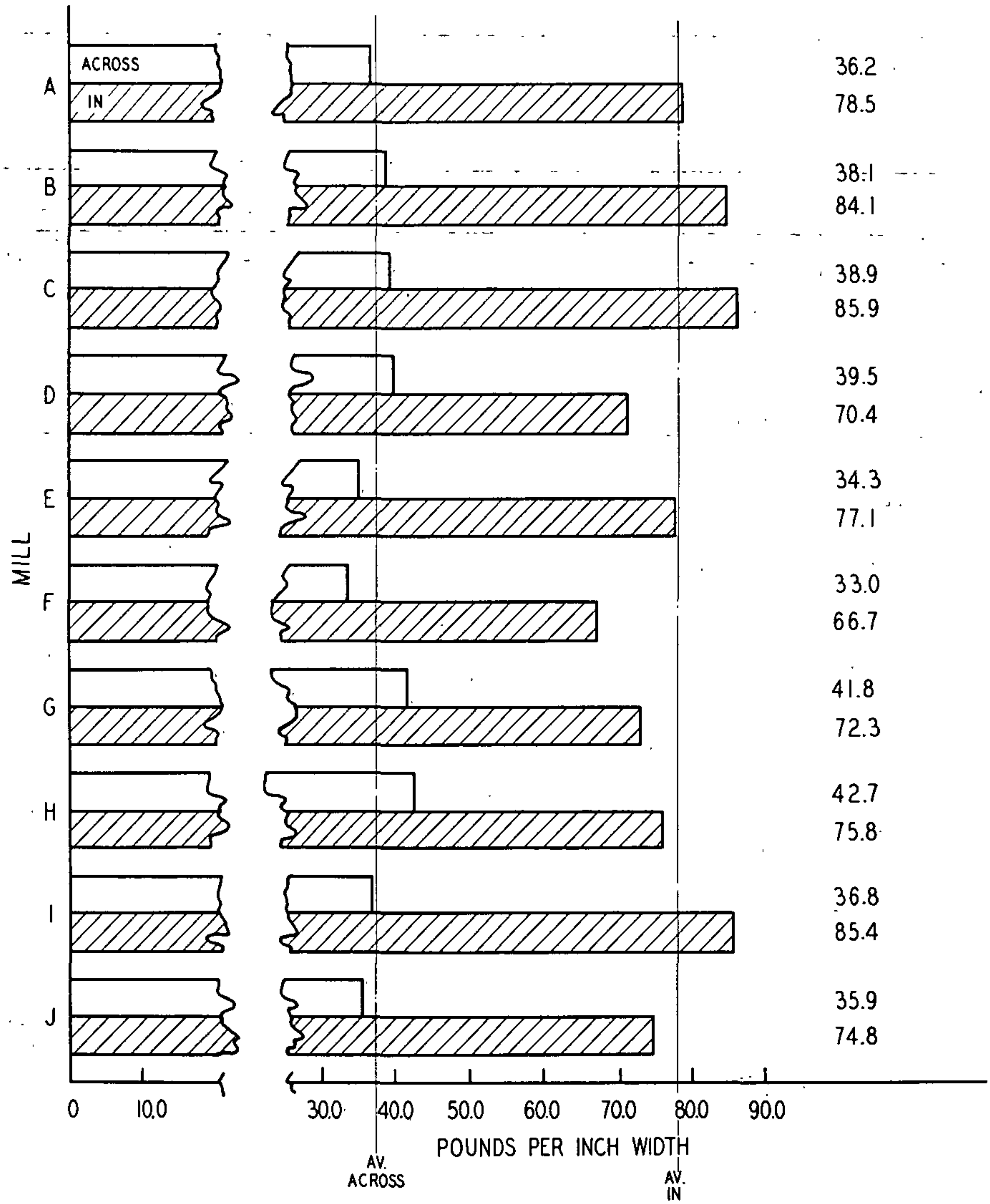

FIGURE 14. Comparison of the average of Amthor tensile strength 42-lb. Fourdrinier kraft liner among mills.

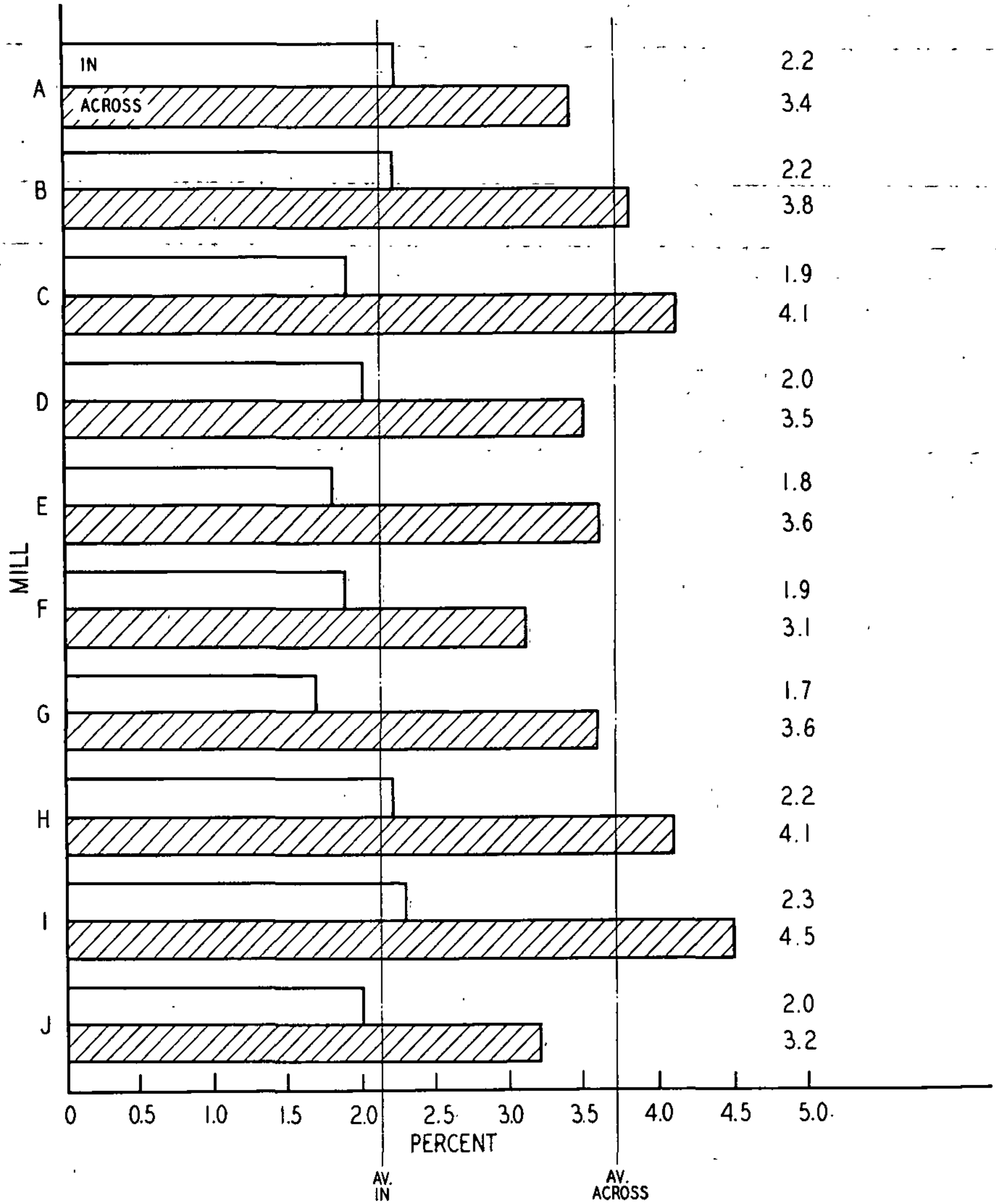

FIGURE 15. Comparison of the average Amthor stretch of 42-lb. Fourdrinier kraft liner among mills.

tion values is of the magnitude of 5:4. The average results obtained, in both directions, for Mill F were the lowest of all the mills participating; also, the average Riehle compression for the in-machine direction for Mill F was of approximately the same order of magnitude as the group average for the across-machine direction.

The results of the Elmendorf tear test are graphically presented in Figure 13. The group average test results were 354 and 394 grams per sheet for the in-machine and across-machine directions, respectively. The ratio of the group average of the in-machine direction to the group average of the across-machine direction is of the order of 0.9:1. Mills F and J had the lowest and Mill I the highest tear values in both directions.

The results of the Amthor tensile test are shown in Figure 14. A comparison of the results indicates that the ratio of the across-machine direction values to the in-machine direction values is of the order of 1:2. The group averages obtained were 77.8 and 37.8 pounds per inch width for the in- and across-machine directions, respectively. The averages for Mill F were the lowest in both directions and the averages for Mill G and I were the highest in the in-machine direction; however, Mills G and H were the highest in the across-machine direction.

The Amthor stretch results are presented in Figure 15. The group averages obtained were 2.1 and 3.7%, respectively, for in- and across-machine directions. The ratio of the in-machine direction values to the across-machine direction values is approximately 6:10.

A comparison of the averages of all the strength test results indicates that Mills H and I were the highest and Mill F the lowest. The averages for the group would result in a theoretical liner having the following characteristics:

Basis weight, lb.	42.1
Caliper, in.	0.015
Apparent density, lb./cu. ft.	33.7
Bursting strength, points	98
G. E. puncture, units	36
Moisture content, %	8.1
Riehle compression, lb.	
In	29.0
Across	22.5
Elmendorf tear, g./sheet	
In	354
Across	394
Amthor tensile, lb./in.	
In	77.8
Across	37.8
Amthor stretch, %	
In	2.1
Across	3.7

A comparison of the standard deviations of the mills for each test characteristic is given in Table IV. It may be noted from the results for each test characteristic that the basis weight and caliper have the lowest percentage standard deviation and the Amthor stretch the highest. The lower the percentage standard deviation, the less is the indicated variation in that particular characteristic.

In a study of this type it is often of value to know how the average quality of board made in one mill compares with the average quality of the same grade of board produced by other mills. With the above thought in mind, the results tabulated in Table III were treated statistically to determine if there were any significant differences in the physical characteristics obtained for one mill as compared with the average physical characteristics for the balance of the mills participating. Whether or not significant differences exist in the same test characteristic between two different groups of data can be determined by calculating the ratio of the difference of the means of each group to the standard error of the difference between the same two groups.

The standard error of the difference can be readily calculated from the standard errors of the two means under comparison. These standard errors, in turn, can be calculated from the standard deviations listed in Table IV. The following equations are used for these calculations:

$$\text{S. E.} = \frac{\sigma}{\sqrt{N}} \quad \text{or} \quad [\text{S. E.}]^2 = \frac{\sigma^2}{N},$$

where S. E. = standard error,
σ = standard deviation, and
N = number of items in array.

$$[\text{S. E.}]_\alpha^2 = \frac{[\text{S. E.}]_A^2 + [\text{S. E.}]_B^2 + \cdots + [\text{S. E.}]_X^2}{n^2}$$

where $[\text{S. E.}]_\alpha$ = standard error of a group of similar arrays,
n = number of arrays being considered, and
A, B, $\cdots$, X = respective arrays under consideration.

Therefore,

$$[\text{S. E.}]_\alpha^2 = \frac{\dfrac{\sigma_A^2}{N_A} + \dfrac{\sigma_B^2}{N_B} + \cdots + \dfrac{\sigma_X^2}{N_X}}{n^2}.$$

$$[\text{S. E.}]_{\text{Diff.}} = \sqrt{[\text{S.E.}]_1^2 + [\text{S.E.}]_2^2},$$

where $[\text{S. E.}]_{\text{Diff.}}$ = standard error of the difference, and
$[\text{S. E.}]_1$ and $[\text{S. E.}]_2$ = standard errors of the items or groups of items being considered.

These calculations are illustrated by comparing the basis weight of Mill A with that of the other mills as a group in the following manner. First, it is necessary to determine the difference of the means—i.e., the average basis weight for Mill A minus the average basis weight for Mills B to J, inclusive. The average basis weight for Mill A was 41.1 pounds and the average for the group was 42.2 pounds. Thus, the difference of the means is -1.1 pounds, the value being negative, inasmuch as we are comparing Mill A with the group average which, in this case, is of greater magnitude.

TABLE IV

COMPARISON OF STANDARD DEVIATIONS BETWEEN MILLS

LINER

Mill	Basis Weight, lb.	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
A	1.13	0.362	6.26	2.11	1.65	1.15	21.8	18.2	5.19	1.57	0.279	0.363
B	1.31	0.751	6.42	2.02	2.06	1.24	32.6	21.5	6.34	2.90	0.190	0.446
C	0.785	0.537	5.38	2.08	1.60	1.47	14.6	27.4	4.37	3.27	0.219	0.584
D	1.59	1.07	6.51	3.57	1.96	1.25	24.2	28.7	4.56	3.07	0.237	0.441
E	0.981	1.12	18.6	4.01	2.77	1.68	38.4	47.2	11.2	3.54	0.299	0.437
F	1.77	0.374	10.3	4.35	1.55	1.46	33.5	36.4	5.09	3.87	0.106	0.134
G	0.753	0.394	6.08	2.09	1.25	1.63	11.1	23.6	1.84	4.01	0.229	0.556
H	0.937	0.405	5.11	2.27	1.82	1.05	39.7	20.3	6.44	4.05	0.183	0.303
I	0.874	0.290	4.91	1.46	2.19	1.25	15.8	18.7	3.66	0.996	0.179	0.287
J	0.845	0.532	11.7	3.69	1.43	0.920	37.1	42.1	9.54	2.11	0.204	0.673
Average	1.10	0.584	8.13	2.77	1.83	1.31	26.9	28.4	5.82	2.94	0.213	0.422
Average Standard Deviation, %	2.6	3.9	8.3	7.7	6.3	5.8	7.6	7.2	7.5	7.8	10.1	11.4

The square of the standard error of Mill A is calculated from formula (1):

$$[\text{S. E.}]_A^2 = \frac{\sigma_A^2}{N_A}. \qquad (1)$$

From Table IV, σ_A is 1.13 and from Table III, N_A is 28; therefore,

$$[\text{S. E.}]_A^2 = (1.13)^2/28 \text{ or } 0.0456.$$

The squared form is used because it can be substituted directly into formula (3).

The standard error of the group composed of Mill B through Mill J, inclusive, is calculated by the use of formula (2):

$$[\text{S. E.}]_\alpha^2 = \frac{\dfrac{\sigma_B^2}{N_B} + \dfrac{\sigma_C^2}{N_C} + \cdots + \dfrac{\sigma_J^2}{N_J}}{n^2}. \qquad (2)$$

Substituting the appropriate values from Tables III and IV,

$$[\text{S. E.}]_\alpha^2 = \frac{\dfrac{(1.31)^2}{21} + \dfrac{(0.785)^2}{15} + \cdots + \dfrac{(0.845)^2}{21}}{(9)^2} = 0.0093.$$

Since

$$[\text{S. E.}]_{\text{Diff.}} = \sqrt{[\text{S. E.}]_A^2 + [\text{S. E.}]_\alpha^2}, \qquad (3)$$

therefore,

$$[\text{S. E.}]_{\text{Diff.}} = \sqrt{(0.0456)^2 + (0.0093)^2} = 0.23.$$

From these values, the ratio of the difference of means to $[\text{S. E.}]_{\text{Diff.}}$ is:

$$\text{Ratio} = \frac{\text{Difference of means}}{[\text{S. E.}]_{\text{Diff.}}} = \frac{-1.1}{0.23} = -4.8.$$

Throughout this study, it is considered that, if the magnitude of this ratio (i.e., difference of means/$[\text{S. E.}]_{\text{Diff.}}$) is less than 2, no significant difference exists. Reference to the appropriate table (normal variability) shows that a ratio of 2.0 indicates that there is a significant difference 95% of the time or that the probability that the difference happened by chance is 1:19. When the ratio is equal to 3.0, the chance probability is greatly decreased (i.e., to about 1:200). Thus the ratio of -4.8, obtained for the comparison of the average basis weight of Mill A with the average of the group B to J, inclusive, indicates that there is a significant difference between the average value obtained for A and the average obtained for the group B to J, inclusive. Since the ratio is negative, it is known at once that the average value obtained for Mill A is lower than the group average.

Similarly, all the test results obtained for Mill A were compared with the group averages obtained for the group B to J, inclusive. These results are given in Table V. The results indicate that there was a significant difference in the values obtained except for bursting strength, Riehle compression in both directions, Amthor tensile in the in-machine direction, and Elmendorf tear and Amthor stretch in the across-machine direction. Similarly, all the tests, in which a significant difference was indicated, were of a lower magnitude for Mill A than for the group averages obtained for Mills B to J, inclusive, except Amthor stretch in the in-machine direction, which was slightly higher than the group average.

The results obtained when the averages for Mill B are compared with those of the balance of the group may be seen in Table VI. The results indicate that there was a significant difference in all the values obtained except G. E. puncture, Elmendorf tear in both directions, and Amthor tensile and stretch in the across-machine direction. Similarly, the values for those tests in which a significant difference was indicated were of greater magnitude than the averages obtained for the group.

A comparison of the average values obtained for

TABLE V

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL A WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of A	41.1	14.8	99	35	28.5	22.1	343	391	78.5	36.2	2.2	3.4
Mean of α	42.2	15.0	97	36	28.7	22.0	353	391	76.9	37.9	2.0	3.7
Difference of means ($A-\alpha$)	−1.1	−0.18	+1.8	−1.72	−0.184	+0.151	−10.2	−0.3	+1.55	−1.64	+1.627	−0.3171
Standard error of difference	0.23	0.028	1.47	0.481	0.352	0.248	4.83	4.40	1.13	0.414	0.056	0.220
Ratio: $(A-\alpha)/SE_D$	−4.8	−6.5	+1.2	−3.6	−0.5	+0.6	−2.1	−0.1	+1.4	−4.0	+2.9	+1.4
Significant	Yes	Yes	No	Yes	No	No	Yes	No	No	Yes	Yes	No

NOTE. All mean values have been reported to the same precision as the individual test values. It will be observed that some of the intermediate values in the above table have been reported to more places than the mean values. Similarly, the difference of the means will not always correspond to the difference between the reported means, because these values have been rounded off. The mean of α is the mean for the balance of the group.

TABLE VI

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL B WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of B	42.9	15.4	101	37	30.6	23.7	353	397	84.1	38.1	2.2	3.8
Mean of α	42.0	15.0	97	36	28.5	21.8	352	390	76.3	37.7	2.0	3.7
Difference of means ($B-\alpha$)	+0.9	+0.45	+3.9	+0.79	+2.09	+1.89	+1.2	+6.9	+7.74	+0.43	+0.23	+0.143
Standard error of difference	0.19	0.173	1.64	0.52	0.476	0.294	7.53	5.42	1.49	0.692	0.045	0.107
Ratio: $(B-\alpha)/SE_D$	+4.7	+2.6	+2.4	+1.5	+4.4	+6.4	+0.2	+1.3	+5.2	+0.6	+5.1	+1.3
Significant	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No

NOTE. *See* Note to Table V.

TABLE VII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL C WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of C	42.7	14.5	100	39	29.8	22.2	364	405	85.9	38.9	1.9	4.1
Mean of α	42.1	15.1	97	36	28.6	22.4	351	390	76.1	37.6	2.0	3.6
Difference of means ($C-\alpha$)	+0.6	−0.55	+2.9	+3.05	+1.27	−3.85	+13.1	+15.0	+9.78	+1.29	−0.172	+0.43
Standard error of difference	0.22	0.150	1.63	0.601	0.443	0.396	4.54	7.57	1.26	0.888	0.059	0.156
Ratio: $(C-\alpha)/SE_D$	+2.7	−3.7	+1.8	+5.1	+2.9	−4.7	+2.9	+2.0	+7.8	+1.5	−2.9	+2.8
Significant	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

NOTE. *See* Note to Table V.

TABLE VIII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL D WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of D	41.7	14.8	98	36	28.1	22.5	360	378	70.4	39.5	2.0	3.5
Mean of α	42.2	15.0	97	36	28.8	21.9	351	393	77.8	37.5	2.0	3.7
Difference of means ($D-\alpha$)	−0.5	−0.21	+0.7	−0.53	−0.73	+0.543	+8.8	−14.3	−7.41	+1.93	−0.077	−0.19
Standard error of difference	0.36	0.239	1.66	0.820	0.457	0.296	3.24	6.81	1.15	0.726	0.055	0.105
Ratio: $(D-\alpha)/SE_D$	−1.4	−0.9	+0.4	−0.6	−1.6	+1.8	+2.7	−2.1	−6.4	+2.7	−1.4	−1.8
Significant	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No

NOTE. *See* Note to Table V.

TABLE IX

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL E WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of E	43.4	15.7	91	35	27.5	20.6	324	365	77.1	34.3	1.8	3.6
Mean of α	42.0	14.9	98	36	28.8	22.1	355	394	77.1	38.1	2.0	3.7
Difference of means ($E-\alpha$)	+1.4	+0.78	−6.8	−1.73	−1.37	−1.5	−31.6	−29.1	−0.02	−3.77	−0.266	−0.054
Standard error of difference	0.31	0.342	5.64	1.231	0.847	0.519	11.77	14.4	3.41	1.10	0.092	0.138
Ratio: $(E-\alpha)/SE_D$	−4.7	+2.3	−1.2	−1.4	−1.6	−2.9	−2.7	−2.0	0.0	−3.4	−2.9	−0.4
Significant	Yes	Yes	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No

NOTE. *See* Note to Table V.

TABLE X

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL F WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of F	39.7	13.4	85	33	23.3	18.7	302	343	66.7	33.0	1.9	3.1
Mean of α	42.4	15.2	99	37	29.3	22.3	358	396	78.3	38.2	2.0	3.8
Difference of means ($F-\alpha$)	−2.7	−1.82	−13.9	−3.88	−6.03	−3.66	−55.8	−53.5	−11.57	−5.28	−0.102	−0.684
Standard error of difference	0.57	0.131	3.38	1.39	0.516	0.473	10.83	11.76	1.70	1.252	0.038	0.061
Ratio: $(F-\alpha)/SE_D$	−4.7	−13.9	−4.1	−2.8	−11.7	−7.7	−5.2	−4.5	−6.8	−4.2	−2.7	−11.2
Significant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTE. *See* Note to Table V.

TABLE XI

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL G WITH THE BALANCE OF THE GROUP

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of G	41.9	15.6	91	38	27.4	23.7	380	405	72.3	41.8	1.7	3.6
Mean of α	42.1	14.9	98	36	28.9	21.8	349	390	77.6	37.3	2.1	3.7
Difference of mean $(G-\alpha)$	−0.2	+0.63	−7.1	+1.64	−1.5	+1.92	+31.3	+15.7	−5.36	+4.57	−0.313	−0.095
Standard error of difference	0.22	0.116	1.79	0.602	0.362	0.435	3.82	6.67	0.75	1.07	0.062	0.149
Ratio: $(G-\alpha)/SE_D$	−0.9	+5.4	−4.0	+2.7	−4.1	+4.4	+8.2	+2.4	−7.1	+4.3	−5.1	−0.6
Significant	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

NOTE. *See* Note to Table V.

TABLE XII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL H WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of H	42.6	15.9	108	37	30.7	24.5	386	407	75.8	42.7	2.2	4.1
Mean of α	42.1	14.9	96	36	28.5	21.7	389	349	77.2	37.2	2.0	3.6
Difference of means $(H-\alpha)$	+0.5	+0.96	+11.3	+1.22	+2.17	+2.85	+17.8	+37.5	−1.40	+5.51	+0.238	+0.421
Standard error of difference	0.27	0.123	1.61	0.661	0.511	0.304	6.06	10.86	1.81	1.114	0.052	0.092
Ratio: $(H-\alpha)/SE_D$	+1.9	+7.8	+9.3	+1.8	+4.2	+9.4	+2.9	+3.5	−0.8	+4.9	+4.6	+4.6
Significant	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

NOTE. *See* Note to Table V.

TABLE XIII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL I WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of I	43.5	15.3	109	41	30.9	21.8	465	408	85.4	36.8	2.3	4.5
Mean of α	42.0	15.0	96	36	28.5	22.0	346	384	76.2	37.8	2.0	3.6
Difference of mean $(I-\alpha)$	+1.5	+0.32	+12.7	+5.39	+2.39	−0.258	+62.3	+82.3	+9.23	−1.02	+0.269	+0.90
Standard error of difference	0.21	0.085	1.36	0.413	0.493	0.291	4.22	4.84	0.97	0.358	0.042	0.075
Ratio: $(I-\alpha)/SE_D$	+7.1	+3.8	+9.3	+13.1	+4.8	−0.9	+14.8	+17.0	+9.5	−2.8	+6.4	+12.0
Significant	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

NOTE. *See* Note to Table V.

TABLE XIV

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL J WITH THE BALANCE OF THE GROUP

LINER

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of J	41.7	14.7	93	32	30.4	23.7	301	355	74.8	35.9	2.0	3.2
Mean of α	42.2	15.1	98	37	28.5	21.8	358	395	77.4	37.9	2.0	3.7
Difference of mean $(J-\alpha)$	−0.5	−0.38	−5.3	−4.23	+1.91	+1.91	−56.7	−40.6	−2.53	−2.02	+0.029	−0.56
Standard error of difference	0.21	0.129	2.68	0.846	0.352	0.233	8.44	9.56	2.15	0.540	0.048	0.153
Ratio. $(J-\alpha)/SE_D$	−2.4	−2.9	−2.0	−5.0	+5.4	+8.2	−6.7	−4.2	−1.2	−3.7	+0.6	−3.6
Significant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes

NOTE. *See* Note to Table V.

Mill C with the group average excluding C is presented in Table VII. The results indicate that there was a significant difference in all the test values except bursting strength and the Amthor tensile test in the across-machine direction. All the values in which a significant difference existed were greater than the value for the group averages with the exception of caliper, Riehle compression in the across-machine direction, and Amthor stretch in the in-machine direction.

The average test results obtained for Mill D, as compared with the average test results obtained for the remainder of the group, are given in Table VIII. The only test results which exhibited a significant difference were Elmendorf tear and Amthor tensile in both directions. This phenomenon indicates that the average quality of Mill D, as determined by these tests, was approximately the same as the average quality for the group.

A comparison of the average test values obtained for Mill E with the averages for the balance of the group may be observed in Table IX. The results indicate that a significant difference existed in all the test results except those for bursting strength, G. E. puncture, Riehle compression and Amthor tensile in the in-machine direction, and Amthor stretch in the across-machine direction. With the exception of the average caliper value, all the results wherein a significant difference existed were lower than the corresponding value for the group average.

The results of the comparison of the average test values obtained for Mill F with the averages for the balance of the group may be found in Table X. The results indicate that a significant difference existed between all the average test results obtained for Mill F and the corresponding group average. All the average test values obtained for F were lower than the corresponding group average.

The comparison of the average test values obtained for Mill G with the averages for the balance of the group is given in Table XI. It may be noted that the only test results in which a significant difference was not indicated were in basis weight and Amthor stretch in the across-machine direction.

The average test values obtained for Mill H are compared with the average for the remainder of the group in Table XII. It may be noted that basis weight, G. E. puncture, and Amthor tensile in the in-machine direction were the only test results in which a significant difference was not indicated. Both the basis weight and G. E. puncture, however, appear to be close to the borderline in respect to significance. All the test results for Mill H, wherein a significant difference was indicated, are of a greater magnitude than the corresponding group average value; thus, the average quality for Mill H, as determined by these tests, was higher than the group average.

The comparison of the average test values obtained for Mill I with the average for the balance of the group is presented in Table XIII. A significant difference is indicated in all test results except the Riehle compression in the across-machine direction. With the exception of the Amthor tensile in the across-machine direction, the average test results for Mill I, wherein a significant difference was indicated, were of a greater magnitude than the corresponding average test results of the group.

A comparison of the test averages for Mill J with the average test results obtained for the remainder of the group may be seen in Table XIV. A significant difference was indicated for all the average values except Amthor tensile and stretch in the machine direction. Of those average results showing significant differences, all but the averages of the Riehle compression in both directions, were of lower magnitude than the corresponding average values for the group.

DISCUSSION OF INDIVIDUAL MILL TEST RESULTS FOR 42-POUND D.F.B.S. FOURDRINIER KRAFT LINER

MILL A

The average results of the various physical tests conducted on the samples of liner rolls made by Mill A are shown in Table XV. Details of the maximum and minimum values for each roll tested are given in Table LXI of the Appendix. The average basis weight was slightly lower than the grade specification of 42 pounds. The average apparent density was 33.2 pounds per cubic foot. It may also be noted that the average bursting strength was 99 points and the average G. E. puncture value was 35 units. The average moisture content was 9.1% on an ovendry basis.

In a study of this type, the interest is not solely in the absolute value of the average test values within a given mill or among mills, but also in the variation in the individual values which make up those averages. To say that the average of a group of test observations is 100 is of little value unless the uniformity or probability of a given variation of the values which make up this average is known.

The probability of a given variation in board from a given mill may be calculated statistically if test values, based on a sufficient number of individual specimens, are available from an adequate number of rolls from that mill. For each type of test, it is first necessary to calculate the average, and then to calculate the standard deviation as a measure of the variability among the rolls. The procedure may be illustrated for basis weight of the liner samples from Mill A.

For Mill A the average basis weight was 41.1 pounds and the standard deviation was calculated to be 1.13 pounds. Accordingly, reference to the appropriate tables (Probability Integrals) shows that a range of 41.1 ± 1.1 pounds or 40.0 to 42.2 pounds may be expected to contain 68.3% of the rolls of this grade produced by Mill A. In most cases it is of more interest, however, to consider the percentage of rolls which might be expected to be contained within any prespecified test value limits. Thus, assume that it is required to find the chance that the basis weight for a roll will fall within ± 0.5 pound of the average basis weight. It is noted that 0.5 pound is a fraction $(0.5/1.13=0.44)$ equal to 0.44 of the standard deviation for the basis weight for Mill A. By referring to the appropriate tables, it is found that 34% of the rolls should fall within the selected limits. This indicates that Mill A has a uniformity, in respect to basis weight, such that 34% of the rolls made in the 42-pound grade should be within the limits 40.6 to 41.6 pounds. Using the same line of procedure, it may be shown that a range of ± 1 pound is equal to 0.88 of the standard deviation for Mill A, and thus the probability of the basis weight being within the limits 40.1 to 42.1 pounds is 62%. (*It should be noted in a precautionary way that the probability of a given test value lying within a given range is not doubled when the range is doubled.*) As previously mentioned, it is fully recognized that the application of statistical methods to these data has limitations. It is included, however, to demonstrate the potentialities of its application and to predict, within limits, the variation to be expected in the physical characteristics of board made by the different mills.

Table XVI gives the standard deviations and probable variations to be expected in the rolls of 42-pound liner made by Mill A. It may be seen from these results that the chance probability or uniformity for Mill A in regard to caliper is such that the greater portion of the rolls should fall within the range of ± 0.001 inch (0.0138 to 0.0158 inch) of the average caliper. The uniformity of the bursting strength indicates that only three fourths of the rolls would be expected to fall within a range limit of ± 7.5 points (91.5 to 106.5 points). On a percentage basis, the uniformity in respect to the G. E. puncture is approximately the same as that for the bursting strength. The uniformity in respect to Riehle compression, Elmendorf tear, and Amthor tensile and stretch may also be observed in Table XVI. Naturally, as the arbitrarily selected limits increase, the greater will be the percentage of rolls falling within that range. The ranges used are purely arbitrary and are not intended as an attempt to specify acceptable limits. The moisture content was not treated statistically as it was felt that the secondary effects, such as warehouse storage conditions, would possibly prevent the legitimate application of statistics to the moisture data.

Mill B

The average test results obtained on samples of liner made by Mill B are shown in Table XVII (*see also* Table LXII of the Appendix). The average basis weight was slightly in excess of the specified grade weight. The average caliper was 0.0154 inch and the average apparent density was 33.4 pounds per cubic foot. The average bursting strength and G. E. puncture were 101 points and 37 units, respectively. The average moisture content was 8.7% on an ovendry basis.

The statistical evaluation of these test results may be found in Table XVIII. The standard deviation for the basis weight was 1.31. The results indicate that the uniformity of basis weight for Mill B is such that only 30.0% of the rolls should be expected to fall within the range limit of ± 0.5 pound (42.4 to 43.4 pounds), approximately 55% within the range limit ± 1.0 pound (41.9 to 43.9 pounds), and approximately 87% within the range limit of ± 2.0 pounds (40.9 to 44.9 pounds). The standard deviation for the caliper is 0.75 and thus approximately 82% of the rolls should fall within the caliper range limit of ± 0.001 inch (0.0144 to 0.0164 inch). The uniformity of the bursting strength as judged by the standard deviation indicates that approximately 30% of the rolls should fall within the bursting strength range limit of ± 2.5 points (98.5 to 103.5 points), approximately 56% within the range limit of ± 5.0 points (96 to 106 points), and approximately 76% within the range limit of ± 7.5 points (93.5 to 108.5 points). In terms of percentage, the uniformity of the G. E. puncture is of approximately the same order of magnitude as the bursting strength. The Riehle compression, Elmendorf tear, and Amthor tensile and stretch tests showed rather large standard deviations.

TABLE XV

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL A

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	12-30-44	42.1	14.9	33.8	8.3	94	39	25.7	20.2	378	401	81.6	38.1	2.0	3.5
2	12-30-44	42.8	14.8	34.7	7.6	99	38	27.0	20.0	366	414	83.7	38.8	2.2	3.3
3	1-20-45	40.9	14.2	34.6	9.7	109	34	29.0	21.0	341	406	84.6	35.9	2.7	3.7
4	1-20-45	41.0	14.1	34.8	9.2	110	35	28.5	21.6	336	412	85.3	37.4	2.9	3.6
5	11-15-44	42 1	14.3	35.3	13.2	107	36	25.8	22.7	387	415	76.8	39.8	2.8	3.5
6	1-26-45	42.1	15.1	33.4	10.7	111	37	29.2	23.4	363	417	85.9	38.3	2.4	3.7
7	11-15-44	40.1	14.5	33.2	11.7	103	34	29.0	22.1	351	396	78.1	37.6	2.5	3.4
8	1-16-45	39.2	14.6	32.2	8.4	99	33	25.9	20.2	310	370	73.8	36.1	1.7	2.6
9	1-16-45	38.5	14.5	31.8	7.9	90	31	27.5	21.2	334	366	72.8	35.7	1.9	2.8
10	1-15-45	41.4	14.8	33.5	7.8	95	36	27.5	21.5	350	398	81.0	36.0	2.0	2.9
11	1-15-45	41.4	15.5	32.0	7.2	92	35	28.8	22.3	384	407	82.5	35.2	2.0	3.7
12	1-15-45	41.1	15.3	32.2	6.3	88	35	28.1	21.5	349	398	81.7	34.6	2.0	3.5
13	1-15-45	41.2	15.3	32.3	7.0	93	37	27.6	22.0	377	418	82.2	36.0	1.9	2 9
14	7-1-44	40.7	15.1	32.3	11.3	98	35	31.6	22.9	355	382	70.7	35.4	1.9	3.7
15	7-1-44	41.3	15.2	32.6	12.0	104	37	31.6	22.3	357	394	74.0	33.5	2.3	3.7
16	7-1-44	40.0	14.6	32.8	11.8	96	33	31.5	21.8	350	380	69.4	35.1	2.2	4.2
17	7-1-44	39.1	14.4	32.5	10.6	88	32	30.0	22.0	333	371	69.4	33.9	2.1	3.8
18	2-8-45	41.9	15.3	32.8	9.1	104	34	29.8	24.4	339	404	80.5	36.9	2.0	3.7
19	2-8-45	41.2	15.0	32.9	8.8	104	32	28.4	24.7	336	382	86.0	36.2	2.2	3.6
20	3-12-45	41.6	14.9	33.5	9.6	99	32	31.2	21.3	319	373	84.3	35.0	2.2	3.5
21	3-11-45	41.2	14.8	33.4	8.1	101	32	29.2	22.7	313	375	81.2	35.7	2.0	3.2
22	3-14-45	42.7	14.9	34.3	9.9	100	36	27.6	22.3	321	370	77.1	35.2	2.1	3.3
23	3-15-45	40.4	14.8	32.7	7.9	95	33	29.4	22.8	316	370	80.7	33.1	2.0	3.5
24	3-15-45	43.3	15.1	34.4	10.1	98	37	27.7	22 6	331	404	74.7	36.1	2.2	3.4
25	3-14-45	40.6	15.0	32.4	8.7	94	34	27.1	23.4	339	357	70.6	37.1	2.1	2.8
26	3-14-45	42.0	15.3	32 9	8.4	103	37	28.8	23.5	326	404	76.9	37.0	2.3	3.0
27	11-15-44	40.5	14.8	32.8	7.6	95	33	28.2	21.4	325	373	74.9	37.4	2.1	3.3
28	11-15-44	40.0	14.6	32.8	6.0	99	33	27.5	21.5	320	385	77.3	37.5	2.0	3.4
	Average	41.1	14.8	33.2	9.1	99	35	28.5	22.1	343	391	78.5	36.2	2.2	3.4

TABLE XVI

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL A

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	43.3	15.5	111	39	31.6	24.7	387	418	86.0	39.8	2.9	4.2
Minimum	38.5	14.1	88	31	25.7	20.0	310	357	69.4	33.1	1.7	2.6
Average	41.1	14.8	99	35	28.5	22.1	343	391	78.5	36.2	2.2	3 4
Standard deviation	1.13	0.362	6.26	2.11	1.65	1.15	21.8	18.2	5.19	1.57	0.279	0.363
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	34	99	31	36	46	62	27	32	23	48	28	42
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	62	100	58	52	64	81	51	59	44	80	53	73
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	92	—	77	84	93	99	83	90	66	94	72	90

* These range limits were arbitrarily selected.

TABLE XVII
PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL B
Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	1-29-45	42.2	15.7	32.2	9.0	101	34	29.7	22.6	337	412	83.6	35.4	2.4	3.6
2	10-17-44	44.7	15.9	33.7	8.4	106	39	30.2	25.2	394	426	90.0	42.0	2.1	3.3
3	1-29-45	44.1	15.5	34.1	8.9	105	36	28.7	22.6	356	395	77.6	36.1	2.4	3.9
4	3-25-45	42.9	13.5	38.1	8.2	102	37	31.3	25.5	415	398	71.3	43.8	2.2	4.3
5	3-25-45	41.1	13.8	35.6	8.4	92	35	27.5	23.3	402	367	70.0	41.3	2.0	4.1
6	12-29-44	42.4	16.0	31.8	9.6	104	37	30.0	22.4	368	428	89.2	38.7	2.1	3.5
7	2-14-45	42.0	15.7	32.0	6.8	94	34	34.0	24.4	346	377	81.4	33.2	2.1	4.1
8	2-14-45	42.2	15.3	33.0	6.0	96	35	33.9	25.0	365	397	83.1	36.6	2.1	4.1
9	2-14-45	42.7	15.9	32.2	6.8	91	39	29.3	23.8	391	418	78.0	38.3	1.8	3.8
10	9-25-44	45.0	16.4	32.9	10.8	104	40	31.1	22.5	365	416	89.3	39.4	2.5	3.6
11	9-15-44	42.7	15.9	32.2	9.7	91	37	29.1	22.9	329	376	79.9	37.9	2.0	3.2
12	9-15-44	45.0	16.2	33.3	9.7	103	40	31.6	24.2	373	433	90.1	39.3	2.3	3.3
13	9-25-44	42.8	15.6	32.9	11.1	103	38	32.3	23.8	352	407	85.7	38.7	2.4	3.5
14	9-25-44	43.5	15.7	33.2	9.7	106	39	35.2	25.2	345	407	91.4	39.5	2.4	3.4
15	9-25-44	45.7	15.6	35.2	8.1	112	40	32.0	25.5	389	421	89.6	42.4	2.6	3.8
16	4-45	41.8	14.8	33.9	9.1	101	36	27.9	22.1	314	379	83.1	35.9	2.3	5.0
17	4-45	42.3	15.0	33.8	9.6	108	37	30.3	24.3	319	389	92.4	39.3	2.3	3.6
18	4-45	42.3	16.4	31.0	8.0	93	37	29.4	23.6	319	380	81.2	33.9	2.1	3.5
19	4-45	42.7	15.1	33.9	7.7	111	36	31.3	24.7	332	381	90.9	39.1	2.2	3.8
20	4-45	41.3	15.0	33.0	8.0	95	35	28.9	22.0	307	371	83.5	34.6	2.3	4.4
21	4-45	41.2	14.9	33.2	8.1	98	34	28.7	21.7	304	366	83.9	34.8	2.2	4.3
Average		42.9	15.4	33.4	8.7	101	37	30.6	23.7	353	397	84.1	38.1	2.2	3.8

TABLE XVIII
STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL B

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	45.7	16.4	111	40	35.2	25.5	415	433	92.4	43.8	2.6	5.0
Minimum	41.1	13.5	91	34	27.5	21.7	304	367	70.0	33.2	1.8	3.2
Average	42.9	15.4	101	37	30.6	23.7	353	397	84.1	38.1	2.2	3.8
Standard deviation	1.31	0.75	6.42	2.02	2.06	1.24	32.6	21.5	6.34	2.90	0.19	0.45
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	30	82	30	38	38	58	18	27	19	27	40	34
Range limit (±)*	1.0	2	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	55	99	56	54	53	77	35	52	36	51	71	63
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	87	—	76	86	86	98	64	84	77	70	89	82

* Range limits were arbitrarily selected.

TABLE XIX

PHYSICAL CHARACTERISTICS OF 42-LB D.F.B.S. FOURDRINIER KRAFT LINER

MILL C

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	1-29-45	43.7	13.7	38.2	7.7	98	37	28.0	23.1	385	393	81.6	43.0	2.2	5.0
2	1-29-45	42.8	13.4	38.3	7.8	98	35	29.4	23.3	356	371	82.7	43.0	2.1	4.8
3	1-29-45	44.0	14.0	37.7	7.7	109	38	31.2	24.5	389	389	86.4	45.0	2.2	4.7
4	—	41.7	14.2	35.2	8.2	88	36	31.2	22.8	351	380	76.6	38.8	1.5	4.3
5	3- 8-45	42.6	14.8	34.5	7.4	104	41	31.6	23.5	377	442	87.2	36.2	1.7	3.8
6	8- 9-44	42.2	15.0	33.8	8.3	99	42	31.0	21.4	361	392	82.4	36.9	1.7	3.3
7	3- 9-45	42.1	14.6	34.6	7.6	101	41	29.7	21.3	349	440	87.6	36.0	1.8	3.3
8	3- 9-45	42.5	14.9	34.2	8.2	99	41	32.8	22.8	371	433	89.8	37.0	1.8	3.9
9	4- 4-45	42.1	15.0	33.7	5.5	99	40	29.9	21.1	376	411	92.0	35.7	1.9	4.2
10	4- 4-45	42.3	14.7	34.5	5.8	103	40	28.9	22.0	366	401	85.2	36.7	1.8	4.4
11	1-29-45	43.8	13.9	37.8	5.6	102	38	30.3	24.6	366	368	84.7	44.3	1.9	4.5
12	1- 4-45	41.8	15.0	33.4	6.6	99	38	28.3	20.6	342	407	86.6	37.9	1.6	3.6
13	1- 4-45	42.7	14.9	34.4	6.1	93	38	27.3	20.4	357	381	84.8	36.5	1.8	3.3
14	1- 4-45	42.5	15.0	34.0	6.3	97	38	27.6	19.7	342	403	86.1	36.8	1.8	3.5
15	2- 8-45	44.0	14.7	35.9	7.1	109	41	30.5	22.3	373	458	94.8	39.4	2.2	4.5
Average		42.7	14.5	35.3	7.1	100	39	29.8	22.2	364	405	85.9	38.9	1.9	4.1

TABLE XX

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL C

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	44.0	15.0	109	42	32.8	24.6	389	458	94.8	45.0	2.2	5.0
Minimum	41.7	13.4	88	35	27.3	19.7	342	368	76.6	36.0	1.5	3.3
Average	42.7	14.5	100	39	29.8	22.2	364	405	85.9	38.9	1.9	4.1
Standard deviation	0.785	0.537	5.38	2.08	1.60	1.47	14.6	27.4	4.37	3.27	0.219	0.584
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	48	94	35	37	47	50	39	21	27	24	35	27
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	80	99	65	53	65	69	70	42	51	46	64	50
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	99	—	84	85	94	96	96	72	75	64	83	70

* Range limits were arbitrarily selected.

TABLE XXI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

Mill D

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G E. Puncture, units	Riehle Compression, lb In	Riehle Compression, lb Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	2- 7-45	40.8	14.7	33.3	8.6	94	38	28.3	23.3	355	374	65.3	41 9	1.8	3.1
2	2- 7-45	40.9	14.7	33.4	7.9	102	37	28.6	21.4	336	392	74.9	36 0	1.8	3.0
3	2- 7-45	41.0	14.8	33.2	7.9	93	37	25.8	22.9	383	349	65.0	42.0	1.8	3.1
4	2- 7-45	40.3	14.9	32.4	7.1	84	36	24.4	21.1	375	347	59.3	41.3	1.6	2.8
5	12-30-44	43.9	16.7	31.5	7.7	100	44	27.4	21.6	391	415	69.7	39.8	1.9	3.2
6	12-30-44	45.4	16.6	32.8	7.4	100	44	28.8	22.2	407	442	72.7	38.7	2.0	3.6
7	—	42.4	15 3	33.2	9.4	97	36	29.9	23.8	384	366	68.5	42.1	1.8	3.7
8	8-26-44	40.4	14.4	33.6	12.4	102	34	29.4	23.4	344	373	71.5	40.0	1.5	3.8
9	1-23-45	42.3	16.0	31.7	11.7	101	37	30.1	24.7	369	406	70.9	40.3	1.7	3.3
10	3- 5-45	38.8	13.3	34 9	4.2	91	30	31.4	23.8	320	348	74.0	37.5	1.9	4.0
11	3- 5-45	39.6	13.0	36.5	4.3	95	30	31.3	22.7	334	341	76.2	38.5	1.9	4.3
12	3-12-45	41.6	14.3	34.8	7.0	94	33	27.0	24.7	378	345	61.5	46.6	2.0	3.3
13	3-12-45	39.7	12.8	37.2	7.4	104	32	27.0	21.8	332	335	70.4	43.7	2.0	3.5
14	2-12-45	40.8	14.3	34.2	8.0	95	33	26.1	20.4	310	361	70.8	33.0	1.9	3.1
15	2-25-45	42.5	14.7	34.7	6.0	102	35	27.8	21.4	366	399	75.5	38.5	2.1	3.1
16	9-26-44	43.4	14.9	34.9	6.3	105	35	31.1	23.3	374	409	72.3	41.2	2.2	4.3
17	2-25-45	41.9	14.5	34.6	6.6	105	34	26.9	22.5	357	382	74.0	37.5	2.3	3.2
18	10-11-44	41.9	16.8	29.9	8.0	86	35	25.9	20.4	370	387	67.6	34.6	2.0	3.8
19	2- 9-45	43.3	14.6	35.6	6.7	110	36	28.2	21.4	360	402	74.3	38.7	2.2	3.7
20	11- 3-44	41.0	15.1	32.6	5.5	93	36	27.8	22.4	358	372	70.4	39.3	2.3	4.1
21	2- 9-45	42.8	14.8	34.7	6.2	102	38	25.9	22.7	362	398	74.3	37.3	2.3	3.8
Average		41.7	14.8	33.8	7.4	98	36	28.1	22.5	360	378	70.4	39.5	2.0	3.5

TABLE XXII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

Mill D

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	45.4	16.8	110	44	31.4	24.7	407	442	76.2	46.6	2.3	4.3
Minimum	38.8	12.8	84	30	24.4	20.4	310	335	59.3	33.0	1.5	2.8
Average	41.7	14.8	98	36	28.1	22.5	360	378	70.4	39.5	2.0	3.5
Standard deviation	1.59	1.07	6.51	3.57	1.96	1.25	24.2	28.7	4.56	3.07	0.237	0.441
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	24	65	30	22	39	58	24	21	26	26	33	35
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	47	94	56	33	56	77	46	40	49	48	60	64
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	79	—	75	60	87	98	79	71	73	67	80	83

* Range limits were arbitrarily selected.

Mill C

The average test results obtained for the liner made by Mill C are given in Table XIX (*see also* Table LXIII of the Appendix) and the statistical evaluation of these results in Table XX. The results indicate that the average basis weight for Mill C was slightly in excess of the specified weight for this grade. The average caliper was 0.0145 inch and the average apparent density was 35.3 pounds per cubic foot. The average bursting strength and G. E. puncture values were 100 points and 39 units, respectively. The average moisture content was 7.1% on the ovendry basis.

The standard deviation for basis weight for Mill C is 0.785. This rather low standard deviation suggests that approximately 48% of the rolls should fall within a range limit of ±0.5 pound (42.2 to 43.2 pounds), 80% within a range limit of ±1.0 pound (41.7 to 43.7 pounds), and practically all the rolls within a range limit of ±2.0 pounds (40.7 to 44.7 pounds). The standard deviation for the caliper is 0.537, and thus approximately 68% of the rolls should fall within a caliper range limit of ±0.0005 inch (0.0140 to 0.0150 inch) and approximately 94% within the range limit of ±0.001 inch (0.0135 to 0.0155 inch). The uniformity of the bursting strength indicates that approximately 35% of the rolls should fall within a range limit of 2.5 points (97.5 to 102.5 points), 65% within the range limit of ±5.0 points (95 to 105 points), and approximately 84% within a range limit of ±7.5 points (92.5 to 107.5 points). Percentagewise, the G. E. puncture is of approximately the same order of uniformity. In general, the standard deviations for the Riehle compression, Elmendorf tear, and Amthor tensile and stretch are of such magnitude as to indicate considerable lack of uniformity within the low arbitrary ranges but rather good agreement within the wider arbitrarily selected ranges.

Mill D

The average test results obtained for the liner manufactured by Mill D are shown in Table XXI (*see also* Table LXIV of the Appendix). The statistical evaluation of these results is given in Table XXII. The average basis weight for Mill D was, for all practical purposes, of the same order of magnitude as the specified grade weight of 42 pounds. This weight and the average caliper of 0.0148 inch resulted in an average apparent density of 33.8 pounds per cubic foot. The average bursting strength and G. E. puncture were 98 points and 36 units, respectively. The average moisture content was 7.4% on an ovendry basis.

Inasmuch as the standard deviation of the basis weight was 1.59, it is to be expected that only 24% of the rolls would fall within a basis weight range limit of ±0.5 pound (41.2 to 42.2 pounds), 47% within a range limit of ±1.0 pound (40.7 to 42.7 pounds), and 79% within a range limit of ±2.0 pounds (39.7 to 43.7 pounds). On the basis of a standard deviation of 1.07 for caliper, 65% of the rolls should fall within a caliper range limit of ±0.001 inch (0.0138 to 0.0158 inch) and only 94% within the range limit of ±0.002 inch (0.0128 to 0.0168 inch). The uniformity of the bursting strength, as shown by the standard deviation of 6.51, indicates that only 30% of the rolls should be expected to fall within a bursting strength range limit of ±2.5 points (95.5 to 100.5 points), 56% within a range limit of ±5.0 points (93 to 103 points), and 75% within a range limit of ±7.5 points (90.5 to 105.5 points). The G. E. puncture test results, with an average value of 36 and a standard deviation of 3.57, indicate a slightly greater probable variation than the bursting strength. The standard deviations for the Riehle compression, Elmendorf tear, and Amthor tensile and stretch indicate considerable nonuniformity in the narrower range limits selected.

Mill E

The average test results obtained for the liner produced by Mill E are given in Table XXIII (*see also* Table LXV of the Appendix) and the statistical evaluation of these results in Table XXIV. The average basis weight was in excess of the specified grade weight of 42 pounds. The average caliper was 0.0157 inch which results in an apparent density of 33.2 pounds per cubic foot. The average bursting strength and G. E. puncture were 91 points and 35 units, respectively. The average moisture content was 7.5%; however, as may be noted in Table XXIII, the average moisture content is based on the results obtained for only eight rolls.

The standard deviation of 0.981 for basis weight indicates that the basis weight of 39% of the rolls produced should fall within the range limit of ±0.5 pound (42.9 to 43.9 pounds), 69% within the range limit of ±1.0 pound (42.4 to 44.4 pounds), and 96% within the range limit of ±2.0 pounds (41.4 to 45.4 pounds). Mill E has a uniformity with respect to caliper such that 63% of the rolls should fall within the range limit ±0.001 inch (0.0147 to 0.0167 inch) and 93% within the range limit ±0.002 inch (0.0137 to 0.0177 inch). The standard deviation of 18.6 for the bursting strength indicates extreme nonuniformity with the probable chance variation that only 31% should fall within the range limit of ±7.5 points (83.5 to 98.5 points). It may be observed, however, that Rolls 1 and 2 were extremely low in all test results and, since there were only 11 rolls sampled of this mill's product, the effect of these rolls is considerable. In all probability, the presence of these two rolls has distorted the uniformity far more than practical consideration would permit. If the standard deviation for bursting strength were calculated after excluding Rolls 1 and 2, it would be 5.45 as compared with 18.6 when these two rolls are included. On the basis of statistics, however, it is not permissible to exclude these roll values.

TABLE XXIII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL E

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu. ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	2-13-45	44.9	17.3	31.1	9.0	52	28	22.0	17.5	274	278	54.0	29.9	1.2	2.7
2	2-13-45	44.6	17.8	30.1	5.2	58	28	24.3	18.6	271	282	60.5	29.6	1.3	2.9
3	—	42.5	14.0	36.4	8.5	92	31	25 0	18.7	314	349	75.7	34.5	1.6	3.7
4	3-20-45	43.8	16.1	32.6	9.0	97	36	29.7	21.2	313	375	84.9	32.9	1.9	3.7
5	3-21-45	43.0	16.0	32.2	6.9	92	35	30.4	20.9	303	362	82.3	33.3	1.7	3.6
6	3-21-45	43.3	15.9	32.7	7.5	98	34	28.7	21.7	317	380	88.0	33.2	1.9	3.8
7	3-20-45	44.2	15.5	34.2	6.8	105	38	30.9	22.4	331	385	84.3	33.8	2.0	3.8
8	3-21-45	41.7	15.4	32.5	7.3	104	36	28.8	20.3	317	369	89.9	32.6	2.1	4.0
9	4- 6-45	42.9	14.3	36.0	*	106	39	28.5	22.7	362	404	78.9	38.4	2.0	4.0
10	4- 6-45	43.6	15.2	34.4	*	103	39	26.4	21.8	400	427	76.7	40.8	2.0	4.0
11	4- 6-45	42.4	15.3	33.3	*	96	37	27.5	21.2	361	403	72.7	38.5	1.9	3.8
Average		43.4	15.7	33.2	7.5	91	35	27.5	20.6	324	365	77.1	34.3	1.8	3.6

* No moisture samples obtained.

TABLE XXIV

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL E

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	44.9	17.8	106	39	30.9	22.7	400	427	89.9	40.8	2.1	4.0
Minimum	41.7	14.0	52	28	22.0	17.5	271	278	54.0	29.6	1.2	2.7
Average	43.4	15.7	91	35	27.5	20.6	324	365	77.1	34.3	1.8	3.6
Standard deviation	0.981	1.12	18.6	4.01	2.77	1.68	38.4	47.2	11.2	3.54	0.299	0.437
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	39	63	10	20	28	45	16	13	10	22	26	35
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	69	93	21	29	41	63	30	25	21	42	50	64
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	96	—	31	55	72	93	56	48	35	60	68	83

* Range limits were arbitrarily selected.

TABLE XXV
PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL F

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g /sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	5- 4-45	41.1	13.5	36.5	10.7	98	39	24.3	18.4	338	404	71.2	38.7	2.0	3.1
2	4-15-45	42.4	13.9	36.6	11.4	96	37	21.5	18.9	335	370	71.4	35.9	2.0	2.9
3	5- 5-45	37.5	13.1	34.3	8.7	76	28	22.3	16.5	270	310	63.9	27.5	1.7	3.4
4	5- 5-45	41.6	13.5	37.0	11.1	75	32	21.6	18.0	283	334	67.0	29.5	1.8	3.1
5	5- 5-45	39.3	13.0	36.3	10.3	83	29	23.7	19.8	279	325	63.6	32.8	2.0	3.0
6	5- 5-45	39.4	13.4	35.3	7.8	78	31	23.2	19.7	292	320	61.1	33.8	2.0	3.1
7	5- 5-45	36.9	12.6	35.1	9.5	76	28	23.3	19.9	262	285	60.3	33.3	1.9	3.0
8	5- 4-45	40.0	13.7	35.0	10.5	97	37	23.4	19.9	338	379	72.0	35.2	2.0	3.0
9	5- 4-45	40.5	13.5	36.0	10.6	95	37	26.9	19.8	348	369	74.0	36.0	2.0	3.1
10	5- 5-45	38.4	13.5	34.1	9.5	74	29	22.6	16.0	276	333	62.3	26.9	1.9	3.0
Average		39.7	13.4	35.6	10.0	85	33	23.3	18.7	302	343	66.7	33.0	1.9	3.1

TABLE XXVI
STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL F

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	42.4	13.9	98	39	24.3	19.9	348	404	74.0	38.7	2.0	3.4
Minimum	36.9	12.6	74	28	21.5	16.0	262	285	60.3	26.9	1.7	2.9
Average	39.7	13.4	85	33	23.3	18.7	302	343	66.7	33.0	1.9	3.1
Standard deviation	1.77	0.374	10.3	4.35	1.55	1.46	33.5	36.4	5.09	3.87	0.106	0.134
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	22	99	19	18	48	50	17	17	23	21	65	86
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	42	100	38	27	67	70	35	32	44	40	94	99
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	74	—	53	51	95	96	63	59	67	56	99	100

* Range limits were arbitrarily selected.

TABLE XXVII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL G

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	4- 2-45	42.6	15.5	33.0	7.3	93	37	27.4	23.6	373	429	76.0	41.4	1.7	3.1
2	4- 2-45	42.5	15.9	32.1	4.9	87	38	26.7	23.2	382	413	73.5	40.8	1.4	2.9
3	4- 2-45	42.0	15.8	31.9	7.4	88	37	25.7	22.3	382	426	73.0	41.7	1.6	3.1
4	4- 2-45	41.7	15.7	31.9	6.8	85	37	26.1	22.0	392	420	73.5	41.9	1.5	2.8
5	4- 2-45	42.2	15.9	31.8	8.1	92	38	25.5	22.0	390	423	74.7	40.7	1.5	2.8
6	1-22-45	41.2	16.1	30.7	5.8	89	36	28.8	21.8	377	399	71.5	37.1	2.0	4.0
7	1-22-45	41.7	16.2	30.9	7.0	92	38	28.1	23.8	394	436	72.3	40.8	2.0	3.8
8	12-12-44	42.0	15.0	33.6	10.5	106	38	28.8	25.3	377	405	70.7	50.6	2.0	3.7
9	2-19-45	41.5	15.5	32.1	8.2	97	36	28.9	25.7	383	375	71.6	44.7	2.0	4.3
10	2-19-45	41.7	15.2	32.9	6.3	95	35	27.9	26.2	381	382	70.0	44.4	2.0	4.2
11	4- 2-45	43.3	15.3	34.0	6.9	88	44	27.4	23.1	394	424	73.9	37.9	1.8	4.0
12	4- 2-45	40.2	15.3	31.5	5.8	91	39	28.1	23.7	364	407	70.8	38.6	1.6	3.6
13	4- 2-45	41.6	15.3	32.6	5.5	79	39	25.6	22.1	383	410	69.7	35.7	1.4	3.3
14	11-13-44	42.6	16.0	31.9	7.3	88	36	28.8	26.8	382	358	70.3	48.4	1.8	4.1
15	3-13-45	41.0	15.0	32.8	7.9	94	37	26.6	24.1	353	371	72.5	42.8	1.8	4.3
Average		41.9	15.6	32.2	7.0	91	38	27.4	23.7	380	405	72.3	41.8	1.7	3.6

TABLE XXVIII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL G

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	43.3	16.2	106	44	28.9	26.8	394	436	76.0	50.6	2.0	4.3
Minimum	40.2	15.0	79	35	25.5	21.8	353	358	69.7	35.7	1.4	2.8
Average	41.9	15.6	91	38	27.4	23.7	380	405	72.3	41.8	1.7	3.6
Standard deviation	0.753	0.394	6.08	2.09	1.25	1.63	11.1	23.6	1.84	4.01	0.229	0.556
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	49	99	32	37	58	46	50	25	59	20	34	28
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	82	100	59	53	77	64	82	48	90	38	62	53
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	99	—	78	85	98	93	99	80	99	55	81	72

* Range limits were arbitrarily selected.

Mill F

The average test results obtained on the liner made by Mill F are reported in Table XXV (*see also* Table LXVI of the Appendix). The results indicate that the average basis weight is considerably lower than the specified weight for this grade. The average caliper was 0.0134 inch, which resulted in an average apparent density of 35.6 pounds per cubic foot. The average bursting strength and G. E. puncture values were 85 points and 33 units, respectively. The average moisture content was 10.0% on an ovendry basis.

The statistical evaluation of these test results is given in Table XXVI. On the basis of a standard deviation of 1.77 for basis weight, it should be expected that only 22% of the rolls will fall within a basis weight range limit of ±0.5 pound (39.2 to 40.2 pounds), 42% of the rolls within a range limit of ±1.0 pound (38.7 to 40.7 pounds), and 74% of the rolls within a range limit of ±2.0 pounds (37.7 to 41.7 pounds). The chance variation or uniformity of the caliper as determined by standard deviation indicates an expectancy of approximately all of the rolls falling within the range limit of ±0.001 inch (0.0124 to 0.0144 inch). The standard deviation for the bursting strength indicates that the uniformity is such that only 19% of all rolls should fall within the range limit of ±2.5 points (82.5 to 87.5 points) of the average obtained, 38% of the rolls within the range limit of ±5.0 points (80.0 to 90.0 points) and 53% within the range limit of ±7.5 points (77.5 to 92.5 points). The probable variation for the G. E. puncture test appears to follow approximately the same trend as the bursting strength variation. The probable variation for Riehle compression and Amthor stretch appears to be slightly less than the variation to be expected for Elmendorf tear and Amthor tensile.

Mill G

The average test results obtained on samples of liner made by Mill G are given in Table XXVII (*see also* Table LXVII of the Appendix). The average basis weight was, for all practical purposes, the same as the specified grade weight. The average caliper was 0.0156 inch and the average apparent density was 32.2 pounds per cubic foot. The average bursting strength and G. E. puncture values were 91 points and 38 units, respectively. The average moisture content was 7.0% on an ovendry basis.

The statistical evaluation of these results is given in Table XXVIII. The standard deviation for basis weight indicates that approximately 49% of the rolls should fall within a basis weight range limit of ±0.5 pound (41.4 to 42.4 pounds), 82% within a range limit of ±1.0 pound (40.9 to 42.9 pounds) and practically all the rolls produced of this grade should fall within a range limit of ±2.0 pounds (39.9 to 43.9 pounds). On the basis of the results obtained for caliper, it should be expected that practically all the rolls would fall within a caliper range limit of ±0.001 inch (0.0146 to 0.0166 inch). The standard deviation of the bursting strength was of such magnitude that it should be expected that only 32% of the rolls should fall within a range limit of ±2.5 points (88.5 to 93.5 points), 59% within the range limits of ±5.0 points (86.0 to 96.0 points), and approximately 78% within the range limit of ±7.5 points (83.5 to 98.5 points). The magnitude of the standard deviation for the G. E. puncture test indicates approximately the same probable variation as for the bursting strength. The standard deviations for the Riehle compression, Elmendorf tear, Amthor tensile and stretch indicate that the probable variation to be expected is quite large.

Mill H

The average test results obtained on the samples of liner manufactured by Mill H are tabulated in Table XXIX (*see also* Table LXVIII of the Appendix). The average basis weight obtained for Mill H was slightly in excess of the specified grade weight. The average caliper was 0.0159 inch and the average apparent density was 32.2 pounds per cubic foot. The average bursting strength and G. E. puncture were 108 points and 37 units, respectively. The average moisture content was 8.0% on an ovendry basis.

The statistical evaluation of these test results is shown in Table XXX. The standard deviation for basis weight is of the magnitude that 40% of the rolls manufactured by Mill H in this grade should fall within a basis weight range limit of ±0.5 pound (42.1 to 43.1 pounds), 72% within the range limit of ±1.0 pound (41.6 to 43.6 pounds), and practically 97% within the range limit of ±2.0 pounds (40.6 to 44.6 pounds). On the basis of the results obtained for caliper, it should be expected that practically all the rolls should fall within ±0.001 inch (0.0149 to 0.0169 inch) of the average caliper. The statistical evaluation of the bursting strength indicates that approximately 38% of the rolls should fall within a bursting strength range limit of ±2.5 points (105.5 to 110.5 points), approximately 67% within the range limit of ±5.0 points (103 to 113 points), and approximately 86% within the range limit of ±7.5 points (100.5 to 115.5 points). The variation for the G. E. puncture test exhibits relatively the same trend as the bursting strength. The standard deviations for the Riehle compression, Elmendorf tear, and Amthor tensile and stretch indicate considerable lack of uniformity in the tests.

Mill I

The average test results obtained for the liner made by Mill I are shown in Table XXXI (*see also* Table LXIX of the Appendix). The average basis weight was in excess of the specified weight for this grade. The average caliper was 0.0153 inch and the average apparent density was 34.2 pounds per cubic foot. The average bursting strength and G. E. puncture were 109 points and 41 units, respectively. The average moisture content was 8.4% on an ovendry basis.

The statistical evaluation of these test results may

TABLE XXIX

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL H

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	12-31-44	44.5	15.7	34.0	8.8	112	42	29.7	25.4	449	452	73.5	47.8	2.5	3.8
2	12-31-44	44.6	16.5	32.4	9.4	96	42	27.0	24.5	481	427	62.7	50.3	2.3	4.4
3	3-19-45	42.1	15.2	33.2	8.1	107	37	32.4	25.7	390	400	69.2	45.7	2.0	4.4
4	3-20-45	41.5	15.2	32.8	9.0	103	35	29.7	25.4	397	371	63.9	49.7	2.0	4.5
5	3-20-45	42.2	16.4	30.9	7.1	108	35	34.8	26.1	340	405	80.0	42.5	2.1	3.7
6	3-20-45	41.6	15.9	31.4	7.7	105	36	31.3	22.8	339	391	79.5	39.1	2.1	4.0
7	3-20-45	42.4	16.4	31.0	6.7	101	37	32.1	22.7	346	405	75.9	37.7	1.9	3.6
8	4-13-45	42.0	16.1	31.3	6.3	110	36	28.6	23.9	373	389	80.5	40.9	2.3	3.9
9	4-13-45	42.3	15.6	32.5	8.9	115	35	30.9	24.4	360	393	80.9	41.7	2.4	4.3
10	4-13-45	42.7	15.8	32.4	8.8	111	38	30.2	23.8	378	400	80.8	39.2	2.4	3.8
11	4-13-45	42.9	15.9	32.4	8.5	108	38	30.5	23.7	391	409	80.0	41.0	2.3	4.1
12	4-13-45	42.8	16.1	31.9	7.8	107	38	30.8	24.8	375	406	82.1	40.2	2.4	3.8
13	4-13-45	41.9	15.9	31.6	8.1	108	37	30.1	25.0	380	431	79.1	41.3	2.3	4.4
14	4-13-45	42.3	15.6	32.5	7.4	114	36	31.1	25.4	406	420	73.7	40.3	2.3	4.2
	Average	42.6	15.9	32.2	8.0	108	37	30.7	24.5	386	407	75.8	42.7	2.2	4.1

TABLE XXX

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL H

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	44.6	16.5	115	42	34.8	26.1	481	452	82.1	50.3	2.5	4.5
Minimum	41.5	15.2	96	35	27.0	22.7	339	371	62.7	37.7	1.9	3.6
Average	42.6	15.9	108	37	30.7	24.5	386	407	75.8	42.7	2.2	4.1
Standard deviation	0.937	0.405	5.11	2.27	1.82	1.05	39.7	20.3	6.44	4.05	0.183	0.303
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	40	99	38	34	42	66	15	29	18	20	42	49
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	72	100	67	49	59	85	30	54	36	38	72	81
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	97	—	86	81	90	99	55	86	56	54	90	95

* Range limits were arbitrarily selected.

TABLE XXXI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL I

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	1-20-45	42.5	15.3	33.3	8.7	111	40	30.5	22.4	418	468	90.9	36.6	2.0	4.2
2	1-20-45	42.7	15.1	33.9	8.9	107	42	28.7	21.2	428	473	88.2	37.9	2.0	4.3
3	1-20-45	42.5	15.3	33.3	8.5	109	42	28.7	20.6	422	506	88.4	37.7	2.1	4.6
4	1-31-45	43.9	15.1	34.9	7.0	106	40	29.0	20.8	434	470	88.5	37.1	2.3	4.2
5	1-31-45	43.5	15.2	34.3	7.1	105	41	26.7	20.3	411	462	86.3	35.8	2.2	4.1
6	1-31-45	43.1	15.5	33.4	6.9	108	41	29.5	22.5	401	462	85.3	38.0	2.2	4.3
7	1-31-45	43.5	15.5	33.7	7.0	104	41	30.0	20.4	408	487	87.5	35.3	2.2	4.3
8	1-31-45	42.1	15.2	33.2	6.5	102	39	29.2	21.5	407	443	78.6	36.6	2.0	4.5
9	1-30-45	43.4	15.5	33.6	10.0	106	40	29.9	21.9	411	442	81.9	37.1	2.2	4.3
10	1-31-45	43.2	15.5	33.4	8.9	109	40	29.8	20.4	405	463	83.9	36.5	2.2	4.5
11	1-31-45	43.6	15.3	34.2	8.8	114	41	31.0	23.7	390	466	85.5	37.2	2.3	4.7
12	1-30-45	43.8	15.7	33.5	9.6	109	40	30.0	22.3	422	470	80.5	37.0	2.3	4.4
13	1-30-45	43.3	15.9	32.7	9.4	100	41	29.7	23.6	390	458	78.4	35.3	2.2	4.3
14	3- 2-45	42.8	14.7	34.9	9.7	119	39	31.2	22.1	394	474	83.5	36.3	2.6	5.3
15	3- 2-45	45.4	15.1	36.1	10.8	121	42	32.3	22.2	431	497	84.2	37.8	2.6	5.1
16	3- 2-45	45.0	15.3	35.3	11.4	112	42	32.1	21.9	416	491	85.6	38.3	2.6	4.8
17	1-11-45	42.6	15.0	34.1	8.2	104	38	32.1	18.6	366	430	82.5	35.1	2.3	4.4
18	3-10-45	44.5	14.9	35.8	7.3	110	42	35.5	21.9	391	453	89.6	36.5	2.5	4.6
19	3-10-45	43.3	14.9	34.9	6.6	107	42	34.5	22.1	416	451	86.9	36.3	2.2	4.5
20	1-18-45	43.9	15.3	34.4	8.1	110	43	33.6	22.0	412	454	87.0	38.0	2.3	4.5
21	10-24-44	45.0	15.6	34.6	7.6	108	43	34.5	22.0	411	443	92.2	35.4	2.3	4.4
22	2- 3-45	44.1	15.6	33.9	8.4	110	44	30.3	24.1	401	469	83.4	37.9	2.2	4.6
Average		43.5	15.3	34.2	8.4	109	41	30.9	21.8	408	465	85.4	36.8	2.3	4.5

TABLE XXXII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL I

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	45.4	15.9	121	44	35.5	24.1	434	506	92.2	38 3	2.6	5.3
Minimum	42.1	14.7	100	38	26.7	18.6	366	430	78.4	35.1	2.0	4.1
Average	43.5	15.3	109	41	30.9	21.8	408	465	85.4	36.8	2 3	4.5
Standard deviation	0.874	0.290	4.91	1.46	2.19	1.25	15.8	18.7	3.66	0.996	0.179	0.287
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	43	99	39	50	35	58	36	31	32	68	42	52
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	75	100	69	70	50	77	66	58	59	95	74	84
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	98	—	87	96	83	98	94	89	83	99	91	96

* Range limits were arbitrarily selected.

TABLE XXXIII
PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL J
Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb /cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	3-17-45	39.7	14.9	32.0	8.7	77	31	28.2	24.9	320	339	59.1	38.3	1.9	3.1
2	8-28-44	43.4	13.3	39.2	8.6	88	31	27.9	21.6	288	344	70.6	34.3	1.7	2.8
3	3-15-45	41.9	15.4	32.6	7.6	97	34	28.9	23.8	319	378	76.5	38.2	2.0	2.8
4	3-15-45	41.5	15.3	32.5	8.4	99	33	29.5	24.1	324	368	75.5	38.2	2.0	2.7
5	8-26-44	41.1	14.6	33.8	8.1	82	29	30.2	22.4	277	334	68.8	34.4	1.6	2.4
6	2- 2-45	41.4	15.2	32.7	8.4	78	28	30.0	24.1	247	294	64.2	33.5	2.1	2.4
7	2-20-45	41.2	14.6	33.9	8.0	83	31	32.9	22.6	288	324	69.2	32.0	2.0	3.0
8	2-20-45	40.5	14.0	34.7	9.1	82	30	30.4	23.4	274	313	68.5	33.1	2.1	3.3
9	2- 9-45	41.7	14.5	34.5	5.7	79	29	32.2	22.7	236	291	68.2	33.6	1.9	3.1
10	2- 9-45	40.5	14.7	33.1	4.6	78	28	29.0	24.3	214	276	66.8	34.1	2.0	2.5
11	2-25-45	41.9	15.2	33.1	7.7	96	34	30.6	22.7	290	370	75.7	34.3	2.0	3.0
12	4- 1-45	42.1	15.2	33.2	6.0	83	30	29.9	24.8	301	352	68.6	34.7	2.0	2.3
13	4- 1-45	41.9	15.1	33.3	7.5	92	30	31.7	24.9	298	331	67.5	38.6	2.0	3.0
14	4- 1-45	41.5	14.9	33.4	6.2	87	30	29.4	24.2	302	339	69.2	36.6	1.8	2.9
15	2-23-45	41.7	14.9	33.6	8.2	100	31	33.4	24.4	318	381	77.8	36.9	2.3	3.2
16	2-25-45	41.2	14.9	33.2	7.4	103	30	31.7	24.3	318	361	80.0	36.2	2.2	3.1
17	3- 3-45	42.7	14.6	35.1	8.4	106	39	31.2	23.7	362	423	92.2	37.2	2.4	4.3
18	3- 3-45	42.8	14.5	35.4	6.5	111	38	31.1	23.3	338	403	92.0	37.8	2.3	4.4
19	3- 3-45	42.2	14.1	35.9	9.4	109	38	30.5	23.2	331	400	84.3	36.4	2.2	4.2
20	3- 3-45	42.4	14.0	36.3	7.2	105	38	30.0	24.8	344	412	85.8	36.1	2.3	4.3
21	3- 3-45	42.2	14.1	35.9	10.2	108	38	30.3	23.5	338	412	90.8	39.3	2.2	4.1
Average		41.7	14.7	34.2	7.7	93	32	30.4	23.7	301	355	74.8	35.9	2.0	3.2

TABLE XXXIV
STATISTICAL EVALUATION OF PHYSICAL TESTS ON 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL J

	Basis Weight, lb (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb /in. In	Amthor Tensile, lb /in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	43.4	15.4	111	39	33.4	24.9	362	423	92.2	39.3	2.4	4.4
Minimum	39.7	13.3	77	28	27.9	21.6	214	276	59.1	32.0	1.6	2.3
Average	41.7	14.7	93	32	30.4	23.7	301	355	74.8	35.9	2.0	3.2
Standard deviation	0.845	0.532	11.7	3.69	1.43	.92	37.1	42.1	9.54	2.11	0.204	0.673
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	44	94	17	21	52	72	16	14	13	36	38	24
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	76	99	33	32	71	90	31	28	24	66	67	44
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	98	—	48	58	96	99	58	52	40	84	86	63

* Range limits were arbitrarily selected.

be seen in Table XXXII. The standard deviation for the basis weight is of such magnitude that it should be expected that approximately 43% of all the rolls manufactured by Mill I should fall within a basis weight range limit of ±0.5 pound (43.0 to 44.0 pounds), 75% within the range limit of ±1.0 pound (42.5 to 44.5 pounds), and approximately 98% within the range limit of ±2.0 pounds (41.5 to 45.5 pounds). On the basis of the results obtained for caliper, it should be expected that approximately all the rolls should fall within a caliper range limit of ±0.001 inch (0.0143 to 0.0163 inch). The statistical evaluation of the results obtained for the bursting strength indicate that approximately 39% of the rolls should fall within a range limit of ±2.5 points (106.5 to 111.5 points), approximately 69% within the range limit of ±5.0 points (104 to 114 points), and approximately 87% within the range limit of ±7.5 points (101.5 to 116.5 points). The results obtained indicate that, in terms of percentage, the rolls made by this mill should be slightly more uniform in respect to G. E. puncture than to bursting strength. The results of the Riehle compression, Elmendorf tear, and Amthor tensile and stretch indicate standard deviations of considerable magnitude.

Mill J

The average test results obtained for the rolls of liner made by Mill J are given in Table XXXIII (*see also* Table LXX of the Appendix). The average basis weight obtained is practically the same as the specified grade weight. The average caliper was 0.0147 inch and the average apparent density was 34.2 pounds per cubic foot. The average bursting strength and G. E. puncture values were 93 points and 32 units, respectively. The average moisture content was 7.7% on an ovendry basis.

The statistical evaluation of these results are reported in Table XXXIV. The magnitude of the standard deviation for basis weight indicates that approximately 44% of the rolls manufactured by Mill J should fall within a basis weight range limit of ±0.5 pound (41.2 to 42.2 pounds), approximately 76% within the range limit of ±1.0 pound (40.7 to 42.7 pounds) and approximately 98% within the range limit of ±2.0 pounds (39.7 to 43.7 pounds). The results obtained for caliper indicate that approximately 94% of the rolls should fall within a caliper range limit of ±0.001 inch (0.0137 to 0.0157 inch). The standard deviation for the bursting strength is of such magnitude that it should be expected that approximately 17% of the rolls manufactured by Mill J should fall within a range limit of ±2.5 points (90.5 to 95.5 points), approximately 33% should fall within the range limit of ±5.0 points (88.0 to 98.0 points), and approximately 48% within the range limit of ±7.5 points (85.5 to 100.5 points). The statistical evaluation of the Riehle compression values indicates a rather low probable variation, whereas the results obtained for G. E. puncture, Elmendorf tear, Amthor tensile and stretch indicate considerable probable variation.

EVALUATION OF THE PHYSICAL CHARACTERISTICS OF .009/26-LB. KRAFT AND BOGUS CORRUGATING MEDIUMS

PROCEDURE

The tests and procedures employed throughout this evaluation study have been described on pages 8 to 10.

For the purpose of comparison of the characteristics of the product within a given mill and also between mills, each Fourdrinier Kraft Board Institute mill which makes .009/26-lb. corrugating medium has been given an arbitrarily selected code letter; they have been identified in this report by the letters S to Z, inclusive. The corrugating medium manufactured by Mill V was a bogus medium. Consequently, the group averages have been calculated in two ways: (*1*) including the bogus medium and (*2*) excluding the bogus medium.

The test results have been given the same statistical treatment as was employed in the treatment of the 42-lb. liner.

COMPARISON OF MILL AVERAGES

The results of the various physical tests performed on samples of .009/26-lb. corrugating medium have been compiled in Table XXXV on the basis of mill averages. Complete details of the individual tests are given in Tables LXXI–LXXVIII of the Appendix.

The average results obtained for basis weight are shown graphically in Figure 16. The average basis weight for the group participating was 26.8 pounds including and 26.9 pounds excluding the bogus medium. Both of these group averages are in excess of the grade weight specified. Mill X had the highest average basis weight and Mill V the lowest. The basis weight averages for all the mills were within ±1 pound of the group average.

The average caliper results are plotted in Figure 17. The average caliper value for the group was 0.010 inch, regardless of whether or not the bogus medium was included. Mill U had the highest average caliper and Mills Y and Z the lowest. All the individual mill averages for caliper were within ±0.0007 inch of the group average caliper.

The average apparent densities, in pounds per cubic foot, are pictured graphically in Figure 18. The group average apparent density when the bogus medium was included was 32.3 pounds per cubic foot and 32.5 pounds per cubic foot when it was not included. The highest average apparent density was obtained for Mill Z and the lowest for Mill U. It is interesting to note that the mill averages for apparent density varied over a considerable range.

From the data graphically presented in Figure 19, it may be observed that the average moisture content for the group was 9.4% including the bogus medium and 9.5% when the bogus medium was not included. Mill T had the highest average moisture content and Mill U the lowest. Two of the mills (T and W) had average moisture values in excess of 11%.

From the data presented in Figure 20, it is seen that the average bursting strength for the group, including the bogus medium, was 62 points; it was 66 points when the bogus was not included. The bursting strength, expressed in points per pound basis weight, was 2.31 when the bogus was included and 2.45 when the bogus was not included. The highest mill average bursting strength was obtained for Mill Z and the lowest for Mill V (the bogus medium). The average bursting strength for the bogus medium was approximately 50% of the average bursting strength obtained for the other mills.

TABLE XXXV

COMPARISON OF PHYSICAL CHARACTERISTICS BETWEEN MILLS

CORRUGATING MEDIUM

Mill	Rolls Tested	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
S	10	27.3	10.1	32.4	8.5	68	20	19.5	15.5	268	276	52.3	30.4	1.6	4.7
T	10	27.0	10.0	32.5	11.8	57	20	15.9	12.8	237	261	45.1	24.2	1.8	3.7
U	21	26.9	10.7	30.2	8.4	65	20	19.7	13.5	238	266	53.0	25.7	2.0	4.8
V	13	25.8	10.1	30.7	9.2	32	11	12.9	10.3	121	134	31.0	17.2	1.4	2.4
W	13	26.8	10.1	31.8	11.1	69	19	17.7	11.5	228	300	56.6	21.8	2.1	3.8
X	14	27.4	9.8	33.7	8.7	68	21	17.1	13.1	250	281	52.1	25.3	2.1	4.3
Y	10	26.0	9.3	33.9	9.7	58	15	17.3	12.3	189	219	50.7	22.1	2.0	3.6
Z	11	26.8	9.3	34.7	9.1	75	20	19.9	15.8	251	262	53.8	33.0	2.0	4.7
Group Average*		26.8	10.0	32.3	9.4	62	18	17.6	13.0	223	251	49.5	24.8	1.9	4.0
Group Average†		26.9	10.0	32.5	9.5	66	19	18.3	13.4	238	268	52.2	25.9	2.0	4.3

* Including bogus from Mill V.
† Excluding bogus.

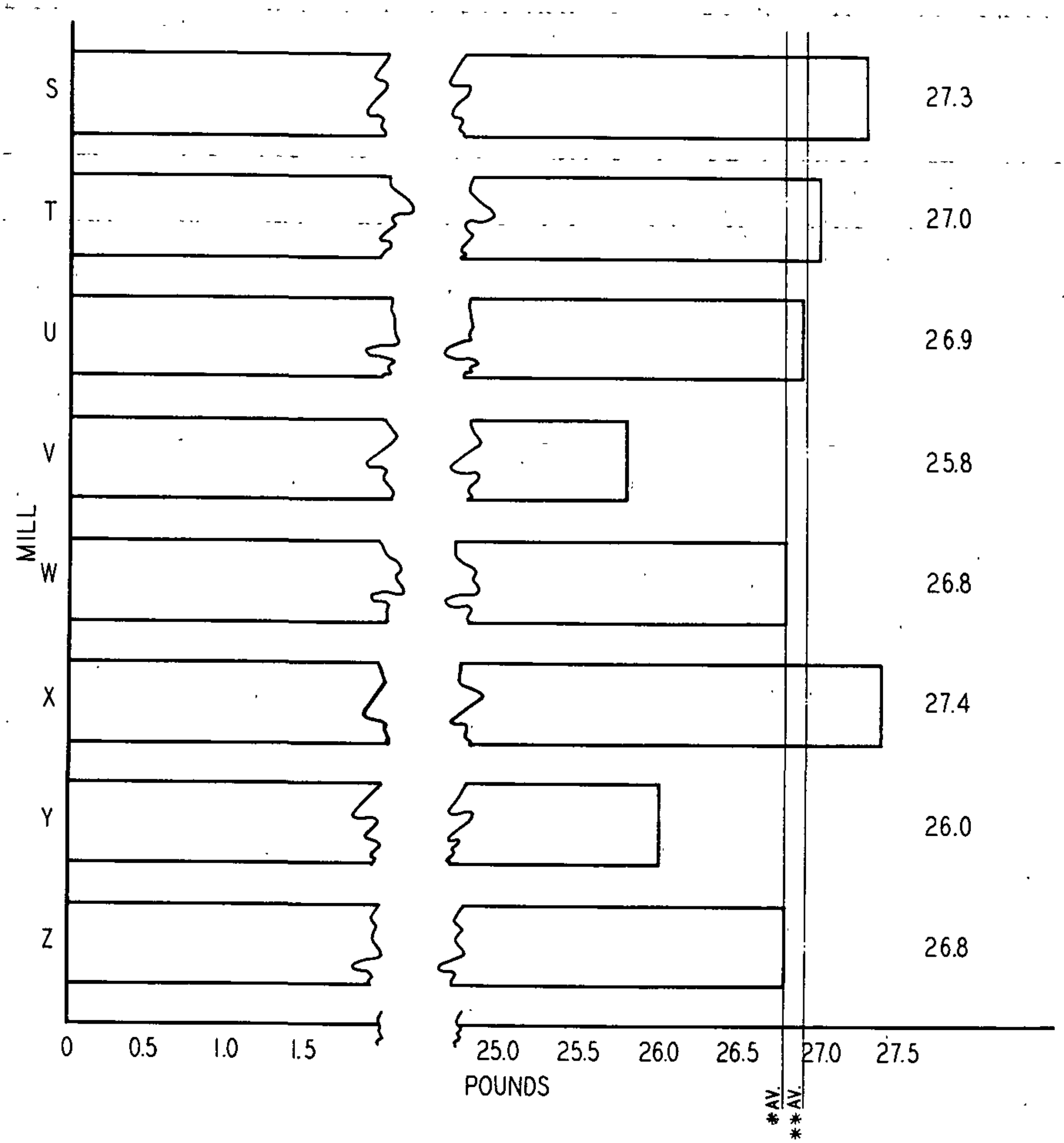

FIGURE 16. Comparison of the average basis weight of .009/26-lb. corrugating medium among mills.

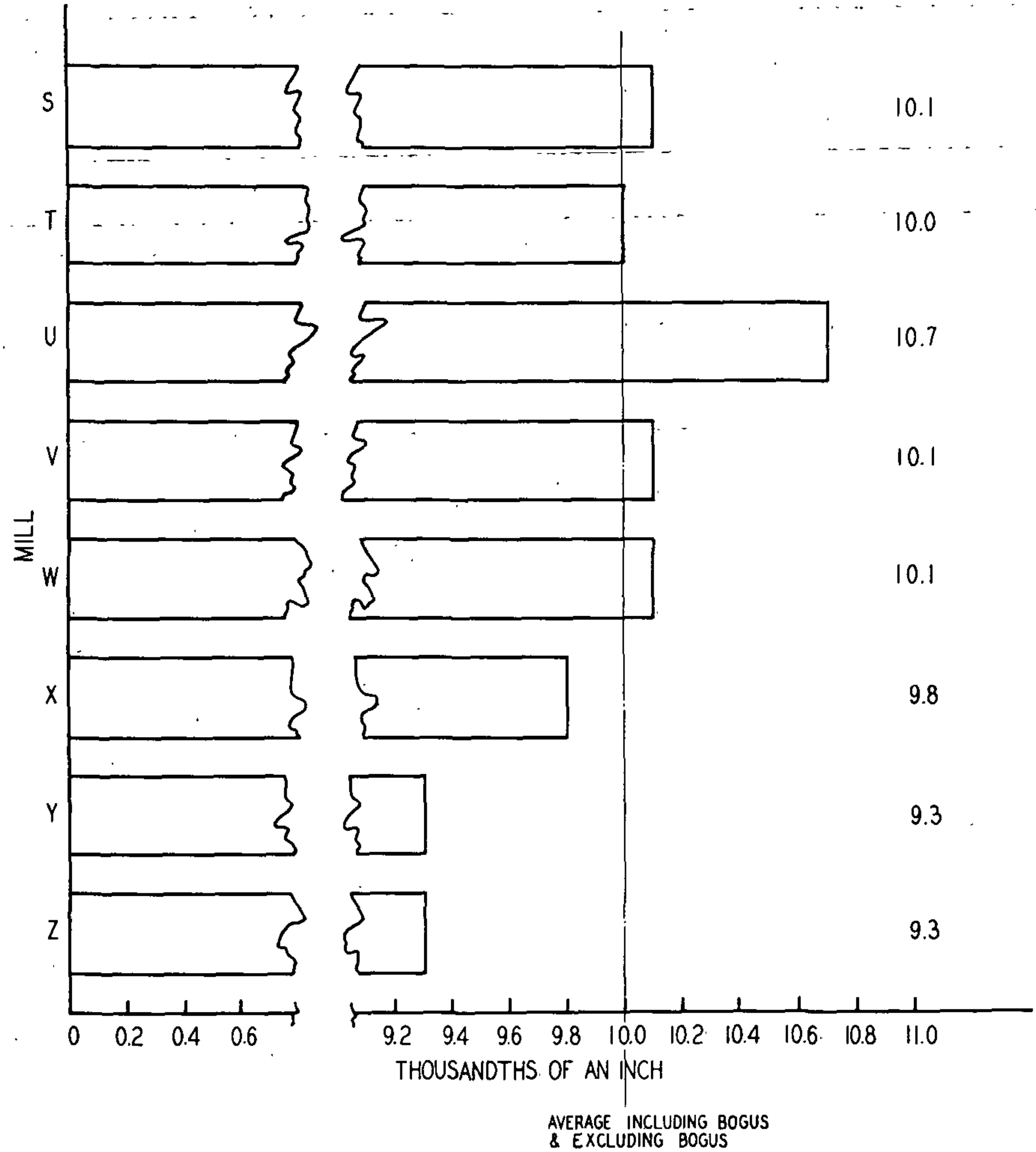

FIGURE 17. Comparison of the average caliper of .009/26-lb. corrugating medium among mills.

(Because the averages were calculated to the nearest tenth only, the average value of the caliper was the same when the bogus samples were excluded as when they were included.)

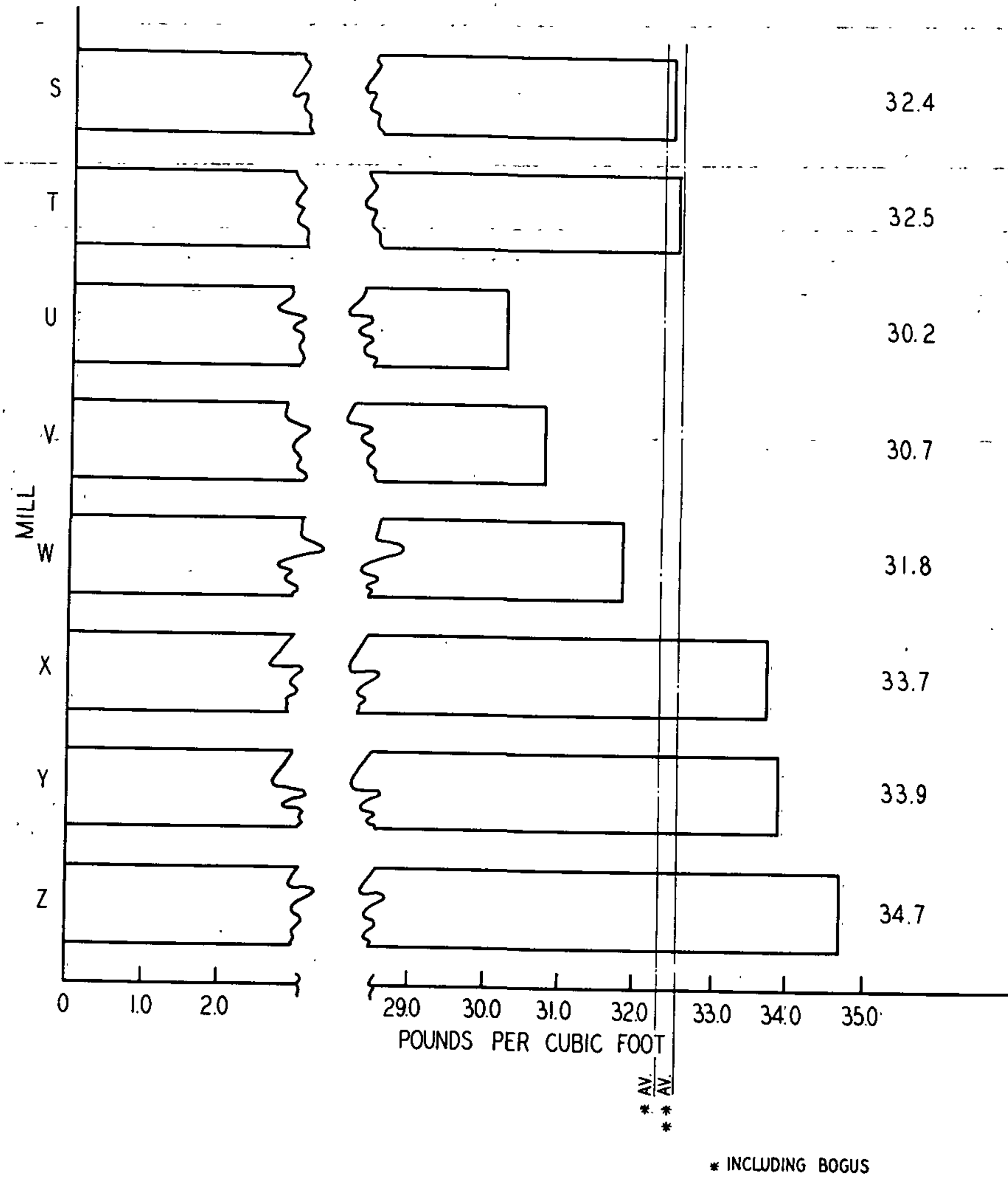

FIGURE 18. Comparison of the average apparent density of .009/26-lb. corrugating medium among mills.

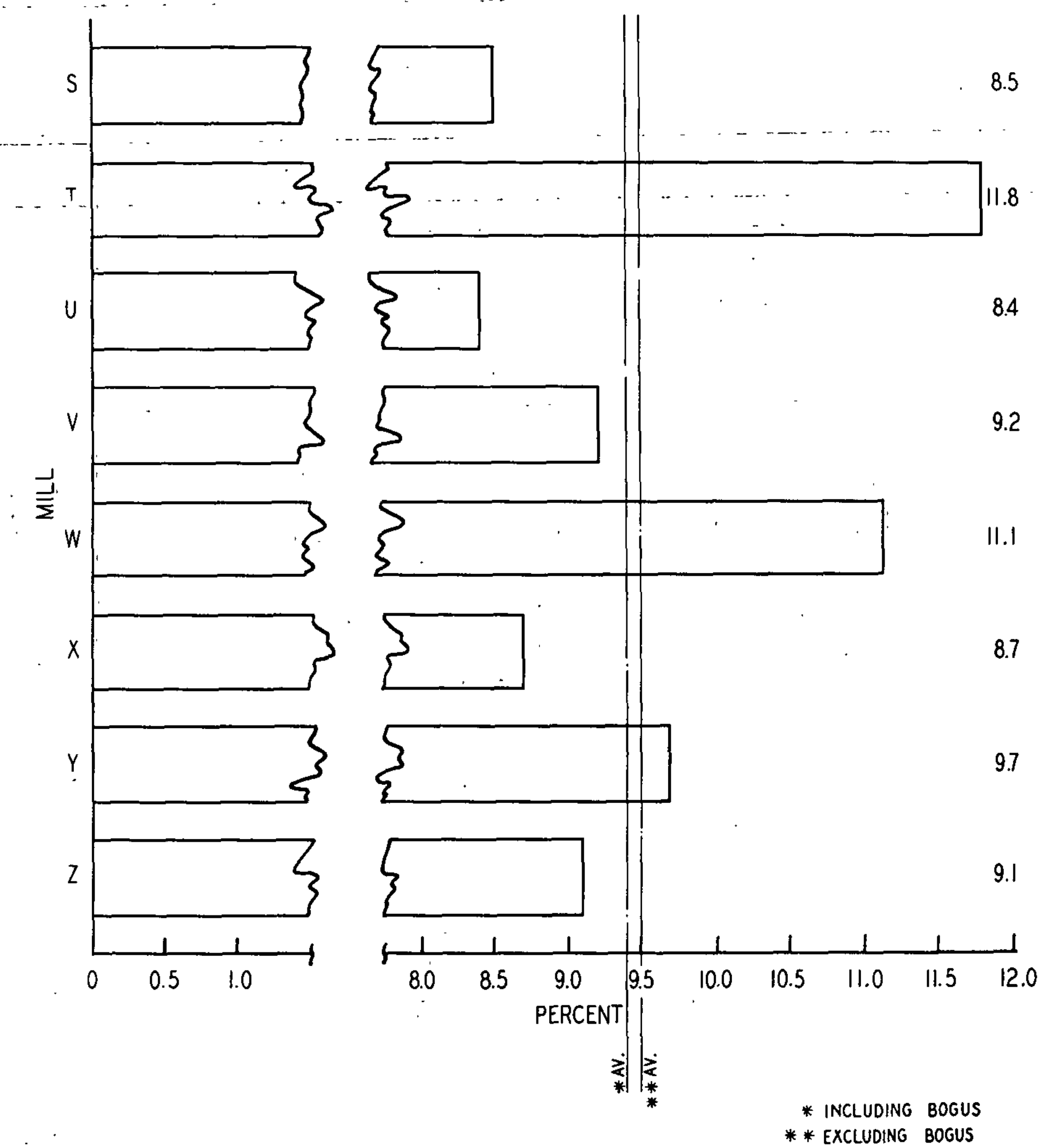

FIGURE 19. Comparison of the average moisture content of .009/26-lb. corrugating medium among mills.

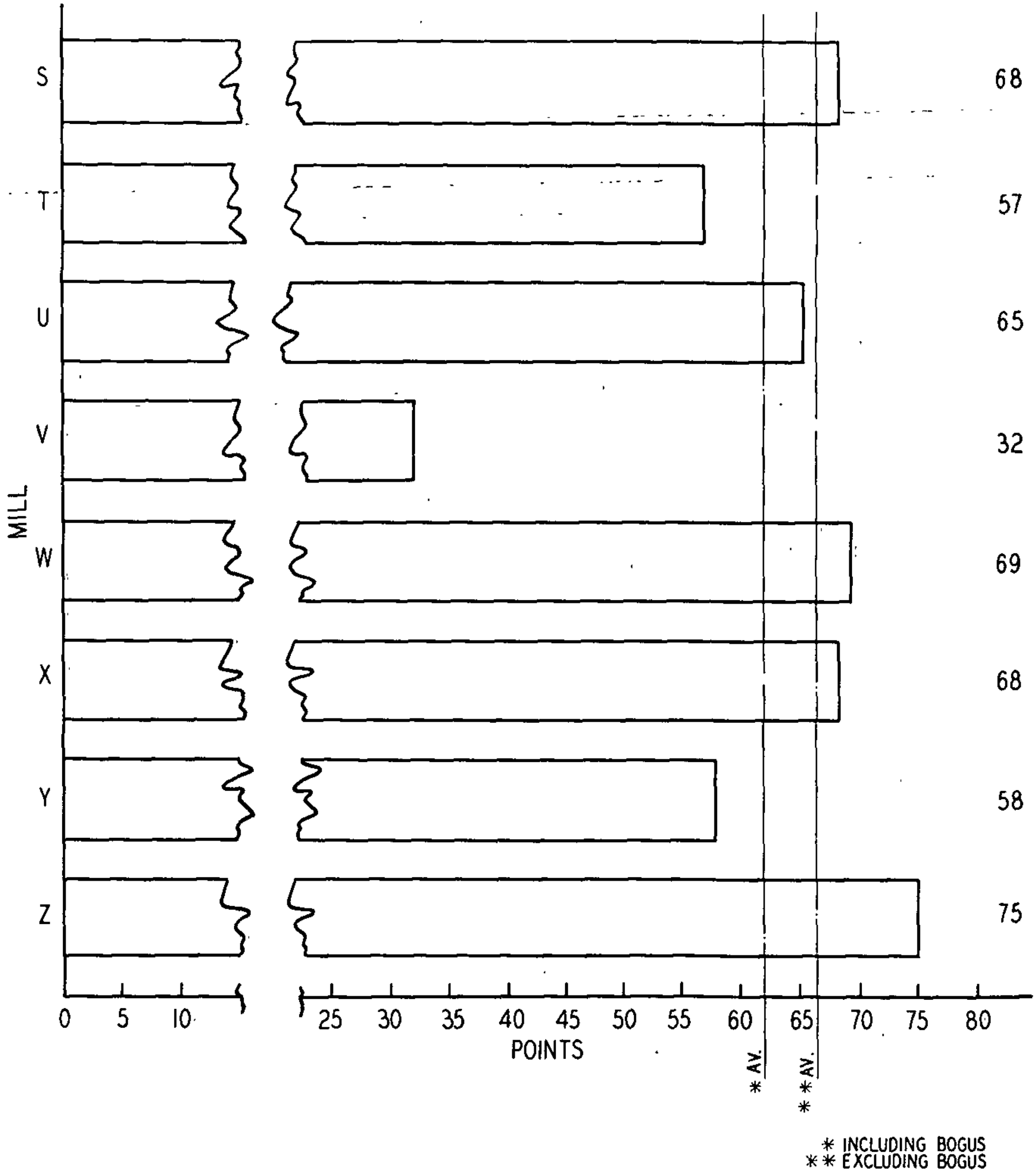

FIGURE 20. Comparison of the average bursting strength of .009/26-lb. corrugating medium among mills.

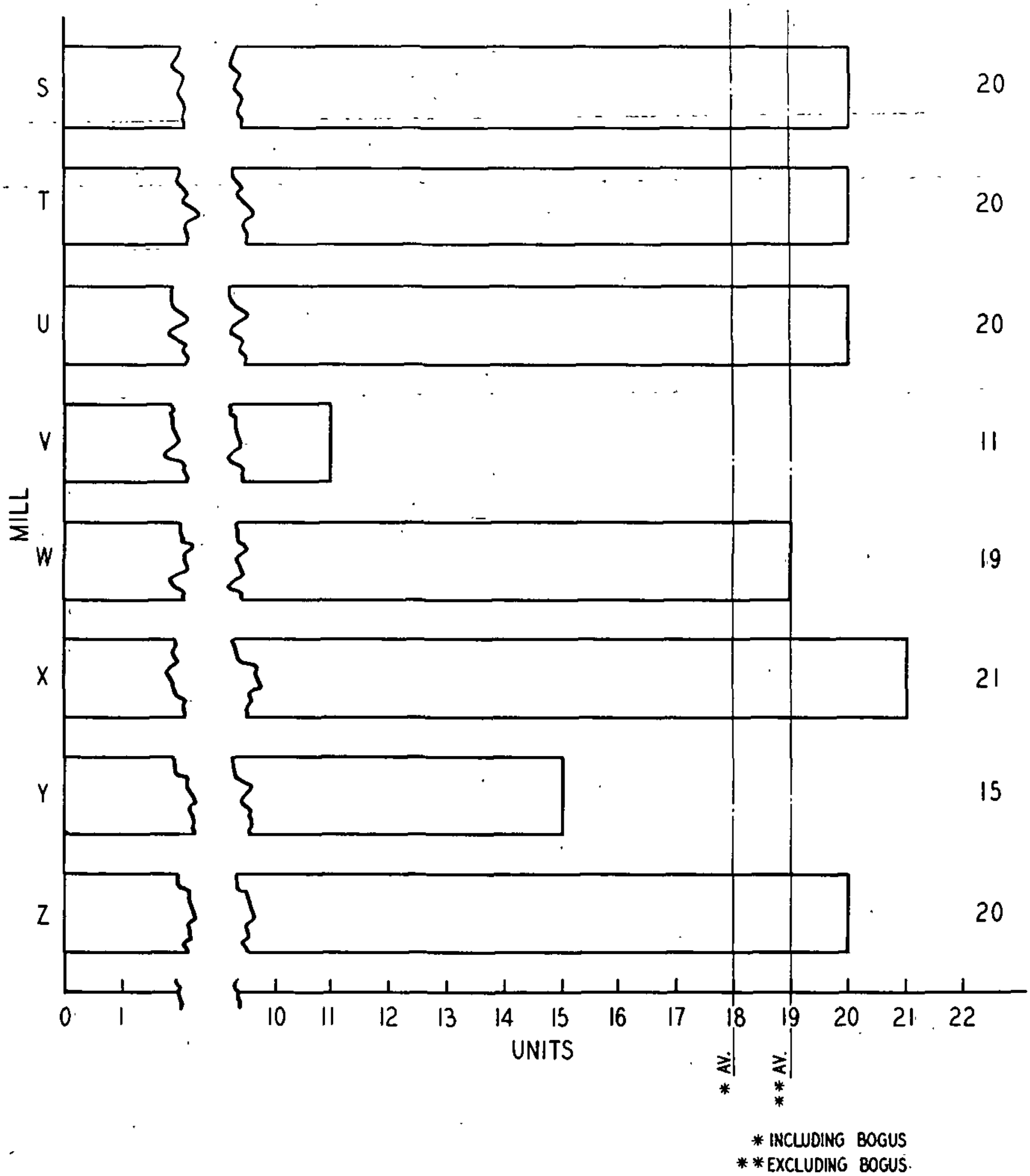

FIGURE 21. Comparison of the average General Electric puncture test of .009/26-lb. corrugating medium among mills.

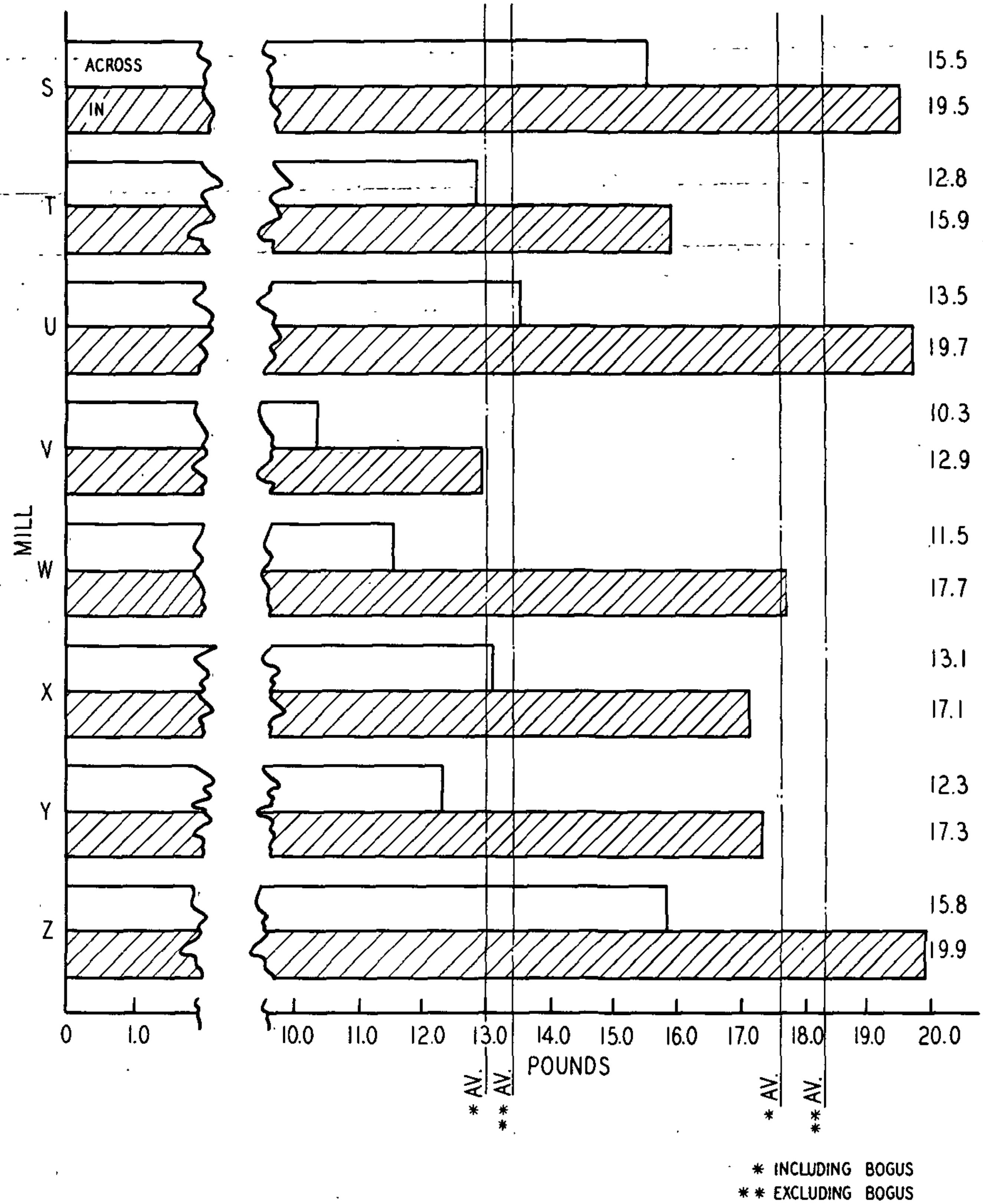

FIGURE 22. Comparison of the average Riehle compression test of .009/26-lb. corrugating medium among mills.

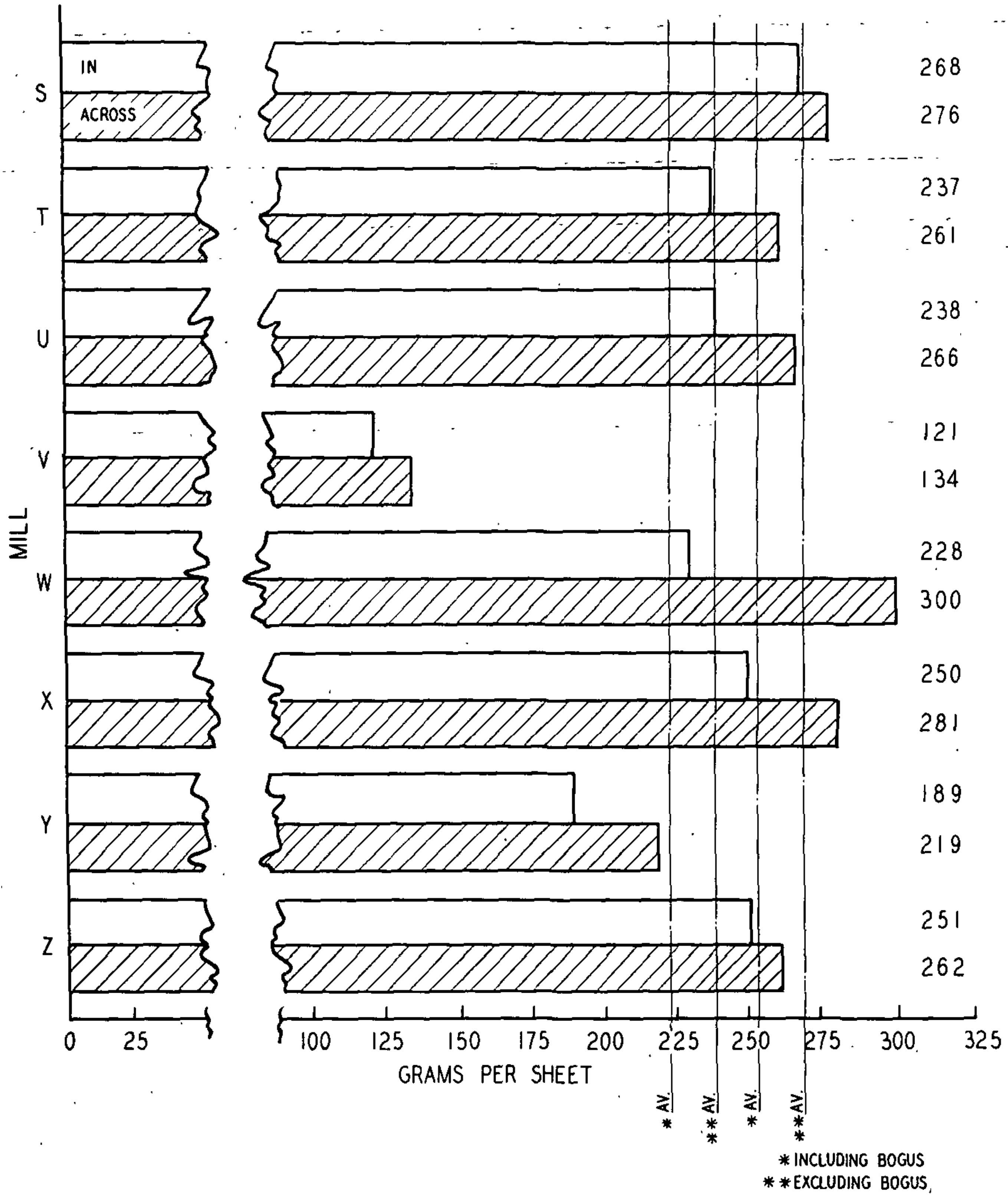

FIGURE 23. Comparison of the average Elmendorf tear of .009/26-lb. corrugating medium among mills.

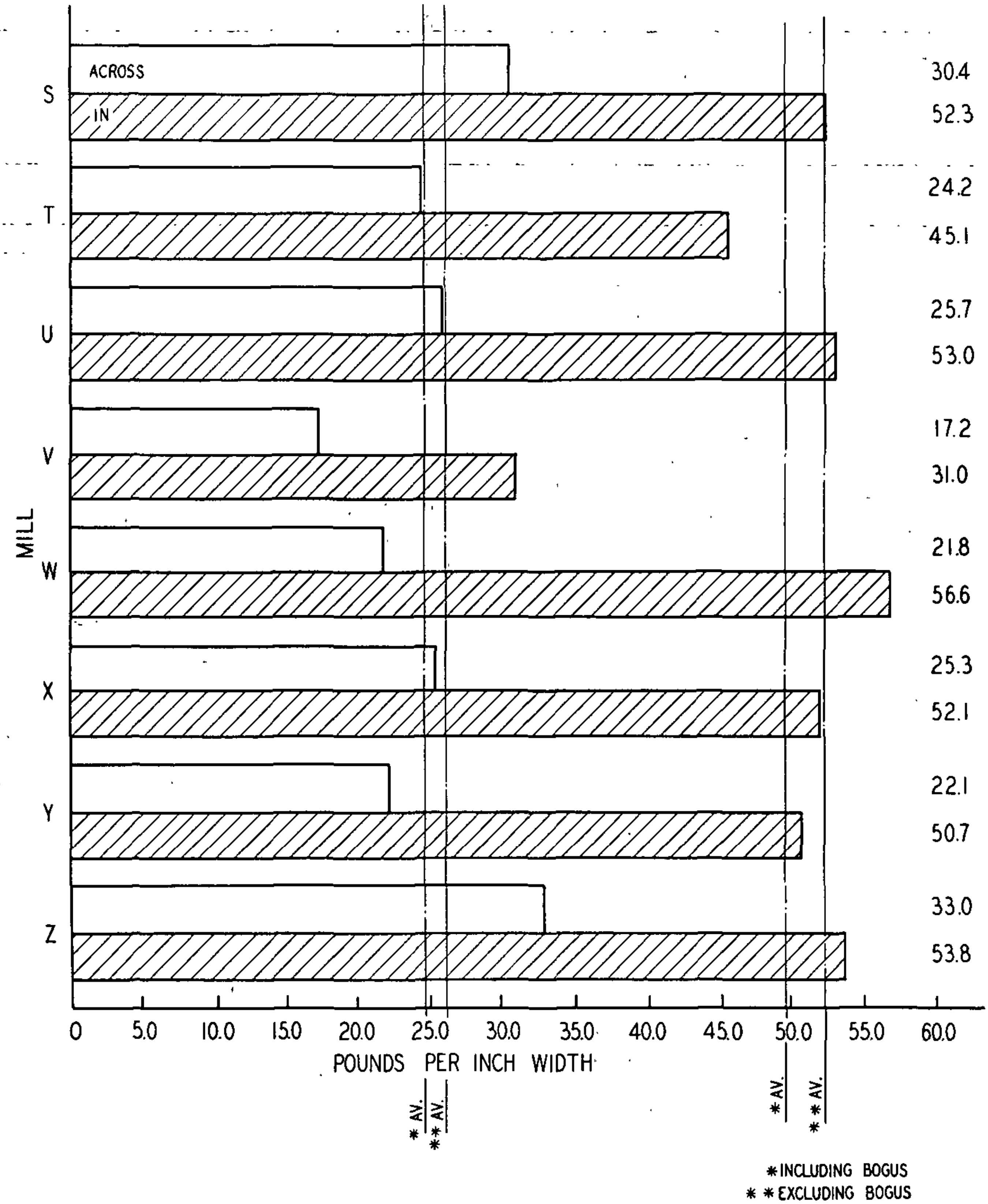

FIGURE 24. Comparison of the average Amthor tensile strength of .009/26-lb. corrugating medium among mills.

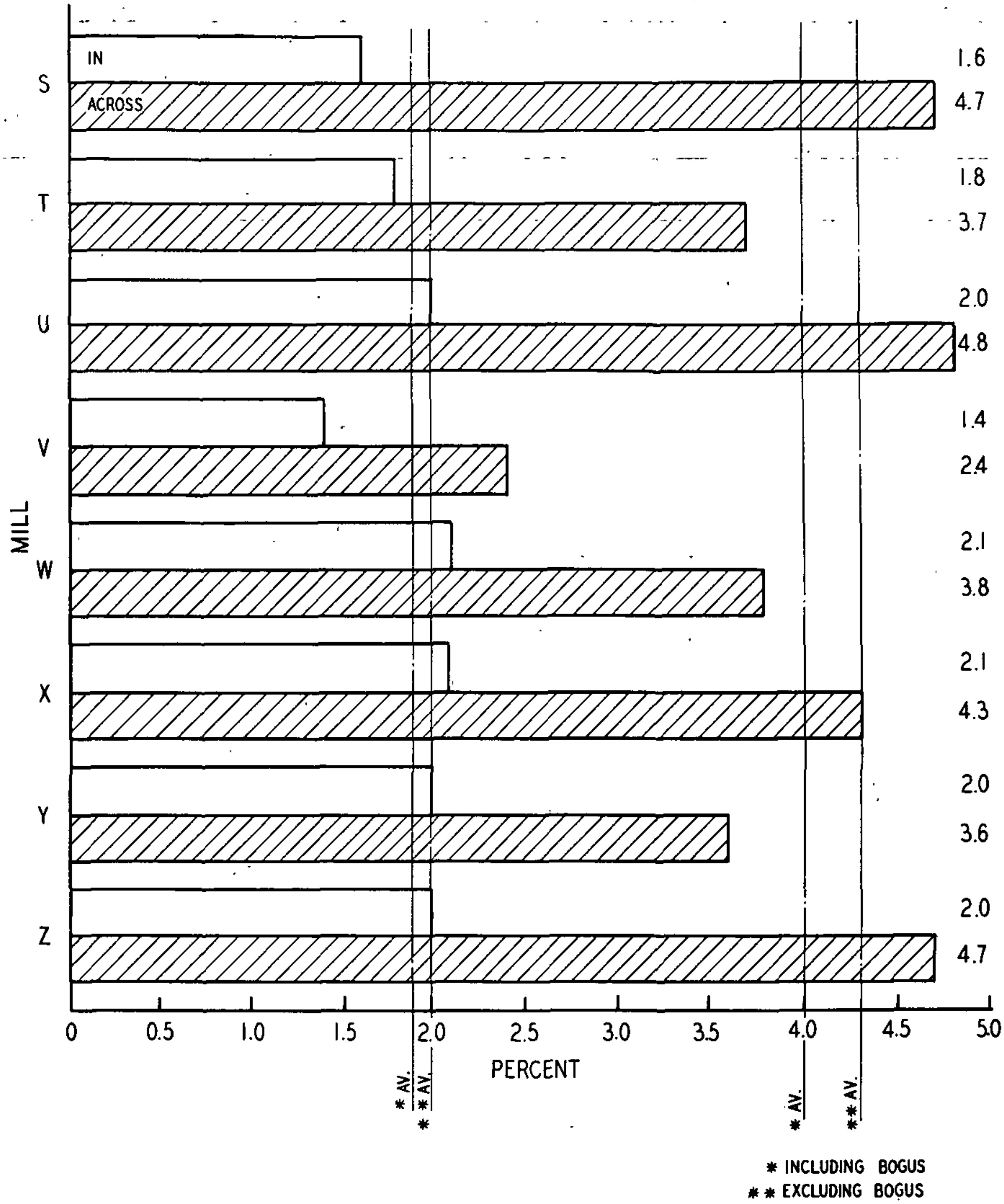

FIGURE 25. Comparison of the average Amthor stretch of .009/26-lb. corrugating medium among mills.

The mill averages obtained for the G. E. puncture test are graphed in Figure 21. Because the magnitude of these results was so low that all the values fell on the extreme lower range of the indicating scale for the tester, it is doubtful if much significance can be attached to them at this time.

The average Riehle compression test results are shown graphically in Figure 22. The group average was 17.6 pounds in the in-machine direction and 13.0 pounds for the across-machine direction when the bogus was included but were 18.3 and 13.4 pounds, respectively, when the bogus medium was not included. The highest mill average was obtained for Mill Z and the lowest for Mill V (the bogus medium). The across-machine direction group average, excluding the bogus medium, was approximately 3.7% greater than the in-machine direction average for the bogus medium. The ratio of the across-machine direction values to the in-machine direction values was, on the average, of the order of 3:4.

The results of the Elmendorf tear test are graphically presented in Figure 23. The group averages for each direction were 223 and 251 grams per sheet, respectively, when the bogus medium was included, and 238 and 268 grams per sheet, respectively, when the bogus medium was excluded. The highest average tear value in the in-machine direction was obtained for Mill S but Mill W had the highest average tear in the across-machine direction. Mill V had the lowest mill average tear values in both directions. The ratio of the in-machine direction values to the across-machine direction values was, in general, of the order of 0.9:1.

The results of the Amthor tensile test are shown graphically in Figure 24. The group averages obtained (including the bogus medium) were 49.5 and 24.8 pounds per inch width for the in-machine direction and the across-machine direction, respectively, and 52.2 and 25.9 pounds per inch width, respectively, when the bogus medium was excluded. The results indicate that Mill W had the highest average tensile value in the in-machine direction and Mill Z the highest across-machine tensile average, whereas Mill V had the lowest average tensile strength for both directions. The average ratio of across-machine direction to in-machine direction was of the order of 1:2.

The Amthor stretch results are presented graphically in Figure 25. The group averages for the in-machine and across-machine direction stretch were 1.9 and 4.0%, respectively, when the bogus medium was included, and 2.0 and 4.3%, respectively, when the bogus medium was excluded. Mill V had the lowest average stretch in both directions tested. The average ratio of the in-machine direction stretch to the across-machine direction was of the order of 1:2.

A comparison of all the strength test results indicates that the averages for Mill Z were the highest and those for Mill V the lowest of the group.

The standard deviations of the physical characteristics of the corrugating medium made by each mill may be seen in Table XXXVI. The results indicate that the corrugating medium of Mill S had a lower composite average standard deviation for all the tests performed than those of the other mills. It would appear, therefore, that the corrugating medium of Mill S was more uniform than the products of the other mills on the basis of this evaluation. A comparison of the group average percentage standard deviations for the various test characteristics indicates that basis weight and caliper were the least variant and Amthor stretch the most variant of all the test characteristics studied.

The average test results tabulated in Table XXXV were treated statistically to determine if there was any significant difference between the average physical characteristics obtained for a given mill and the group average physical characteristics obtained for the balance of the mills participating. Whether or not a significant difference exists in a given test characteristic between two mills or groups of mills is denoted by the magnitude (see page 24) of the ratio of the difference of the means of each mill or group to the standard error of the difference between the same two mills or groups. In this work it has been assumed that all ratios of 2 or more indicated significant differences.

TABLE XXXVI

COMPARISON OF STANDARD DEVIATIONS BETWEEN MILLS

CORRUGATING MEDIUM

Mill	Basis Weight, lb.	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
S	0.328	0.301	2 91	0.843	0.783	0.810	14.8	11 9	2.92	1.70	0.103	0 276
T	1.350	0.827	6.89	1.62	1.34	0.932	28.6	30.7	4.21	2.23	0.155	0 536
U	0.903	0.645	5.18	1.46	1.76	0.974	18.6	17.5	4.34	3.57	0.281	0.447
V	0.889	0.341	3.64	1.45	1.17	1.01	18.7	18.7	3.70	2.72	0.224	0.249
W	0.910	0.692	4.54	1.17	1.62	0.740	15.2	17.7	3.69	0.872	0.350	0.440
X	0.881	0.507	3.14	1.78	1.25	0.941	22.9	24.8	4.88	2.61	0.133	0.851
Y	0.746	0.474	11.0	2.10	2.80	1.61	20.8	25.9	4.90	2.83	0.157	0.488
Z	0.522	0.366	5.21	1.03	1.59	1.22	17.1	24.6	3.86	2.65	0.155	0.659
Average	0.816	0.519	5.31	1.43	1.54	1.03	19.6	21.5	4.06	2.40	0.195	0.493
Average standard deviation, %	3.0	5.2	8.6	7.9	8 8	7.9	8.8	8.6	8.2	9.7	10.3	12.3

The application of this treatment to a comparison of the average results obtained for Mill S with the averages obtained for the group T to Z, inclusive, may be seen in Table XXXVII. The results obtained indicate that, when the average test values of Mill S are compared with the group average of Mills T to Z, there is a significant difference in all the test values obtained, except for the Amthor tensile in the across-machine direction. With the exception of Amthor stretch in the in-machine direction, all the average test values exhibiting significant differences were of a greater magnitude than the corresponding group values. Thus, the quality for Mill S, as determined by these tests, was significantly greater than the average quality for the group.

The results obtained when the averages for Mill T are compared with the average of the balance of the group may be seen in Table XXXVIII. The results indicate that there was a significant difference in all the test values except basis weight, caliper, Elmendorf tear, Amthor tensile in the across-machine direction, and Riehle compression in the across-machine direction. With the exception of the average G. E. puncture value, all the test values having significant differences for Mill T were of a lower magnitude than the corresponding values for the balance of the group.

A comparison of the average values obtained for Mill U with the group average excluding U is presented in Table XXXIX. The results indicate that there was a significant difference in all the test values except those for basis weight and Riehle compression and Amthor tensile tests in the across-machine direction. All the test values in which a significant difference existed were of a greater magnitude than the corresponding group average values.

The results of the comparison of the average test results obtained for Mill V with the average test results obtained for the remainder of the group participating are given in Table XL. It may be observed that the caliper value was the only test characteristic for which a significant difference was not indicated between it and the corresponding group characteristic. All the test values for Mill V in which a significant difference was indicated were of a lower magnitude than the corresponding test values for the group.

The results of the comparison of the average test results obtained for Mill W with the average test results obtained for the balance of the group are shown in Table XLI. Significant differences existed in all the test results except basis weight, caliper, Riehle compression and Elmendorf tear in the in-machine direction, and Amthor stretch in the across-machine direction.

The results obtained when the average test values for Mill X were compared with the average values of the balance of the group are presented in Table XLII. The only test values in which a significant difference did not exist were caliper, Amthor tensile and stretch in the across-machine direction, and Riehle compression. Similarly, all the significant values for Mill X were greater than the average values obtained for the group.

The average test values obtained for Mill Y, and the average test results obtained for the balance of the group are given in Table XLIII. The test values in which no significant difference was indicated are bursting strength, Riehle compression in both directions, and Amthor tensile in the in-machine direction. With the exception of Amthor stretch in the in-machine direction all the significant test values obtained for Mill Y were of a lower magnitude than the corresponding test values for the group.

The average test values for Mill Z and the average values for the balance of the group are given in Table XLIV. The results indicate that a significant difference exists for all the test values except for basis weight and for Elmendorf tear in the across-machine direction. With the exception of caliper, all the test values for Mill Z in which a significant difference exists were of a greater magnitude than the corresponding group values.

DISCUSSION OF INDIVIDUAL MILL TEST RESULTS FOR .009/26-LB. CORRUGATING MEDIUMS

Mill S

The average results of the various physical tests conducted on samples of .009/26-lb. kraft corrugating medium made by Mill S are shown in Table XLV (*see also* Table LXXI of the Appendix). It may be observed that the average basis weight was higher than the specified grade weight. The average caliper was 0.0101 inch and the average apparent density was 32.4 pounds per cubic foot. The average bursting strength was 68 points. The average Riehle compression was 19.5 and 15.5 for the in- and across-machine directions, respectively. The average moisture content was 8.5% on an ovendry basis.

Table XLVI gives the standard deviations and the probable variation to be expected in the rolls of .009/26-lb. corrugating medium made by Mill S. These results show that the chance probability or uniformity for Mill S as regards basis weight is such that approximately 87% of the corrugating rolls should fall within a range limit of ±0.5 pound (26.8 to 27.8 pounds) and practically all the rolls should fall within a range limit of ±1.0 pound (26.3 to 28.3 pounds). The standard deviation of the caliper results indicates that the greater portion of the rolls should fall within a range limit of ±0.001 inch (0.0091 to 0.0111 inch). The uniformity of the bursting strength indicates that 61% of the rolls should fall within a range limit of ±2.5 points (65.5 to 70.5 points), 91% within the range limit of ±5.0 points (63 to 73 points), and practically all the rolls within the range limit of ±7.5 points (60.5 to 75.5 points). The standard deviation for the Riehle compression is such that it should be expected that approximately 80% of the rolls should fall within a

TABLE XXXVII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL S WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of S	27.3	10.1	68	20	19.5	15.5	268	276	52.3	30.4	1.6	4.7
Mean of α	26.7	9.9	61	18	17.2	12.7	216	246	48.9	24.2	1.9	3.9
Difference of mean ($S-\alpha$)	+0.63	+0.24	+7.8	+2.5	+2.25	+2.74	+51.9	+30.0	+3.40	+6.17	−0.29	+0.86
Standard error of difference	0.143	0.114	1.15	0.315	0.312	0.283	5.19	4.55	1.03	0.604	0.0398	0.105
Ratio: $(S-\alpha)/SE_D$	+4.4	+2.1	+6.8	+7.9	+7.2	+9.7	+10.0	+6.6	+3.3	+1.0	−7.3	+8.2
Significant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

NOTE. All mean values have been reported to the same precision as individual test values. It will be observed that some of the intermediate values in the above table have been reported to more places than the mean values. Similarly the difference of the means will not always correspond to the difference between reported means, because these values have been rounded off. The mean of α is the mean for the balance of the group.

TABLE XXXVIII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL T WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of T	27.0	10.0	57	20	15.9	12.8	237	261	45.1	24.2	1.8	3.7
Mean of α	26.7	9.9	62	18	17.7	13.1	221	248	49.9	25.1	1.9	4.0
Difference of mean ($T-\alpha$)	+0.31	+0.09	−5.0	+1.8	−1.81	−0.33	+16.1	+12.6	−4.79	−0.84	−0.11	−0.38
Standard error of difference	0.433	0.266	2.27	0.535	0.462	0.318	9.26	9.96	1.40	0.753	0.0538	0.178
Ratio: $(T-\alpha)/SE_D$	+0.7	+0.3	−2.2	+3.4	−3.9	−1.0	+1.7	+1.3	−3.4	−1.1	−2.0	−2.1
Significant	No	No	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes

NOTE. *See* Note to Table XXXVII.

TABLE XXXIX

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL U WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of U	26.9	10.7	65	20	19.7	13.5	238	266	53.0	25.7	2.0	4.8
Mean of α	26.7	9.8	61	18	17.2	13.0	221	247	48.8	24.8	1.9	3.9
Difference of mean ($U-\alpha$)	+0.16	+0.91	+4.0	+1.9	+2.47	+0.47	+17.5	+18.6	+4.16	+0.87	+0.13	+0.92
Standard error of difference	0.219	0.153	1.33	0.359	0.426	0.245	4.66	4.61	1.05	0.821	0.0650	0.114
Ratio: $(U-\alpha)/SE_D$	+0.7	+5.9	+3.0	+5.3	+5.8	+1.9	+3.8	+4.0	+4.0	+1.1	+2.0	+8.1
Significant	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes

NOTE: *See* Note to Table XXXVII.

TABLE XL

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL V WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of V	25.8	10.1	32	11	12.9	10.3	121	134	31.0	17.2	1.4	2.4
Mean of α	26.9	9.9	66	19	18.2	13.5	237	266	51.9	26.1	1.9	4.2
Difference of mean $(V-\alpha)$	−1.11	+0.20	−33.4	−7.8	−5.20	−3.21	−116.6	−132.3	−20.92	−8.90	−0.52	−1.84
Standard error of Difference	0.264	0.113	1.23	0.433	0.373	0.305	5.65	5.78	1.12	0.799	0.0658	0.091
Ratio: $(V-\alpha)/SE_D$	−4.2	+1.8	−27.2	−18.0	−13.9	−10.5	−20.6	−22.9	−18.7	−11.1	−7.9	−2.0
Significant	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTE. *See* Note to Table XXXVII.

TABLE XLI

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL W WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of W	26.8	10.1	69	19	17.7	11.5	228	300	56.6	21.8	2.1	3.8
Mean of α	26.7	9.9	61	18	17.5	13.3	222	243	48.3	25.4	1.8	4.0
Difference of mean $(W-\alpha)$	+0.08	+0.17	+8.0	+1.1	+0.17	−1.79	+5.7	+57.3	+8.31	−3.57	+0.25	−0.24
Standard error of difference	0.269	0.200	1.43	0.364	0.484	0.239	4.79	5.52	1.12	0.371	0.0988	0.135
Ratio: $(W-\alpha)/SE_D$	+0.3	+0.8	+5.6	+3.0	+0.4	−7.5	+1.2	+10.4	+7.4	−9.6	+2.5	−1.8
Significance	No	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No

NOTE. *See* Note to Table XXXVII.

TABLE XLII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL X WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Mean of X	27.4	9.8	68	21	17.1	13.1	250	281	52.1	25.3	2.1	4.3
Mean of α	26.7	9.9	61	18	17.6	13.1	219	245	48.9	24.9	1.9	4.0
Difference of mean $(X-\alpha)$	+0.74	−0.13	+7.2	+2.7	−0.41	+0.02	+31.2	+35.6	+3.19	+0.36	+0.22	+0.31
Standard error of difference	0.254	0.148	1.09	0.502	0.383	0.279	6.50	7.07	1.37	0.746	0.0421	0.233
Ratio: $(X-\alpha)/SE_D$	+2.9	−0.9	+6.6	+5.4	−1.1	+0.1	+4.8	+5.0	+2.3	+0.5	+5.2	+1.3
Significant	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No

NOTE. *See* Note to Table XXXVII.

TABLE XLIII

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL Y WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of Y	26.0	9.3	58	15	17.3	12.3	189	219	50.7	22.1	2.0	3.6
Mean of α	26.8	10 0	62	19	17.5	13 2	228	254	49.1	25.4	1.9	4.0
Difference of mean ($Y-\alpha$)	0.82	−0 75	−4.3	−3 9	−0.23	−0.95	−38.6	−35 3	+1.54	−3.27	+0.18	−0.44
Standard error of difference	0.254	0.161	3 52	0.679	0.897	0.520	6.91	8.53	1.61	0.929	0.0543	0 164
Ratio: $(Y-\alpha)/SE_D$	−3.2	−4.7	−1.2	−5.7	−0 3	−1.8	−5.6	−4.1	+1.0	−3.5	+3.3	−2.7
Significant	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes

NOTE. *See* Note to Table XXXVII.

TABLE XLIV

COMPARISON OF THE PHYSICAL CHARACTERISTICS OF MILL Z WITH THE BALANCE OF THE GROUP

CORRUGATING MEDIUM

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Mean of Z	26.8	9 3	75	20	19.9	15.8	251	262	53.8	33.0	2.0	4.7
Mean of α	26.8	10 0	60	18	17.2	12.7	219	248	48.7	23.8	1.9	3.9
Difference of mean ($Z-\alpha$)	−0.03	−0.73	+15.7	+1.6	+2.79	+3.05	+32.7	+13.5	+5.11	+9.18	+0.14	+0.81
Standard error of difference	0.185	0.126	1.71	0.352	0.512	0.386	5.61	7.80	1.25	0.841	0.0517	0.206
Ratio: $(Z-\alpha)/SE_D$	−0.0	−5.8	+9.2	+4.5	+5.4	+7.9	+5.8	+1.7	+4.1	+10.9	+2.7	+3.9
Significance	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

NOTE. *See* Note to Table XXXVII.

range limit, in both directions, of ±1.0 pound and approximately 94% within a range limit of ±1.5 pounds. The uniformity with respect to G. E. puncture, Elmendorf tear, Amthor tensile and stretch may also be seen in Table XLVI. Naturally, as the arbitrarily selected limits increase, the greater is the portion of rolls falling within that range. The ranges used are purely arbitrary and are not intended as an attempt to specify acceptable limits of uniformity. The moisture content was not treated statistically because it was felt that secondary effects, such as warehouse storage conditions, might cause too great an effect to permit the legitimate application of statistics.

MILL T

The average test results obtained for the kraft corrugating medium made by Mill T are shown in Table XLVII (*see also* Table LXXII of the Appendix). The average basis weight obtained was 1 pound higher than the specified weight. The average caliper was 0.010 inch and the average apparent density was 32.5 pounds per cubic foot. The average bursting strength value was 57 points. The average Riehle compression values were 15.9 and 12.8 pounds for the in- and across-machine directions, respectively. The average moisture content was 11.8% on an ovendry basis.

The statistical evaluation of these test results may be seen in Table XLVIII. For basis weight, the standard deviation was 1.35, indicating that 29% of the rolls made by Mill T should fall within a range limit of ±0.5 pound (26.5 to 27.5 pounds), 54% within a range limit of ±1.0 pound (26.0 to 27.0 pounds), and approximately 86% within a range limit of ±2.0 pounds (25.0 to 29.0 pounds). The standard deviation for caliper was 0.827; thus, approximately 77% of the rolls of corrugating medium made by Mill T might be expected to fall within a range limit of ±0.001 inch (0.009 to 0.011 inch) and approximately 98% within a

TABLE XLV

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL S

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	2-7-45	27.5	9.6	34.4	3.4	72	21	19.5	14.8	250	268	56.8	27.9	1.7	4.6
2	2-7-45	27.8	9.9	33.7	6.2	66	20	21.2	15.6	253	270	57.2	28.9	1.8	5.1
3	2-7-45	27.6	9.7	34.1	6.4	64	20	19.7	14.3	250	269	53.9	28.5	1.7	5.1
4	2-6-45	27.1	10.5	31.0	11.5	71	21	19.7	14.4	281	269	49.7	30.1	1.6	4.8
5	2-6-45	27.3	10.3	31.8	9.6	69	21	19.8	15.2	288	282	50.0	29.5	1.5	4.6
6	2-6-45	27.1	10.1	32.2	9.8	71	21	18.5	15.9	265	286	51.6	30.7	1.6	4.8
7	2-6-45	27.0	10.3	31.5	12.3	64	21	19.0	15.6	279	300	49.6	31.6	1.6	4.8
8	2-6-45	27.2	10.4	31.4	11.9	70	19	19.4	16.0	287	285	49.2	31.0	1.5	4.9
9	8-9-44	27.7	10.3	32.3	4.9	69	21	19.4	16.7	265	269	52.2	33.4	1.5	4.2
10	8-9-44	26.8	10.1	31.8	8.5	67	19	18.4	16.4	263	261	52.8	31.9	1.7	4.5
Average		27.3	10.1	32.4	8.5	68	20	19.5	15.5	268	276	52.3	30.4	1.6	4.7

TABLE XLVI

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL S

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	27.8	10.5	72	21	21.2	16.7	288	300	57.2	33.4	1.8	5.1
Minimum	26.8	9.6	64	19	18.4	14.3	250	261	49.2	28.5	1.5	4.2
Average	27.3	10.1	68	20	19.4	15.5	268	276	52.3	30.4	1.6	4.7
Standard deviation	0.328	0.301	2.91	0.843	0.783	0.810	14.8	11.9	2.92	1.70	0.103	0.276
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	87	99	61	77	80	78	39	48	39	44	67	53
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	99	100	91	93	94	94	69	79	70	76	95	85
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	100	—	99	99	99	99	96	99	91	92	100	97

* Range limits were arbitrarily selected.

TABLE XLVII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL T

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	5- 1-45	29.5	11.2	31.6	10.8	47	22	14.2	11.6	293	326	39.0	21.4	1.7	3.2
2	5- 1-45	29.5	11.8	30.0	12.5	43	23	13.7	11.2	284	304	37.1	19.2	1.6	2.6
3	5- 2-45	25.9	9.5	32.7	13.3	61	20	18.1	13.8	225	231	46.0	24.9	1.5	3.9
4	5- 2-45	26.6	9.5	33.6	12.9	63	20	16.9	12.2	224	238	48.7	25.6	1.7	3.8
5	5- 2-45	26.6	9.8	32.6	12.5	59	19	16.7	12.6	226	266	45.9	24.7	2.0	4.0
6	5- 2-45	26.4	9.7	32.7	12.6	63	19	15.5	13.0	211	248	47.7	26.7	1.9	3.0
7	3-31-45	27.1	9.9	32.8	10.8	55	18	17.1	13.6	242	259	42.5	25.2	1.8	4.0
8	5- 2-45	26.4	9.3	34.1	11.4	62	19	15.3	14.1	229	244	49.4	25.0	1.9	4.1
9	5- 2-45	25.9	9.7	32.0	10.9	58	20	15.9	12.9	214	246	48.0	24.1	1.9	3.8
10	5- 2-45	26.4	9.5	33.3	10.7	60	18	15.8	13.0	220	245	47.0	25.3	1.8	4.2
Average		27.0	10.0	32.5	11.8	57	20	15.9	12.8	237	261	45.1	24.2	1.8	3.7

TABLE XLVIII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL T

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	29.5	11.8	63	23	18.1	14.1	293	326	49.4	26.7	2.0	4.2
Minimum	25.9	9.3	43	18	13.7	11.2	211	231	37.1	19.2	1.5	2.6
Average	27.0	10.0	57	20	15.9	12.8	237	261	45.1	24.2	1.8	3.7
Standard deviation	1.35	0.827	6.89	1.62	1.34	0.932	28.6	30.7	4.21	2.23	0.155	0.536
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	29	77	28	46	55	72	21	19	28	35	48	29
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	54	98	53	65	74	89	40	38	52	63	80	55
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	86	—	72	94	98	100	71	67	79	82	95	74

* Range limits were arbitrarily selected

TABLE XLIX

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill U

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	1-30-45	26.3	10.7	29.5	11.6	74	21	16.8	12.9	264	291	51.7	28.5	2.5	4.8
2	1-30-45	25.0	9.7	30.9	11.3	70	18	16.6	13.0	225	239	48.1	29.6	2.4	5.2
3	10- 2-44	26.9	11.4	28.3	8.7	62	20	19.9	13.2	224	272	52.0	21.0	2.0	5.1
4	11-23-44	26.9	9.9	32.6	9.0	63	22	20.1	14.9	276	280	47.8	28.8	1.6	4.0
5	11-23-44	27.4	10.0	32.9	8.3	61	22	18.6	14.5	264	268	48.5	29.1	1.6	4.2
6	10- 2-44	27.2	11.5	28.4	9.7	64	21	21.5	13.1	239	277	54.1	20.7	1.9	5.0
7	11-23-44	26.2	9.4	33.4	9.1	59	19	21.6	14.3	241	254	45.3	29.5	1.6	4.6
8	12-11-44	26.0	10.1	30.9	8.8	65	19	19.3	13.2	223	246	55.4	24.1	2.1	5.1
9	12-11-44	27.2	10.7	30.5	7.7	68	20	23.4	14.2	226	275	57.7	25.0	1.9	5.0
10	12-11-44	27.1	10.4	31.3	9.4	68	19	22.0	14.0	221	258	54.6	24.2	2.0	5.1
11	10-16-44	27.6	11.2	29.6	8.3	70	19	20.9	14.9	238	255	54.4	26.3	2.2	4.9
12	11- 1-44	28.5	11.6	29.5	9.5	66	21	21.1	13.9	256	295	58.0	23.3	1.5	4.3
13	11- 1-44	25.1	10.5	28.7	6.3	59	17	19.4	13.5	209	238	49.6	22.6	2.1	4.9
14	11- 1-44	27.8	10.9	30.6	6.7	61	20	20.5	15.0	229	283	57.7	24.1	1.9	5.0
15	11- 1-44	28.1	11.0	30.6	5.8	67	21	19.1	13.2	244	271	56.5	26.6	2.0	4.1
16	3-18-45	26.8	10.4	30.9	7.4	64	20	18.2	14.4	256	243	44.2	35.7	2.5	5.8
17	11- 1-44	27.6	11.0	30.1	8.7	59	22	18.8	11.8	239	272	55.3	24.3	1.9	5.2
18	11- 6-44	26.1	10.3	30.4	7.6	54	19	18.1	12.1	220	259	51.1	21.7	2.2	5.0
19	9-20-44	26.3	10.9	28.9	5.5	74	17	20.8	12.9	210	243	59.4	26.7	2.1	4.3
20	10- 4-44	27.5	11.6	28.4	7.7	68	20	17.8	11.9	236	280	55.2	23.9	2.0	4.4
21	10- 4-44	27.3	11.4	28.7	8.7	69	20	18.4	12.7	248	284	55.6	24.3	1.8	4.6
Average		26.9	10.7	30.2	8.4	65	20	19.7	13.5	238	266	53.0	25.7	2.0	4.8

TABLE L

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill U

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	28.5	11.6	74	22	23.4	15.0	276	295	59.4	35.7	2.5	5.8
Minimum	25.0	9.4	54	17	16.6	11.8	209	238	44.2	20.7	1.5	4.0
Average	26.9	10.7	65	20	19.7	13.5	238	266	53.0	25.7	2.0	4.8
Standard deviation	0.903	0.645	5.18	1.46	1.76	0.974	18.6	17.5	4.34	3.57	0.281	0.447
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	42	88	37	50	43	70	31	33	27	22	28	35
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	73	99	66	70	60	88	58	61	51	42	52	63
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	97	—	83	96	91	99	89	91	75	60	72	82

* Range limits were arbitrarily selected.

range limit of ± 0.002 inch (0.008 to 0.012 inch). The uniformity of the bursting strength, as denoted by the standard deviation, indicates that only 28% of the rolls should fall within a range limit of ± 2.5 points (54.5 to 59.5 points), 53% within a range limit of ± 5.0 points (52.0 to 62.0 points), and 72% within a range limit of ± 7.5 points (49.5 to 64.5 points). The standard deviations for the Riehle compression test indicate that 55% of the rolls should fall within a range limit of ± 1.0 pound in the in-machine direction, and 72% in the corresponding range limit for the across-machine direction. Practically all of the rolls should fall within a range limit of ± 3.0 pounds for both directions. In general, the standard deviation for G. E. puncture, Elmendorf tear, and Amthor tensile and stretch are of such magnitude as to indicate considerable nonuniformity.

MILL U

The average test results obtained for kraft corrugating medium manufactured by Mill U are presented in Table XLIX (*see also* Table LXXIII of the Appendix). The statistical evaluation of these results is given in Table L. The average basis weight for Mill U was 26.9 pounds, the average caliper was 0.0107 inch, and the average apparent density was 30.2 pounds per cubic foot. The average bursting strength and G. E. puncture were 65 points and 20 units, respectively. The average Riehle compression values for the in- and across-machine directions were 19.7 and 13.5 pounds, respectively. The average moisture content was 8.4% on an ovendry basis.

Inasmuch as the standard deviation for basis weight was 0.903, it is to be expected that only 42% of the rolls would fall within a range limit of ± 0.5 pound (26.4 to 27.4 pounds), 73% within a range limit of ± 1.0 pound (25.9 to 27.9 pounds), and approximately 97% within a range limit of ± 2.0 pounds (24.9 to 28.9 pounds). The standard deviation for caliper indicates that nearly 90% of the rolls should fall within a range limit of ± 0.001 inch (0.0097 to 0.0117 inch). The uniformity of the bursting strength, as shown by the standard deviation of 5.18, indicates that only 37% of the rolls would be expected to fall within a range limit of ± 2.5 points (62.5 to 67.5 points), 66% within a range limit of ± 5.0 points (60.0 to 70.0 points), and 83% within a range limit of ± 7.5 points (57.5 to 72.5 points). For the in- and across-machine direction Riehle compression, 43 and 70% of the rolls, respectively, should fall within a range limit of ± 1.0 pound, 60 and 88% within a range limit of ± 1.5 pounds, and 91 and 99% within a range limit of ± 3.0 pounds. The Elmendorf tear and Amthor tensile and stretch exhibit considerable variation or lack of uniformity.

MILL V

The average test results obtained for .009/26-lb. bogus corrugating medium made by Mill V are given in Table LI (*see also* Table LXXIV of the Appendix) and the statistical evaluation of these results in Table LII. For all practical purposes, the basis weight is the same as the grade weight specified. The standard deviation for basis weight indicates that 42% of the rolls should fall within a range limit of ± 0.5 pound (25.3 to 26.3 pounds), 74% within a range limit of ± 1.0 pound (24.8 to 26.8 pounds), and 98% within a range limit of ± 2.0 pounds (23.8 to 27.8 pounds). The average caliper was 0.0101 inch with a standard deviation of 0.341, indicating that approximately 99% of the rolls should fall within a range limit of ± 0.001 inch (0.0091 to 0.0111 inch). The average apparent density was 30.7 pounds per cubic foot and the average moisture content was 9.2% on an ovendry basis. The average bursting strength was 32 points and the indicated uniformity was such that 51% of the rolls should fall within a range limit of ± 2.5 points (29.5 to 34.5 points), 83% within a range limit of ± 5.0 points (27.0 to 37.0 points), and approximately 96% within a range limit of 7.5 points (24.5 to 39.5 points). The average Riehle compression values in the in- and across-machine directions were 12.9 and 10.3, respectively, with standard deviations indicating a probability that 80 and 86% of all the rolls would fall within a range limit of ± 1.5 pounds. Approximately all the rolls should fall within a Riehle compression range limit of ± 3.0 pounds. The standard deviations for Elmendorf tear and Amthor tensile and stretch indicate that considerable variation should be expected.

MILL W

The average test results obtained for the kraft corrugating medium made by Mill W are seen in Table LIII (*see also* Table LXXV of the Appendix). The statistical evaluation of these results are given in Table LIV. The average basis weight was slightly above the grade weight and the standard deviation of 0.910 indicates an expectancy that 42% of the rolls should fall within the range limit of ± 0.5 pound (26.3 to 27.3 pounds), 73% within a range limit of ± 1.0 pound (25.8 to 27.8 pounds), and 97% within a range limit of ± 2.0 pounds (24.8 to 28.8 pounds). The average caliper was 0.0101 inch and, according to the magnitude of the standard deviation, 85% of the rolls should fall within a range limit of ± 0.001 inch (0.0091 to 0.0111 inch) and 99% within a range limit of ± 0.002 inch (0.0081 to 0.0121 inch). The average apparent density was 31.8 pounds per cubic foot and the average moisture content was 11.1% on an ovendry basis.

The average bursting strength was 69 points. It should be expected that 42% of the rolls should fall within a bursting strength range limit of ± 2.5 points (66.5 to 71.5 points), 73% within a range limit of ± 5.0 points (64.0 to 74.0 points), and 91% within a range limit of ± 7.5 points (61.5 to 76.5 points). The average Riehle compression results in the in- and across-machine directions were 17.7 and 11.5 pounds, respectively. The standard deviations for the Riehle compression indicate that a range limit of ± 1.0 pound should include 46% of the rolls in the in-machine direc-

TABLE LI

PHYSICAL CHARACTERISTICS OF .009/26-LB. BOGUS CORRUGATING MEDIUM

MILL V

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	1-26-45	26.0	10.4	30.0	8.4	31	8	12.9	10.0	95	112	30.3	15.2	1.4	1.9
2	10-21-44	27.3	9.4	34.8	8.4	39	12	13.1	10.1	143	165	37.6	18.0	1.8	2.6
3	—	26.4	10.0	31.7	10.0	31	10	12.9	9.3	123	128	30.3	16.5	1.5	2.7
4	—	24.3	9.9	29.4	11.7	29	11	11.3	9.0	101	123	28.2	14.1	1.4	2.6
5	—	25.7	10.4	29.7	10.1	31	12	13.7	10.1	113	125	31.0	17.0	1.3	2.2
6	—	26.1	9.9	31.6	10.0	36	11	14.7	11.4	128	159	36.1	20.0	1.5	2.5
7	—	26.1	10.3	30.4	8.5	31	13	12.4	10.3	115	129	31.4	18.0	1.2	2.4
8	—	26.9	9.5	34.0	5.9	33	12	14.4	9.9	133	157	35.5	16.4	1.0	2.5
9	—	25.3	10.1	30.0	5.5	31	12	11.8	12.6	146	132	24.3	23.8	1.3	2.7
10	—	25.0	10.3	29.1	7.6	30	11	14.7	9.5	109	127	31.8	14.4	1.3	2.2
11	—	25.5	10.5	29.1	9.8	34	13	12.1	11.2	133	144	28.8	17.8	1.6	2.2
12	—	24.4	10.1	29.0	15.5	38	13	12.9	10.9	141	140	30.9	18.2	1.8	2.3
13	—	26.3	10.3	30.6	7.9	26	10	11.4	9.3	89	100	27.1	13.7	1.4	2.1
Average		25.8	10.1	30.7	9.2	32	11	12.9	10.3	121	134	31.0	17.2	1.4	2.4

TABLE LII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. BOGUS CORRUGATING MEDIUM

MILL V

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	27.3	10.5	39	13	14.7	12.6	146	165	37.6	23.8	1.8	2.7
Minimum	24.3	9.4	26	8	11.3	9.0	89	100	24.3	13.7	1.0	1.9
Average	25.8	10.1	32	11	12.9	10.3	121	134	31.0	17.2	1.4	2.4
Standard deviation	0.889	0.341	3.64	1.45	1.17	1.01	18.7	18.7	3.70	2.72	0.224	0.249
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	42	99	51	51	60	68	31	31	32	29	35	58
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	74	100	83	70	80	86	58	58	58	54	63	89
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	98	—	96	96	99	99	89	89	82	73	82	98

* Range limits were arbitrarily selected.

TABLE LIII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL W

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	2- 1-45	28.0	10.0	33.6	12.0	77	20	18.7	12.4	240	315	64.4	23.6	2.4	3.7
2	11-11-44	28 0	10.5	32.0	11.4	70	20	18.3	12.0	236	316	61.1	22.1	2.3	3.4
3	11-11-44	27.5	10.2	32.4	11.2	74	19	18.2	12.1	229	323	60.2	22.3	2.3	3.5
4	12-28-44	27.4	11 0	29.9	10.7	67	21	16 4	10.9	260	321	54.0	20.5	1.9	3.2
5	12-28-44	27.6	10.9	30.4	12.5	68	21	19.7	12.5	249	301	51.4	20 8	2.1	4 1
6	2-27-45	25.9	9.0	34.5	13.2	74	18	16.0	11.5	214	293	59 6	22.4	2.5	4.1
7	2-27-45	25.4	9.1	33.5	12.2	71	18	15.8	10.3	213	292	56.5	20.9	2.2	3.6
8	2-27-45	25.7	9.1	33.9	10.0	69	18	17.3	10.7	226	310	55.5	22.6	2.5	3.7
9	12-17-44	27 4	10.4	31.6	13.5	66	20	18.9	11.9	215	300	52.9	22.2	1.2	3 9
10	12-17-44	26.2	10.4	30.2	14.3	62	19	20.3	11.7	221	304	54.2	20.9	1.9	3.0
11	2-28-45	26.0	9.4	33.2	11.0	65	18	18.3	11.7	214	269	54.8	22.0	1.9	4.5
12	2- 3-45	27.2	10.6	30.8	6.1	65	20	14.9	10.3	231	277	55.3	21.6	1.9	4.1
13	2- 3-45	26.5	10.2	31.2	6.2	63	18	16.7	11.7	212	276	55.8	21.8	2.1	4.3
	Average	26 8	10.1	31.8	11.1	69	19	17.7	11.5	228	300	56.6	21.8	2.1	3.8

TABLE LIV

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL W

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	28.0	11.0	77	21	20.3	12.5	260	323	64.4	23.6	2.5	4.5
Miminum	25.4	9.0	62	18	14.9	10.3	212	269	51.4	20 5	1.2	3.0
Average	26.8	10.1	69	19	17.7	11.5	228	300	56.6	21.8	2.1	3.8
Standard deviation	0.910	0.692	4.54	1.17	1.62	0.740	15.2	17.7	3.69	0.872	0.350	0.440
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	42	85	42	60	46	82	38	32	32	75	23	35
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	73	99	73	80	65	96	68	60	58	98	43	64
Range limit (±)*	2.0	—	7.5	3 0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	97	—	91	99	84	99	95	91	82	99	61	83

* Range limits were arbitrarily selected.

TABLE LV

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL X

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	3-14-45	26.3	9.3	33.9	5.5	64	18	17.8	13.8	231	253	51.8	23.6	2.0	4.2
2	3-14-45	27.1	9.5	34.2	6.7	67	19	18.1	12.9	236	261	51.9	23.0	1.9	4.2
3	3-13-45	26.0	9.2	33.9	5.1	71	18	18.1	13.4	221	242	53.9	23.3	2.0	4.5
4	3-13-45	26.4	9.3	34.1	5.3	70	19	18.7	13.8	219	246	56.7	23.8	2.2	4.8
5	11-27-44	27.4	10.7	30.7	7.8	66	21	17.7	12.6	249	298	54.8	22.4	1.9	4.3
6	11-27-44	27.3	10.7	30.6	9.0	68	21	17.5	12.4	243	290	55.2	22.5	1.9	4.4
7	3-13-45	27.3	9.1	36.0	8.6	68	20	17.2	13.9	248	265	48.5	29.6	2.3	4.9
8	3-30-45	29.1	10.1	34.6	9.1	63	24	15.7	14.1	302	320	40.6	30.1	2.0	2.4
9	3-30-45	28.1	9.9	34.1	8.2	68	23	16.2	13.9	289	310	45.8	29.3	2.2	2.9
10	10-15-44	27.7	10.0	33.2	12.0	67	21	14.7	10.8	256	300	50.5	25.5	2.2	4.7
11	9-12-44	27.8	9.8	34.0	11.2	64	20	17.4	13.5	261	295	56.2	25.0	2.1	5.4
12	9-15-44	28.1	10.0	33.7	11.0	75	22	16.8	12.4	250	297	56.4	25.3	2.2	3.8
13	9-20-44	28.5	9.5	36.0	11.2	70	21	18.8	13.9	250	288	58.1	24.9	2.1	5.4
14	6-27-44	26.7	9.9	32.4	11.1	68	22	15.3	12.2	245	266	49.1	25.3	2.0	3.7
	Average	27.4	9.8	33.7	8.7	68	21	17.1	13.1	250	281	52.1	25.3	2.1	4.3

TABLE LVI

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL X

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	29.1	10.7	75	24	18.8	14.1	302	320	58.1	30.1	2.3	5.4
Minimum	26.0	9.1	63	18	14.7	10.8	219	242	40.6	22.4	1.9	2.4
Average	27.4	9.8	68	21	17.1	13.1	250	281	52.1	25.3	2.1	4.3
Standard deviation	0.881	0.507	3.14	1.78	1.25	0.941	22.9	24.8	4.88	2.61	0.133	0.851
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	43	95	58	42	58	71	26	24	24	30	55	19
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	75	100	89	60	77	89	49	45	46	56	87	36
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	98	—	98	91	98	99	81	77	69	75	98	52

* Range limits were arbitrarily selected.

TABLE LVII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL Y

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
1	3-12-45	25.4	9.1	33.5	7.2	48	15	18.5	11.0	186	205	45.4	19.5	1.9	3.8
2	10-14-44	25.7	8.9	34.6	8.9	70	13	24.2	15.1	161	188	59.0	27.4	2.3	3.1
3	3-12-45	25.3	9.1	33.4	6.8	48	14	17.0	12.2	183	185	46.3	19.9	2.1	3.1
4	3-10-45	26.0	9.5	32.8	11.7	72	17	16.9	13.7	194	243	55.4	22.3	2.2	3.7
5	3-10-45	26.8	9.8	32.8	7.3	73	18	18.7	13.7	206	238	55.5	21.1	1.9	4.6
6	3-10-45	27.0	9.8	33.1	10.5	65	18	16.8	13.1	238	270	54.0	26.6	2.1	3.7
7	3-12-45	26.1	9.4	33.3	10.8	47	14	15.7	11.3	183	206	46.6	19.4	2.0	3.9
8	3-12-45	27.1	8.2	39.6	12.5	55	13	14.9	10.6	176	220	49.6	22 4	2.1	3.8
9	3-12-45	26 1	9.2	34.0	11.1	51	13	16.0	11.9	180	219	49.0	22.1	1.9	3.3
10	3-12-45	24 9	9.5	31.5	10.1	48	13	14.3	10.0	182	214	45.9	20.2	1.8	3.0
Average		26.0	9.3	33.9	9.7	58	15	17.3	12.3	189	219	50.7	22.1	2.0	3.6

TABLE LVIII

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL Y

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb. In	Riehle Compression, lb. Across	Elmendorf Tear, g./sheet In	Elmendorf Tear, g./sheet Across	Amthor Tensile, lb./in. In	Amthor Tensile, lb./in. Across	Amthor Stretch, % In	Amthor Stretch, % Across
Test values												
Maximum	27.1	9.8	73	18	24.2	15.1	238	270	59.0	27.4	2.3	4.6
Minimum	24 9	8.2	47	13	14.3	10.0	161	185	45.4	19.4	1.8	3.0
Average	26.0	9.3	58	15	17.3	12.3	189	219	50.7	22.1	2.0	3.6
Standard deviation	0.746	0.474	11.0	2.10	2.80	1.61	20 8	25.9	4.90	2.83	0.157	0.488
Range limit (±)*	0.5	1 0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	50	97	18	37	28	46	28	23	24	27	48	32
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3.0	2.0	0.2	0.4
Approximate probability, %	82	99	35	52	41	64	53	44	46	52	80	59
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	99	—	50	83	72	94	85	75	69	71	94	78

* Range limits were arbitrarily selected.

TABLE LIX

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill Z

Roll Averages

Roll	Date Manuf.	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Apparent Density, lb./cu.ft.	Moisture, %	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
								In	Across	In	Across	In	Across	In	Across
1	7-21-44	26.5	9.2	34.6	8 4	70	19	20.2	16.9	265	248	50.5	33.7	1.9	5.0
2	8-12-43	27 3	8.9	36.8	7.8	78	19	21.4	15.8	256	269	54 5	35 7	2.0	4.0
3	5-11-43	27.4	10.2	32.2	8.7	65	22	17.1	14.2	283	316	50.8	26.1	1.7	3.1
4	10-30-44	27.9	9.5	35.2	9.1	85	21	21.0	15.4	257	295	59.5	33.0	2.0	5.1
5	2-26-45	26.5	9.3	34 2	7 5	73	20	21.3	17.6	252	243	55.5	34.5	2.1	4.8
6	2-26-45	26.5	9.1	34.9	9.5	77	19	20.8	17.7	244	236	53.4	35.8	2.3	5.3
7	2-26-45	26.4	9.0	35.2	9.1	79	19	20.9	16.2	226	247	57.8	31.1	2.1	4.9
8	2-26-45	26 4	9.0	35.2	9.9	75	19	20.1	15.0	231	254	55 9	33.6	2.0	5.4
9	2-26-45	26.6	9.0	35.5	10.9	78	19	20.8	15.4	231	241	57 1	32.4	1.9	4.9
10	7-21-44	26.6	9.4	33.9	8.6	74	19	18.5	15.0	257	268	49.4	33.8	1.9	4.4
11	7-21-44	26.3	9.4	33.6	10.8	73	20	17.2	14.2	262	260	47.3	33.1	2.1	4.8
Average		26.8	9.3	34.7	9.1	75	20	19.9	15.8	251	262	53.8	33.0	2.0	4.7

TABLE LX

STATISTICAL EVALUATION OF PHYSICAL TESTS ON .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill Z

	Basis Weight, lb. (12 x 12 /1000)	Caliper, 0.001 in.	Bursting Strength, points	G.E. Puncture, units	Riehle Compression, lb.		Elmendorf Tear, g./sheet		Amthor Tensile, lb./in.		Amthor Stretch, %	
					In	Across	In	Across	In	Across	In	Across
Test values												
Maximum	27.9	10.2	85	22	21.4	17.7	283	316	59.5	35.8	2.3	5.4
Minimum	26.3	8.9	65	19	17.1	14.2	226	236	47.3	26.1	1.7	3.1
Average	26.8	9.3	75	20	19.9	15.8	251	262	53.8	33.0	2.0	4.7
Standard deviation	0.522	0.366	5.21	1.03	1.59	1.22	17.1	24.6	3.86	2.65	0.155	0.659
Range limit (±)*	0.5	1.0	2.5	1.0	1.0	1.0	7.5	7.5	1.5	1.0	0.1	0.2
Approximate probability, %	66	99	37	67	47	59	34	24	30	30	48	24
Range limit (±)*	1.0	2.0	5.0	1.5	1.5	1.5	15.0	15.0	3 0	2.0	0.2	0.4
Approximate probability, %	95	100	66	86	65	78	62	46	56	55	80	46
Range limit (±)*	2.0	—	7.5	3.0	3.0	3.0	30.0	30.0	5.0	3.0	0.3	0.6
Approximate probability, %	99	—	85	99	94	99	92	78	81	74	95	64

* Range limits were arbitrarily selected.

tion and 82% in the across-machine direction. A range limit of ±1.5 pounds should include 65% in the in-machine direction and 96% in the across-machine direction, and a range limit of ±3.0 pounds should include 84 and 99%, respectively. Elmendorf tear and Amthor tensile and stretch exhibited rather large standard deviations, signifying that considerable variation should be expected.

Mill X

The average test results obtained on samples of the kraft corrugating medium made by Mill X are presented in Table LV (*see also* Table LXXVI of the Appendix). It may be observed that the average basis weight was 27.4 pounds. The average caliper was 0.0098 inch and the average apparent density was 33.7 pounds per cubic foot. The average bursting strength was 68 points and the average moisture 8.7% on an ovendry basis. The average Riehle compression values in the in- and across-machine directions were 17.1 and 13.1 pounds, respectively.

The statistical evaluation of these results is given in Table LVI. On the basis of a standard deviation of 0.881 for basis weight, it should be expected that 43% of the rolls should fall within a range limit of ±0.5 pound (26.9 to 27.9 pounds), 75% within a range limit of ±1.0 pound (26.4 to 28.4 pounds), and 98% within a range limit of ±2.0 pounds (25.4 to 29.4 pounds). With a standard deviation for caliper of 0.507, approximately 95% of the rolls should fall within a range limit of ±0.001 inch (0.0088 to 0.0108 inch). Approximately 58% of the rolls should fall within a bursting strength range limit of ±2.5 points (65.5 to 70.5 points), 89% within a range limit of ±5.0 points (63.0 to 73.0 points), and 98% within a range limit of ±7.5 points (60.5 to 75.5 points). The standard deviation for the Riehle compression in the in-machine direction indicates that 58, 77, and 98% of the rolls should fall within range limits of ±1.0, ±1.5, and ±3.0 pounds, respectively. For the across-machine direction, approximately 71, 89, and 99% of the rolls should fall within range limits of ±1.0, ±1.5, and ±3.0 pounds, respectively.

The statistical evaluation of the Elmendorf tear, Amthor tensile and stretch, and G. E. puncture indicates that, on the average, approximately 50% of the rolls should fall within the second arbitrarily selected range limit for each test.

Mill Y

The average results obtained on samples of the kraft corrugating medium made by Mill Y are given in Table LVII (*see also* Table LXXVII of the Appendix). The average basis weight was 26.0 pounds, the average caliper 0.0093 inch, and the average apparent density was 33.9 pounds per cubic foot. The average bursting strength was 58 points, and the average Riehle compression values in the in- and across-machine directions, were 17.3 and 12.3 pounds, respectively. The average moisture content was 9.7% on an ovendry basis.

The statistical evaluation of these results is found in Table LVIII. On the basis of the standard deviation, it should be expected that 50% of the rolls made in this grade by Mill Y should fall within a basis weight range limit of ±0.5 pound (25.5 to 26.5 pounds), 82% within a range limit of ±1.0 pound (25.0 to 27.0 pounds), and 99% within a range limit of ±2.0 pounds (24.0 to 28.0 pounds). Approximately 97% of the rolls should fall within a caliper range limit of ±0.001 inch (0.0083 to 0.0103 inch). The standard deviation for the bursting strength was 11.0, which indicates that only 18% of the rolls should be expected to fall within a range limit of ±2.5 points (55.5 to 60.5 points), 35% within a range limit of ±5.0 points (53.0 to 63.0 points), and 50% within a range limit of ±7.5 points (50.5 to 65.5 points). The standard deviations for the Riehle compression in the in- and across-machine directions indicate that 28 and 46%, respectively, should fall within the range limit of ±1.0 pound, 41 and 64% within the range limit of ±1.5 pounds, and 72 and 94% within the range limit of ±3.0 pounds. The standard deviations for Elmendorf tear, G. E. puncture, and Amthor tensile and stretch indicate considerable nonuniformity of these characteristics in the .009/26-lb. kraft corrugating medium.

Mill Z

The average test results obtained on samples of the kraft corrugating medium made by Mill Z are given in Table LIX (*see also* Table LXXVIII of the Appendix). The average basis weight was 26.8 pounds, the average caliper 0.0093 inch, and the average apparent density 34.7 pounds per cubic foot. The average moisture content was 9.1% on an ovendry basis. The average bursting strength was 75 points and the average Riehle compression values for the in- and across-machine directions were 19.9 and 15.8 pounds, respectively. It should be noted that Rolls Z-2 and Z-3 were made approximately the middle of 1943 and thus were substantially older than the others; however, the average results obtained for these rolls do not vary markedly from the average of the values for the other rolls.

The statistical evaluation of these results is presented in Table LX. The magnitude of the standard deviation for the basis weight indicates that 66% of the rolls should fall within the range limit of ±0.5 pound (26.3 to 27.3 pounds), 95% within the range limit of ±1.0 pound (25.8 to 27.8 pounds), and 99% within a range limit of ±2.0 pounds (24.8 to 28.8 pounds). Approximately 99% of the rolls should fall within a caliper range limit of ±0.001 inch (0.0083 to 0.0103 inch). The standard deviation of the bursting strength indicates that 37% of the rolls should fall within a range limit of ±2.5 points (72.5 to 77.5 points), 66% within a range limit of ±5.0 points (70.0 to 80.0 points), and 85% within a range limit of ±7.5 points (67.5 to 82.5 points). The standard deviations for the Riehle compression values in the in- and across-machine directions indicate that 47 and 59% of the rolls, respectively, should fall within a range limit of ±1.0 pound, 65 and 78% within a range limit of ±1.5 pounds, and 94 and 99% within a range limit of ±3.0 pounds. The standard deviations for Elmendorf tear, G. E. puncture, and Amthor tensile and stretch indicate the respective uniformities of these characteristics.

SUMMARY

The results presented in this part of the baseline study are concerned with the problem of sampling, in a truly impartial cross-sectional manner, the current routine production of the co-operating mills and evaluating—these samples as completely as possible by means of existing board testing methods.

The second phase of the baseline study involved (1) the selection of the most representative rolls of each mill's sampled production, and (2) the fabrication of these representative rolls into corrugated combined boards and their conversion into boxes.

Because the first part of the baseline study was concerned only with the sampling and evaluation of the component parts, no conclusions regarding the relationship between the quality of component parts and the performance of combined board and boxes fabricated from these components can be made at this time.

However, the results of this phase of the study indicate that the average quality of the sampled 42-lb. D.F.B.S. Fourdrinier kraft liner and of the .009/26-lb. kraft and bogus corrugating mediums were as follows:

	Liner	Corrugating Medium
Basis weight, lb./1000 sq. ft.	42.1	26.8
Caliper, in.	0.015	0.010
Apparent density, lb./cu. ft.	33.7	32.3
Bursting strength, points	98	62
G. E. puncture, units	36	18
Moisture, %	8.1	9.4
Riehle compression, lb.		
In	29.0	17.6
Across	22.5	13.0
Elmendorf tear, g./sheet		
In	354	223
Across	394	251
Amthor tensile, lb./in.		
In	77.8	49.5
Across	37.8	24.8
Amthor stretch, %		
In	2.1	1.9
Across	3.7	4.3

It should be remembered that these data are based on the actual rolls sampled and on conventional test methods.

For those tests in which orientation of the specimen is specified, the approximate ratios observed in the in-machine direction and in the across-machine direction were as follows:

	Ratio In:Across
Riehle compression	4:3
Elmendorf tear	0.9:1
Amthor tensile	2:1
Amthor stretch	1:2

The ratio of the bursting strength to the G. E. puncture on 42-lb. D.F.B.S. Fourdrinier kraft liner was of the order of 2.7:1.

The ratio was not computed for the .009/26-lb. corrugating medium since the relatively high capacity of the G. E. puncture tester did not allow sufficient subdivision of the scale to permit distinguishing between the low values obtained with any degree of accuracy.

APPENDIX

TABLE LXI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B S. FOURDRINIER KRAFT LINER

Mill A

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116372/74	1	42.5	41.7	42.1	15.7	14.1	14.9	33.8	9.3	6.5	8.3	126	72	94	44	35	39	33.0	22.0	25.7
116375/77	2	43.2	42.5	42.8	15.3	14.2	14.8	34.7	7.8	7.3	7.6	121	79	99	41	35	38	36.0	22.0	27.0
116389/91	3	41.1	40.7	40.9	14.7	13.8	14.2	34.6	9.8	9.4	9.7	129	79	109	36	31	34	33.5	24.0	29.0
116392/94	4	41.2	40.7	41.0	14.6	13.2	14.1	34.8	9.3	9.2	9.2	126	90	110	37	32	35	31.0	25.5	28.5
116402/04	5	42.3	42.0	42.1	14.9	13.3	14.3	35.3	13.7	12.7	13.2	132	84	107	37	33	36	30.5	21.0	25.8
116405/07	6	42.6	41.7	42.1	15.7	14.6	15.1	33.4	11.2	10.4	10.7	132	80	111	39	33	37	32.5	24.5	29.2
116408/10	7	40.4	39.8	40.1	14.9	14.0	14.5	33.2	11.9	11.4	11.7	129	86	103	37	32	34	33.5	27.0	29.0
116444/46	8	39.4	39.0	39.2	15.6	14.1	14.6	32.2	9.1	7.9	8.4	116	84	99	35	31	33	28.5	22.0	25.9
116447/49	9	38.6	38.5	38.5	15.1	13.8	14.5	31.8	8.2	7.6	7.9	117	78	90	34	28	31	31.0	22.5	27.5
116916/18	10	41.8	41.0	41.4	15.4	9.7	14.8	33.5	8.0	7.5	7.8	113	68	95	40	30	36	30.0	23.5	27.5
116919/21	11	42.1	40.8	41.4	16.1	15.0	15.5	32.0	7.4	7.0	7.2	122	63	92	40	30	35	32.0	25.5	28.8
116922/24	12	41.6	40.8	41.1	16.0	14.7	15.3	32.2	6.9	5.5	6.3	119	62	88	37	32	35	32.0	24.5	28.1
116925/27	13	41.8	40.2	41.2	15.8	14.6	15.3	32.3	7.5	6.8	7.0	126	65	93	40	32	37	33.0	25.0	27.6
117066/68	14	41.2	40.4	40.7	15.7	14.4	15.1	32.3	11.7	10.8	11.3	123	67	98	38	33	35	37.0	26.5	31.6
117069/71	15	41.6	41.1	41.3	15.9	14.4	15.2	32.6	12.8	11.5	12.0	119	90	104	39	35	37	35.5	25.5	31.6
117075/77	16	40.7	39.4	40.0	15.2	13.9	14.6	32.8	12.2	11.3	11.8	117	69	96	35	31	33	37.0	27.5	31.5
117078/80	17	40.1	38.2	39.1	15.1	13.7	14.4	32.5	12.2	9.5	10.6	119	69	88	36	29	32	35.0	26.0	30.0
117140/42	18	42.2	41.7	41.9	16.0	14.9	15.3	32.8	9.9	8.5	9.1	122	83	104	36	30	34	34.5	26.5	29.8
117143/45	19	41.6	40.5	41.2	15.7	14.1	15.0	32.9	10.9	6.7	8.8	122	74	104	34	29	32	33.0	24.5	28.4
117146/48	20	42.0	40.8	41.6	15.9	14.1	14.9	33.5	10.3	8.9	9.6	121	79	99	35	30	32	37.5	26.0	31.2
117149/51	21	41.3	41.0	41.2	15.2	14.2	14.8	33.4	8.7	7.8	8.1	124	80	101	34	28	32	37.5	26.0	29.2
117290/92	22	42.7	42.6	42.7	15.3	14.5	14.9	34.3	11.0	8.4	9.9	122	80	100	38	32	36	30.0	25.0	27.6
117293/95	23	40.8	39.9	40.4	15.4	13.9	14.8	32.7	9.5	5.3	7.9	121	69	95	38	30	33	34.0	26.0	29.4
117296/98	24	43.5	43.0	43.3	15.8	14.5	15.1	34.4	10.6	9.3	10.1	121	74	98	40	35	37	30.0	25.0	27.7
117299/301	25	40.7	40.3	40.6	15.3	14.5	15.0	32.4	9.0	8.5	8.7	120	67	94	37	32	34	31.5	24.0	27.1
117302/04	26	42.4	41.6	42.0	15.9	14.3	15.3	32.9	9.0	7.5	8.4	134	73	103	39	33	37	33.0	24.5	28.8
117741/43	27	41.2	40.0	40.5	15.4	14.3	14.8	32.8	8.3	7.1	7.6	112	80	95	36	30	33	30.0	26.0	28.2
117744/46	28	40.1	40.0	40.0	15.1	14.1	14.6	32.8	7.1	4.3	6.0	125	73	99	35	30	33	31.5	23.5	27.5
Average				41.1			14.8	33.2			9.1			99			35			28.5

TABLE LXII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B S. FOURDRINIER KRAFT LINER

Mill B

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116426/28	1	43.2	41.4	42.2	16.3	14.9	15.7	32.2	9.5	8.6	9.0	117	78	101	37	32	34	35.0	25.0	29.7
116429/31	2	44.8	44.6	44.7	16.5	15.4	15.9	33.7	8.8	8.1	8.4	124	67	106	42	36	39	34.0	28.0	30.2
116432/34	3	44.4	43.6	44.1	16.0	14.8	15.5	34.1	9.3	8.2	8.9	126	88	105	38	34	36	33.5	25.0	28.7
116726/28	4	43.3	42.6	42.9	14.0	12.5	13.5	38.1	8.2	8.2	8.2	128	78	102	40	35	37	36.0	28.0	31.3
116729/31	5	41.3	40.8	41.1	14.1	13.4	13.8	35.6	8.7	8.1	8.4	119	70	92	40	32	35	33.5	23.5	27.5
116735/37	6	43.0	41.7	42.4	16.4	15.5	16.0	31.8	9.7	9.3	9.6	130	72	104	40	32	37	37.0	26.5	30.0
116949/51	7	42.3	41.4	42.0	16.5	15.1	15.7	32.0	7.1	6.3	6.8	112	71	94	37	30	34	38.0	30.0	34.0
116952/54	8	42.6	41.6	42.2	15.9	14.6	15.3	33.0	6.9	5.1	6.0	120	76	96	37	32	35	37.5	28.0	33.9
116955/57	9	44.0	40.6	42.7	16.7	14.8	15.9	32.2	7.7	5.8	6.8	110	66	91	42	35	39	32.5	26.0	29.3
117753/55	10	45.7	44.0	45.0	16.8	15.8	16.4	32.9	11.3	10.2	10.8	119	84	104	42	37	40	33.5	28.0	31.1
117756/58	11	43.6	42.0	42.7	16.5	15.0	15.9	32.2	10.2	9.3	9.7	109	73	91	40	34	37	34.0	25.0	29.1
117759/61	12	45.2	44.8	45.0	16.8	15.7	16.2	33.3	10.3	9.2	9.7	119	80	103	44	38	40	34.5	27.5	31.6
117762/64	13	43.2	42.4	42.8	16.0	15.0	15.6	32.9	11.4	10.9	11.1	120	90	103	47	35	38	37.5	27.5	32.3
117765/67	14	44.0	42.8	43.5	16.2	15.0	15.7	33.2	10.3	9.2	9.7	120	87	106	42	35	39	39.0	32.0	35.2
117768/70	15	46.1	45.1	45.7	16.4	14.7	15.6	35.2	8.9	7.7	8.1	138	88	112	41	37	40	36.5	29.0	32.0
118017/19	16	41.9	41.8	41.8	15.2	14.0	14.8	33.9	9.3	8.9	9.1	144	67	101	39	33	36	31.5	22.0	27.9
118020/22	17	43.4	41.5	42.3	15.5	14.5	15.0	33.8	10.3	8.9	9.6	132	88	108	41	33	37	33.5	24.5	30.3
118023/25	18	43.0	41.2	42.3	17.0	15.8	16.4	31.0	8.5	7.6	8.0	108	74	93	41	35	37	33.0	24.0	29.4
118026/28	19	43.1	42.4	42.7	15.5	14.8	15.1	33.9	8.3	7.3	7.7	134	94	111	39	33	36	35.5	25.5	31.3
118029/31	20	41.7	41.1	41.3	15.3	14.8	15.0	33.0	8.3	7.6	8.0	108	71	95	37	32	35	32.0	25.5	28.9
118032/34	21	41.2	41.1	41.2	15.0	14.5	14.9	33.2	9.0	7.2	8.1	124	78	98	38	31	34	32.0	24.5	28.7
Average				42.9			15.4	33.4			8.7			101			37			30.6

TABLE LXI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL A

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
23.5	17.0	20.2	432	328	378	432	352	401	89.7	71.1	81.6	42.3	31.8	38.1	3.6	1.7	2.0	4.6	2.2	3.5	1
24.5	15.0	20.0	408	304	366	520	352	414	91.4	67.7	83.7	43.7	31.3	38.8	3.0	1.9	2.2	4.1	2.1	3.3	2
24.0	17.0	21.0	368	312	341	448	368	406	93.1	76.2	84.6	41.0	29.0	35.9	3.3	2.3	2.7	4.8	1.9	3.7	3
24.0	19.5	21.6	400	208	336	488	376	412	91.4	76.2	85.3	40.8	33.0	37.4	3.9	2.3	2.9	4.6	2.5	3.6	4
26.0	18.5	22.7	424	360	387	488	384	415	89.7	64.3	76.8	47.1	31.3	39.8	3.2	2.3	2.8	5.1	1.9	3.5	5
25.5	18.5	23.4	432	304	363	464	376	417	96.5	62.6	85.9	42.7	31.8	38.3	2.9	1.6	2.4	4.6	2.6	3.7	6
25.0	20.0	22.1	400	288	351	432	352	396	84.7	69.4	78.1	43.2	33.4	37.6	2.9	2.1	2.5	4.7	2.3	3.4	7
22.5	17.0	20.2	360	264	310	416	328	370	86.3	62.8	73.8	41.6	31.3	36.1	2.2	1.3	1.7	3.4	1.6	2.6	8
23.0	19.5	21.2	392	288	334	392	328	366	87.4	63.8	72.8	39.1	30.0	35.7	2.6	1.1	1.9	3.8	2.0	2.8	9
24.0	17.0	21.5	400	304	350	448	336	398	93.1	64.8	81.0	42.3	32.2	36.0	2.4	1.3	2.0	3.9	2.1	2.9	10
25.5	18.0	22.3	464	320	384	448	352	407	91.4	66.0	82.5	38.3	31.2	35.2	2.4	1.6	2.0	5.1	2.4	3.7	11
25.0	17.5	21.5	392	272	349	480	336	398	93.1	69.4	81.7	40.0	30.8	34.6	3.5	1.6	2.0	4.4	2.3	3.5	12
24.0	20.0	22.0	432	304	377	480	344	418	91.4	72.8	82.2	38.9	32.5	36.0	2.2	1.6	1.9	3.9	2.0	2.9	13
26.5	19.5	22.9	400	312	355	424	336	382	79.2	59.8	70.7	42.5	27.3	35.4	2.5	0.9	1.9	5.5	1.4	3.7	14
25.0	19.0	22.3	424	320	357	448	336	394	77.9	59.6	74.0	37.2	30.3	33.5	2.6	1.8	2.3	4.9	2.4	3.7	15
23.5	18.5	21.8	400	296	350	488	320	380	77.5	62.5	69.4	40.3	29.1	35.1	2.7	1.7	2.2	5.7	2.7	4.2	16
25.0	20.0	22.0	376	296	333	440	328	371	80.6	61.5	69.4	39.3	28.4	33.9	2.5	1.3	2.1	5.0	2.3	3.8	17
28.5	21.5	24.4	424	288	339	480	352	404	93.1	69.4	80.5	44.4	31.5	36.9	2.6	1.7	2.0	5.2	2.0	3.7	18
27.0	23.0	24.7	400	296	336	464	336	382	96.5	72.8	86.0	41.8	32.2	36.2	2.6	1.9	2.2	4.9	2.0	3.6	19
25.0	18.0	21.3	368	264	319	432	336	373	91.4	72.8	84.3	38.9	30.8	35.0	2.5	1.8	2.2	4.6	2.1	3.5	20
26.0	18.5	22.7	352	248	313	400	352	375	94.8	72.8	81.2	40.6	26.2	35.7	2.3	1.6	2.0	4.1	2.0	3.2	21
24.0	20.5	22.3	352	280	321	416	344	370	85.5	70.3	77.1	38.6	31.5	35.2	2.5	1.4	2.1	4.4	2.1	3.3	22
25.5	21.0	22.8	384	248	316	408	336	370	88.0	72.8	80.7	38.1	27.4	33.1	2.7	1.6	2.0	4.7	1.8	3.5	23
26.0	20.0	22.6	376	296	331	456	352	404	83.8	62.1	74.7	39.4	32.8	36.1	2.9	1.0	2.2	4.4	2.0	3.4	24
27.0	18.5	23.4	376	312	339	392	320	357	80.9	66.0	70.6	42.3	29.6	37.1	2.4	1.8	2.1	3.8	1.8	2.8	25
25.5	22.0	23.5	376	288	326	432	368	404	91.4	67.7	76.9	42.0	24.7	37.0	2.7	1.9	2.3	3.8	2.0	3.0	26
23.5	18.5	21.4	368	288	325	416	344	373	80.9	69.2	74.9	40.8	33.0	37.4	3.7	1.6	2.1	4.0	2.2	3.3	27
24.5	18.0	21.5	368	248	320	432	344	385	83.8	69.6	77.3	41.1	31.2	37.5	2.4	1.7	2.0	4.3	2.5	3.4	28
		22.1			343			391			78.5			36.2			2.2			3.4	

TABLE LXII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL B

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
28.5	19.0	22.6	408	288	337	456	352	412	93.1	74.2	83.6	39.6	29.5	35.4	2.8	1.9	2.4	4.6	2.4	3.6	1
28.5	21.5	25.2	424	344	394	488	336	426	101.6	81.3	90.0	51.1	32.7	42.0	2.8	1.6	2.1	4.4	2.0	3.3	2
25.5	19.5	22.6	392	312	356	456	360	395	84.5	59.1	77.6	40.1	32.2	36.1	3.0	1.6	2.4	4.7	2.8	3.9	3
29.0	23.0	25.5	456	368	415	456	360	398	78.7	59.3	71.3	53.7	34.9	43.8	3.0	1.6	2.2	6.9	1.9	4.3	4
27.5	17.5	23.3	432	360	402	432	320	367	79.6	59.6	70.0	50.8	26.9	41.3	2.5	1.6	2.0	7.6	1.0	4.1	5
26.0	18.5	22.4	440	328	368	496	392	428	98.2	77.9	89.2	43.0	33.0	38.7	2.7	1.5	2.1	4.8	2.6	3.5	6
26.5	22.0	24.4	400	304	346	448	328	377	84.7	70.6	81.4	36.9	29.1	33.2	2.4	1.8	2.1	5.6	2.7	4.1	7
29.0	22.0	25.0	432	320	365	440	344	397	88.0	72.8	83.1	42.7	26.1	36.6	2.4	1.8	2.1	6.0	2.0	4.1	8
27.0	18.0	23.8	456	328	391	472	360	418	91.4	66.0	78.0	43.2	32.2	38.3	2.2	1.4	1.8	5.1	1.8	3.8	9
25.5	19.5	22.5	400	312	365	448	344	416	99.9	77.9	89.3	42.5	33.7	39.4	2.9	2.1	2.5	4.4	2.4	3.6	10
25.5	19.5	22.9	376	288	329	424	320	376	93.1	69.4	79.9	41.8	32.3	37.9	2.3	1.6	2.0	4.2	2.0	3.2	11
27.5	21.5	24.2	424	320	373	464	360	433	96.5	77.9	90.1	44.0	34.7	39.3	2.7	2.0	2.3	4.2	2.4	3.3	12
28.0	21.0	23.8	392	304	352	456	376	407	99.9	67.7	85.7	42.2	23.0	38.7	2.7	1.6	2.4	4.4	2.6	3.5	13
27.0	22.0	25.2	384	304	345	464	368	407	99.9	83.0	91.4	44.2	31.8	39.5	2.8	2.1	2.4	4.1	2.1	3.4	14
29.0	21.0	25.5	432	352	389	448	384	421	96.5	71.1	89.6	47.1	38.1	42.4	3.0	2.2	2.6	5.4	2.6	3.8	15
24.5	18.5	22.1	344	280	314	424	328	379	93.1	67.7	83.1	40.6	31.8	35.9	2.7	2.0	2.3	6.7	3.1	5.0	16
26.5	22.0	24.3	376	240	319	424	344	389	105.0	81.3	92.4	43.8	35.4	39.3	2.8	2.0	2.3	4.8	2.9	3.6	17
25.0	22.0	23.6	360	264	319	408	312	380	91.4	74.5	81.2	39.4	27.8	33.9	2.4	1.7	2.1	5.0	2.0	3.5	18
27.5	19.0	24.7	368	296	332	416	352	381	98.2	77.9	90.9	44.2	34.5	39.1	2.5	1.8	2.2	5.3	2.4	3.8	19
24.5	20.0	22.0	360	264	307	408	328	371	99.9	66.0	83.5	41.5	28.4	34.6	2.5	2.1	2.3	6.4	2.7	4.4	20
25.0	18.5	21.7	344	264	304	424	328	366	91.4	72.8	83.9	39.1	28.6	34.8	2.6	1.7	2.2	5.6	2.0	4.3	21
		23.7			353			397			84.1			38.1			2.2			3.8	

TABLE LXIII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL C

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116360/62	1	44.6	42.8	43.7	14.0	13.4	13.7	38.2	8.0	7.5	7.7	122	79	98	41	34	37	34.0	22.0	28.0
116363/65	2	43.6	42.1	42.8	13.8	12.8	13.4	38.3	8.2	7.3	7.8	119	76	98	38	33	35	37.0	22.5	29.4
116366/68	3	45.2	42.9	44.0	14.3	13.5	14.0	37.7	8.2	7.3	7.7	129	90	109	40	34	38	36.5	27.5	31.2
116960/62	4	42.1	41.2	41.7	14.8	13.9	14.2	35.2	8.7	7.7	8.2	107	75	88	42	33	36	34.5	29.0	31.2
116963/65	5	43.0	42.4	42.6	15.1	14.3	14.8	34.5	7.8	6.8	7.4	135	75	104	50	37	41	38.5	28.5	31.6
116975/77	6	42.5	41.9	42.2	15.3	14.7	15.0	33.8	8.9	7.9	8.3	134	77	99	45	39	42	37.5	27.5	31.0
116978/80	7	42.3	41.8	42.1	15.0	14.1	14.6	34.6	8.3	7.2	7.6	125	80	101	45	38	41	36.0	22.0	29.7
116981/83	8	42.6	42.4	42.5	15.2	14.5	14.9	34.2	8.5	7.9	8.2	118	80	99	43	37	41	37.0	27.5	32.8
117459/61	9	42.6	41.6	42.1	15.4	14.6	15.0	33.7	5.9	5.0	5.5	124	65	99	42	38	40	35.5	26.5	29.9
117462/64	10	43.0	41.2	42.3	15.3	14.0	14.7	34.5	6.6	4.9	5.8	142	53	103	43	36	40	32.5	25.5	28.9
117977/79	11	44.9	42.8	43.8	14.5	13.0	13.9	37.8	6.9	3.9	5.6	124	80	102	41	35	38	33.0	26.0	30.3
117980/82	12	42.1	41.6	41.8	15.2	14.5	15.0	33.4	7.5	5.6	6.6	120	78	99	40	35	38	33.5	25.5	28.3
117983/85	13	42.7	42.6	42.7	15.4	14.1	14.9	34.4	6.5	5.3	6.1	113	63	93	41	35	38	29.5	25.0	27.3
117986/88	14	42.7	42.1	42.5	15.4	14.6	15.0	34.0	6.8	5.4	6.3	133	78	97	42	34	38	32.0	24.0	27.6
117989/91	15	44.5	43.6	44.0	15.0	14.2	14.7	35.9	7.8	6.6	7.1	131	87	109	44	37	41	35.0	24.5	30.5
Average				42.7			14.5	35.3			7.1			100			39			29.8

TABLE LXIV

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL D

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
117006/08	1	41.1	40.3	40.8	15.0	14.3	14.7	33.3	8.9	8.3	8.6	110	80	94	40	33	38	33.5	24.0	28.3
117009/11	2	41.8	40.4	40.9	15.0	14.0	14.7	33.4	8.7	6.8	7.9	118	82	102	39	35	37	33.0	24.0	28.6
117012/14	3	41.8	40.2	41.0	15.1	14.1	14.8	33.2	9.1	6.9	7.9	118	63	93	40	35	37	29.5	22.0	25.8
117015/17	4	40.3	40.3	40.3	15.2	14.3	14.9	32.4	8.2	6.3	7.1	118	63	84	38	31	36	29.5	20.0	24.4
117018/20	5	45.4	42.9	43.9	17.3	16.2	16.7	31.5	8.6	6.7	7.7	126	69	100	47	40	44	31.0	25.0	27.4
117021/23	6	46.4	44.6	45.4	17.7	16.0	16.6	32.8	7.9	6.5	7.4	133	75	100	48	41	44	35.5	23.0	28.8
117054/56	7	42.9	41.5	42.4	15.9	14.8	15.3	33.2	11.5	7.6	9.4	117	73	97	40	32	36	33.5	25.0	29.9
117060/62	8	41.0	39.8	40.4	14.9	13.8	14.4	33.6	14.1	11.0	12.4	123	79	102	39	32	34	36.5	25.5	29.4
117063/65	9	42.8	41.8	42.3	16.8	15.4	16.0	31.7	12.8	10.5	11.7	120	79	101	40	34	37	34.0	26.0	30.1
117090/92	10	38.9	38.8	38.8	13.7	12.7	13.3	34.9	5.8	3.1	4.2	124	70	91	32	28	30	33.5	27.0	31.4
117093/95	11	40.3	38.9	39.6	13.5	12.4	13.0	36.5	5.3	3.6	4.3	120	71	95	33	28	30	36.5	27.0	31.3
117111/13	12	42.0	40.8	41.6	14.8	14.0	14.3	34.8	7.7	6.3	7.0	111	68	94	37	30	33	29.5	24.5	27.0
117114/16	13	40.3	39.2	39.7	13.5	12.3	12.8	37.2	7.8	7.0	7.4	121	89	104	33	29	32	30.5	24.0	27.0
117123/25	14	41.6	40.4	40.8	15.5	13.9	14.3	34.2	8.6	7.1	8.0	114	80	95	37	30	33	30.0	22.0	26.1
117167/69	15	43.0	41.8	42.5	15.0	14.5	14.7	34.7	6.2	5.7	6.0	125	82	102	38	31	35	30.5	25.5	27.8
117170/72	16	44.6	41.6	43.4	15.8	14.4	14.9	34.9	7.1	5.6	6.3	130	69	105	39	31	35	35.0	26.5	31.1
117173/75	17	42.2	41.4	41.9	14.9	14.1	14.5	34.6	7.6	5.5	6.6	131	85	105	37	32	34	30.0	23.0	26.9
117176/78	18	43.2	40.4	41.9	17.9	15.4	16.8	29.9	9.0	6.1	8.0	104	64	86	38	32	35	29.0	21.5	25.9
117260/62	19	43.7	42.7	43.3	15.1	14.0	14.6	35.6	7.5	5.7	6.7	147	78	110	37	33	36	35.0	23.0	28.2
117266/68	20	41.2	40.8	41.0	15.4	14.5	15.1	32.6	5.7	5.1	5.5	108	72	93	39	33	36	33.0	24.0	27.8
117269/71	21	43.0	42.6	42.8	15.1	14.3	14.8	34.7	8.2	4.6	6.2	122	76	102	41	35	38	29.0	23.0	25.9
Average				41.7			14.8	33.8			7.4			98			36			28.1

TABLE LXIII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL C

Riehle Compression, lb. Across Max.	Min.	Av.	Elmendorf Tear, g./sheet In Max.	Min.	Av.	Across Max.	Min.	Av.	Amthor Tensile, lb./in. In Max.	Min.	Av.	Across Max.	Min.	Av.	Amthor Stretch, % In Max.	Min.	Av.	Across Max.	Min.	Av.	Roll
30.5	19.0	23.1	448	320	385	440	336	393	93.1	67.7	81.6	48.8	38.6	43.0	2.6	1.8	2.2	8.1	2.6	5.0	1
26.5	18.5	23.3	416	328	356	408	336	371	94.8	71.1	82.7	47.2	37.2	43.0	2.4	1.7	2.1	6.5	2.5	4.8	2
28.5	21.5	24.5	440	320	389	432	320	389	93.1	77.9	86.4	51.3	37.6	45.0	2.6	1.8	2.2	6.3	2.3	4.7	3
26.5	20.0	22.8	376	320	351	472	320	380	81.1	65.2	76.6	41.6	34.7	38.8	2.4	1.1	1.5	5.6	3.2	4.3	4
27.0	20.5	23.5	440	296	377	512	360	442	103.3	77.9	87.2	41.1	30.6	36.2	2.0	1.2	1.7	5.5	2.3	3.8	5
24.0	18.5	21.4	456	304	361	464	304	392	88.0	69.4	82.4	42.3	31.5	36.9	3.0	1.4	1.7	4.5	2.2	3.3	6
24.5	16.0	21.3	384	288	349	504	416	440	98.2	72.8	87.6	41.8	25.7	36.0	2.6	1.6	1.8	4.4	1.7	3.3	7
26.0	18.5	22.8	432	320	371	480	384	433	96.5	77.9	89.8	42.3	32.2	37.0	2.2	1.6	1.8	5.2	2.8	3.9	8
23.0	18.0	21.1	408	336	376	472	368	411	101.6	76.2	92.0	40.0	31.7	35.7	2.3	1.7	1.9	5.2	3.2	4.2	9
25.0	19.5	22.0	448	312	366	448	312	401	101.6	64.3	85.2	40.1	32.8	36.7	2.2	1.2	1.8	5.3	3.3	4.4	10
28.0	20.5	24.6	424	328	366	392	344	368	96.5	69.4	84.7	51.6	35.0	44.3	2.1	1.6	1.9	5.8	2.0	4.5	11
23.5	18.0	20.6	448	296	342	472	368	407	98.2	67.7	86.6	41.0	31.5	37.9	1.9	1.4	1.6	4.8	2.6	3.6	12
23.0	18.5	20.4	392	328	357	440	344	381	94.8	69.9	84.8	42.3	27.1	36.5	2.1	1.3	1.8	4.2	2.1	3.3	13
22.0	17.5	19.7	408	272	342	456	352	403	94.8	72.8	86.1	40.8	31.2	36.8	2.2	1.2	1.8	4.4	2.4	3.5	14
25.0	18.0	22.3	456	328	373	528	392	458	106.7	74.5	94.8	42.3	36.6	39.4	2.4	1.9	2.2	5.5	3.7	4.5	15
		22.2			364			405			85.9			38.9			1.9			4.1	

TABLE LXIV

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL D

Riehle Compression, lb. Across Max.	Min.	Av.	Elmendorf Tear, g./sheet In Max.	Min.	Av.	Across Max.	Min.	Av.	Amthor Tensile, lb./in. In Max.	Min.	Av.	Across Max.	Min.	Av.	Amthor Stretch, % In Max.	Min.	Av.	Across Max.	Min.	Av.	Roll
27.0	20.5	23.3	408	288	355	392	336	374	76.4	53.2	65.3	49.9	27.8	41.9	2.2	1.2	1.8	4.0	2.0	3.1	1
24.0	17.5	21.4	392	296	336	424	344	392	84.1	65.7	74.9	41.6	24.7	36.0	2.3	1.5	1.8	4.0	1.0	3.0	2
25.0	20.5	22.9	424	328	383	408	320	349	74.5	45.7	65.0	47.4	35.6	42.0	2.2	1.2	1.8	4.0	2.2	3.1	3
23.0	17.5	21.1	416	328	375	384	304	347	70.4	45.7	59.3	51.1	29.8	41.3	2.0	1.1	1.6	4.0	1.4	2.8	4
24.5	19.5	21.6	448	344	391	472	360	415	80.6	59.6	69.7	44.0	27.6	39.8	2.8	1.4	1.9	4.0	1.5	3.2	5
25.5	20.0	22.2	480	336	407	512	392	442	82.4	58.2	72.7	46.0	32.7	38.7	3.5	1.5	2.0	4.7	2.1	3.6	6
27.0	22.0	23.8	440	320	384	456	320	366	80.1	58.1	68.5	48.8	27.8	42.1	3.4	1.4	1.8	4.9	1.7	3.7	7
26.5	19.0	23.4	376	312	344	424	312	373	82.6	64.8	71.5	44.4	33.5	40.0	2.0	1.1	1.5	5.3	2.2	3.8	8
28.0	21.5	24.7	536	288	369	456	336	406	80.6	58.1	70.9	43.8	35.7	40.3	2.6	1.2	1.7	3.9	2.6	3.3	9
29.5	19.0	23.8	376	264	320	432	304	348	82.4	63.5	74.0	44.5	26.2	37.5	2.2	1.5	1.9	5.5	1.3	4.0	10
24.5	21.0	22.7	400	288	334	384	296	341	84.3	64.0	76.2	45.4	32.2	38.5	2.4	1.2	1.9	5.6	2.6	4.3	11
29.5	21.5	24.7	424	336	378	376	320	345	67.4	53.5	61.5	54.7	35.2	46.6	2.4	1.3	2.0	4.6	1.9	3.3	12
25.0	18.0	21.8	368	280	332	368	288	335	83.0	57.6	70.4	49.3	34.5	43.7	2.4	1.1	2.0	4.3	1.5	3.5	13
22.5	17.0	20.4	352	280	310	416	304	361	78.7	63.7	70.8	38.4	25.1	33.0	2.3	1.6	1.9	4.1	1.5	3.1	14
24.0	19.5	21.4	400	344	366	448	360	399	84.7	62.6	75.5	42.7	29.8	38.5	2.5	1.3	2.1	4.2	1.6	3.1	15
27.5	19.0	23.3	464	344	374	464	368	409	84.7	62.6	72.3	47.1	34.9	41.2	2.5	1.7	2.2	5.4	2.8	4.3	16
25.5	21.0	22.5	400	328	357	424	344	382	83.0	67.7	74.0	43.2	30.3	37.5	2.6	1.8	2.3	4.3	1.8	3.2	17
23.0	18.0	20.4	416	328	370	464	336	387	71.1	62.6	67.6	38.3	30.8	34.6	2.4	1.6	2.0	4.9	2.5	3.8	18
23.5	18.0	21.4	392	328	360	440	360	402	86.3	67.7	74.3	44.0	26.6	38.7	3.2	1.7	2.2	5.2	1.6	3.7	19
25.0	21.0	22.4	408	320	358	424	320	372	77.9	66.0	70.4	43.5	28.4	39.3	2.6	1.9	2.3	5.5	1.8	4.1	20
26.0	21.0	22.7	400	320	362	424	360	398	84.7	66.0	74.3	42.3	30.0	37.3	2.6	1.9	2.3	4.9	1.8	3.8	21
		22.5			360			378			70.4			39.5			2.0			3.5	

TABLE LXV

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL E

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
117084/86	1	45.1	44.7	44.9	18.2	16.3	17.3	31.1	13.4	6.1	9.0	63	42	52	29	26	28	25.0	19.5	22.0
117087/89	2	45.2	43.9	44.6	18.7	16.4	17.8	30.1	5.4	5.0	5.2	72	41	58	32	24	28	27.5	21.5	24.3
117126/28	3	43.0	41.4	42.5	14.8	13.0	14.0	36.4	9.0	8.2	8.5	119	66	92	34	29	31	32.0	22.0	25.0
117399/401	4	44.5	43.0	43.8	16.8	15.5	16.1	32.6	10.2	8.3	9.0	110	81	97	38	32	36	35.5	24.5	29.7
117402/04	5	44.0	42.3	43.0	17.0	15.2	16.0	32.2	7.4	6.1	6.9	113	66	92	38	31	35	35.0	26.0	30.4
117405/07	6	44.2	42.8	43.3	16.8	15.0	15.9	32.7	8.9	6.2	7.5	119	76	98	38	32	34	32.5	25.0	28.7
117408/10	7	45.0	43.2	44.2	16.0	14.8	15.5	34.2	7.7	5.8	6.8	128	84	105	42	34	38	36.0	26.0	30.9
117411/13	8	42.9	41.1	41.7	16.2	15.0	15.4	32.5	8.1	6.2	7.3	122	84	104	39	33	36	32.0	24.0	28.8
117592/94	9	43.0	42.8	42.9	15.0	13.5	14.3	36.0				126	80	106	46	37	39	33.0	24.0	28.5
117595/97	10	44.1	42.9	43.6	15.9	14.4	15.2	34.4				126	80	103	41	35	39	30.5	20.5	26.4
117598/600	11	43.1	41.6	42.4	15.8	15.0	15.3	33.3				120	81	96	41	35	37	29.5	24.0	27.5
Average				43.4			15.7	33.2			7.5			91			35			27.5

TABLE LXVI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL F

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
118066/68	1	41.5	40.5	41.1	14.1	11.8	13.5	36.5	11.8	9.9	10.7	117	80	98	48	35	39	28.5	18.5	24.3
118069/71	2	42.9	41.3	42.4	14.7	12.1	13.9	36.6	12.9	10.3	11.4	119	66	96	39	34	37	26.0	17.5	21.5
118072/74	3	38.5	36.0	37.5	14.0	12.2	13.1	34.3	9.3	7.7	8.7	93	55	76	32	24	28	25.5	20.0	22.3
118075/77	4	42.8	40.8	41.6	14.0	12.7	13.5	37.0	12.0	10.2	11.1	96	57	75	41	28	32	24.0	19.0	21.6
118108/10	5	40.1	38.7	39.3	13.6	12.3	13.0	36.3	11.8	8.8	10.3	109	68	83	32	26	29	26.5	19.0	23.7
118111/13	6	40.0	39.0	39.4	13.8	12.5	13.4	35.3	8.1	7.5	7.8	97	58	78	34	25	31	25.5	20.0	23.2
118114/16	7	38.0	36.2	36.9	13.1	12.0	12.6	35.1	12.6	7.2	9.5	93	58	76	30	26	28	25.5	21.0	23.3
118117/19	8	40.5	39.3	40.0	14.1	13.0	13.7	35.0	11.5	9.3	10.5	118	79	97	41	32	37	28.0	21.0	23.4
118120/22	9	41.1	39.9	40.5	14.0	11.6	13.5	36.0	11.4	9.7	10.6	116	75	95	46	26	37	29.5	24.0	26.9
118123/25	10	39.1	37.3	38.4	14.0	13.1	13.5	34.1	10.5	8.5	9.5	94	57	74	33	23	29	25.5	18.5	22.6
Average				39.7			13.4	35.6			10.0			85			33			23.3

TABLE LXVII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL G

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G E. Puncture, units			Riehle Compression, lb. In		
		Max	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
117245/47	1	42.9	42.0	42.6	16.1	14.9	15.5	33.0	7.7	6.8	7.3	114	66	93	40	34	37	30.5	22.0	27.4
117248/50	2	42.9	42.1	42.5	16.2	15.5	15.9	32.1	5.5	4.4	4.9	109	55	87	45	35	38	30.5	23.0	26.7
117251/53	3	42.1	41.9	42.0	16.1	15.3	15.8	31.9	7.8	7.1	7.4	107	72	88	39	34	37	28.0	22.5	25.7
117254/56	4	42.4	41.0	41.7	16.1	15.3	15.7	31.9	7.2	6.3	6.8	114	69	85	39	34	37	29.0	24.5	26.1
117257/59	5	42.8	41.8	42.2	16.2	15.4	15.9	31.8	8.7	7.3	8.1	109	65	92	40	35	38	30.0	21.0	25.5
117263/65	6	41.4	40.9	41.2	16.5	15.6	16.1	30.7	7.2	4.3	5.8	107	63	89	43	33	36	33.5	24.5	28.8
117272/74	7	41.9	41.5	41.7	16.8	15.9	16.2	30.9	8.4	6.3	7.0	113	72	92	42	36	38	32.5	25.0	28.1
117320/22	8	42.6	41.5	42.0	15.6	14.1	15.0	33.6	10.8	10.3	10.5	129	84	106	40	36	38	32.0	26.0	28.8
117393/95	9	41.7	41.3	41.5	16.2	15.0	15.5	32.1	8.4	7.9	8.2	127	61	97	39	33	36	34.5	25.0	28.9
117396/98	10	42.4	41.3	41.7	16.0	14.8	15.2	32.9	8.0	4.0	6.3	122	60	95	38	32	35	38.0	23.5	27.9
117480/82	11	44.0	42.7	43.3	15.9	14.6	15.3	34.0	7.5	6.5	6.9	120	65	88	47	41	44	35.0	22.5	27.4
117483/85	12	40.4	39.8	40.2	16.0	14.8	15.3	31.5	6.3	5.2	5.8	122	68	91	42	35	39	33.0	25.0	28.1
117486/88	13	42.0	41.3	41.6	15.9	14.9	15.3	32.6	6.8	4.0	5.5	101	49	79	41	36	39	29.0	23.0	25.6
117489/91	14	43.2	41.7	42.6	16.3	15.6	16.0	31.9	8.3	6.1	7.3	103	72	88	42	33	36	32.0	25.5	28.8
117492/94	15	42.0	40.3	41.0	15.5	14.5	15.0	32.8	8.8	6.6	7.9	114	78	94	38	34	37	29.5	24.0	26.6
Average				41.9			15.6	32.2			7.0			91			38			27.4

TABLE LXV

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL E

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
20.5	14.5	17.5	304	224	274	344	240	278	66.5	42.3	54.0	35.2	25.1	29.9	1.4	0.9	1.2	5.4	1.5	2.7	1
21.5	16.0	18.6	320	240	271	320	240	282	65.9	53.3	60.5	33.5	19.6	29.6	1.5	0.9	1.3	3.9	1.3	2.9	2
21.5	16.5	18.7	328	288	314	400	312	349	88.0	64.7	75.7	38.6	29.8	34.5	1.9	1.2	1.6	4.8	2.3	3.7	3
23.5	19.5	21.2	352	280	313	440	344	375	96.5	72.8	84.9	36.9	27.9	32.9	2.2	1.5	1.9	4.9	2.3	3.7	4
25.0	17.5	20.9	352	232	303	416	320	362	94.8	65.7	82.3	37.4	27.4	33.3	2.0	1.1	1.7	5.6	2.2	3.6	5
24.0	18.0	21.7	360	288	317	400	352	380	98.2	76.2	88.0	36.1	25.7	33.2	2.3	1.7	1.9	4.7	1.8	3.8	6
24.0	18.5	22.4	392	200	331	480	328	385	96.5	69.4	84.3	38.4	29.8	33.8	2.3	1.7	2.0	5.4	2.5	3.8	7
22.5	17.5	20.3	400	184	317	400	296	369	96.5	79.6	89.9	35.6	26.2	32.6	2.3	1.8	2.1	5.3	2.3	4.0	8
25.5	20.0	22.7	432	320	362	528	352	404	88.0	68.2	78.9	44.4	28.1	38.4	2.3	1.4	2.0	5.3	1.9	4.0	9
24.0	18.0	21.8	472	352	400	480	384	427	91.4	64.3	76.7	46.2	31.7	40.8	2.3	1.3	2.0	5.2	1.9	4.0	10
24.0	18.0	21.2	456	192	361	448	352	403	84.7	62.6	72.7	44.7	34.9	38.5	2.2	1.4	1.9	5.2	2.9	3.8	11
		20.6			324			365			77.1			34.3			1.8			3.6	

TABLE LXVI

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL F

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
21.5	14.0	18.4	400	304	338	440	368	404	78.7	62.0	71.2	42.3	33.7	38.7	2.3	1.4	2.0	3.9	2.5	3.1	1
26.0	15.0	18.9	416	296	335	408	304	370	79.6	64.3	71.4	42.8	25.7	35.9	2.2	1.5	2.0	4.7	1.4	2.9	2
21.0	13.5	16.5	304	232	270	352	272	310	70.6	52.7	63.9	30.1	23.7	27.5	2.0	1.3	1.7	4.2	2.6	3.4	3
20.5	15.0	18.0	320	248	283	384	272	334	71.6	59.1	67.0	31.8	26.9	29.5	2.2	1.4	1.8	3.6	2.6	3.1	4
22.5	17.0	19.8	352	216	279	368	280	325	69.4	53.8	63.6	36.4	26.6	32.8	2.4	1.2	2.0	4.2	1.8	3.0	5
21.5	18.0	19.7	328	256	292	368	288	320	67.6	53.0	61.1	37.8	30.5	33.8	2.4	1.6	2.0	3.8	2.4	3.1	6
21.0	17.0	19.9	296	224	262	336	240	285	68.1	52.3	60.3	38.1	28.8	33.3	2.3	1.4	1.9	3.7	2.1	3.0	7
22.5	17.5	19.9	384	296	338	416	336	379	80.8	63.3	72.0	39.1	28.4	35.2	2.4	1.3	2.0	4.0	2.0	3.0	8
22.5	15.5	19.8	400	288	348	432	336	369	83.5	64.2	74.0	40.5	32.0	36.0	2.5	1.5	2.0	4.0	2.3	3.1	9
18.0	12.0	16.0	320	232	276	376	280	333	67.4	50.8	62.3	31.0	22.5	26.9	2.1	1.5	1.9	3.8	2.0	3.0	10
		18.7			302			343			66.7			33.0			1.9			3.1	

TABLE LXVII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL G

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
29.0	19.5	23.6	424	336	373	528	376	429	86.3	69.4	76.0	44.4	37.1	41.4	2.0	1.0	1.7	4.0	2.3	3.1	1
26.0	22.0	23.2	432	320	382	456	360	413	83.0	67.7	73.5	45.4	35.6	40.8	1.8	1.0	1.4	3.8	2.2	2.9	2
24.0	20.0	22.3	456	336	382	504	352	426	83.0	67.7	73.0	45.2	35.6	41.7	1.9	1.2	1.6	4.4	2.0	3.1	3
24.5	18.5	22.0	440	352	392	480	384	420	84.7	66.0	73.5	45.4	35.6	41.9	1.8	1.2	1.5	3.5	1.6	2.8	4
24.5	18.5	22.0	424	352	390	456	384	423	86.3	69.4	74.7	46.2	35.7	40.7	1.8	1.1	1.5	3.8	2.2	2.8	5
24.0	18.5	21.8	416	320	377	440	360	399	79.6	64.3	71.5	41.8	32.8	37.1	2.3	1.6	2.0	5.1	2.8	4.0	6
27.0	21.0	23.8	496	328	394	528	368	436	81.3	62.6	72.3	45.7	33.7	40.8	2.2	1.6	2.0	5.0	2.7	3.8	7
28.0	23.5	25.3	416	344	377	464	368	405	77.9	60.1	70.7	57.6	45.4	50.6	4.0	1.4	2.0	4.4	2.8	3.7	8
28.5	24.0	25.7	448	344	383	424	336	375	79.6	60.9	71.6	49.9	37.2	44.7	2.7	1.6	2.0	5.2	3.2	4.3	9
31.0	23.5	26.2	448	336	381	440	344	382	82.3	56.5	70.0	53.2	33.9	44.4	2.4	1.5	2.0	5.9	2.5	4.2	10
25.5	20.0	23.1	440	344	394	472	360	424	83.5	61.3	73.9	42.7	33.7	37.9	2.4	0.9	1.8	6.0	3.2	4.0	11
26.0	22.0	23.7	416	320	364	528	360	407	81.9	60.3	70.8	42.7	30.8	38.6	2.0	1.3	1.6	4.9	2.0	3.6	12
24.0	20.0	22.1	440	320	383	448	376	410	81.8	56.4	69.7	38.4	31.7	35.7	1.7	0.9	1.4	3.9	2.1	3.3	13
30.0	23.5	26.8	456	328	382	384	312	358	83.0	62.6	70.3	57.1	42.7	48.4	2.0	1.4	1.8	5.1	3.0	4.1	14
27.0	22.5	24.1	384	328	353	432	328	371	83.0	62.6	72.5	50.1	36.9	42.8	2.1	1.4	1.8	5.6	2.9	4.3	15
		23.7			380			405			72.3			41.8			1.7			3.6	

TABLE LXVIII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

Mill H

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
116396/98	1	45.0	44.0	44.5	16.4	15.0	15.7	34.0	9.5	8.3	8.8	131	80	112	45	39	42	34.0	25.0	29.7
116399/401	2	45.7	43.7	44.6	16.9	15.9	16.5	32.4	9.7	8.7	9.4	122	73	96	46	38	42	30.5	25.0	27.0
117039/41	3	42.6	41.6	42.1	15.6	14.5	15.2	33.2	8.3	7.7	8.1	129	91	107	38	36	37	35.0	29.5	32.4
117042/44	4	41.9	41.0	41.5	15.6	14.8	15.2	32.8	9.4	8.5	9.0	130	72	103	38	32	35	37.0	24.5	29.7
117045/47	5	42.7	41.4	42.2	16.9	15.6	16.4	30.9	8.3	5.6	7.1	129	84	108	43	31	35	40.0	31.0	34.8
117048/50	6	42.3	41.2	41.6	16.5	15.2	15.9	31.4	8.5	7.2	7.7	122	78	105	44	33	36	35.0	28.0	31.3
117051/53	7	43.3	41.5	42.4	17.0	15.2	16.4	31.0	7.5	5.2	6.7	124	71	101	40	33	37	36.0	29.0	32.1
117607/09	8	42.4	41.7	42.0	16.4	15.7	16.1	31.3	7.2	5.7	6.3	136	90	110	38	33	36	31.5	26.5	28.6
117610/12	9	42.8	42.0	42.3	16.0	15.0	15.6	32.5	9.9	8.3	8.9	133	90	115	38	32	35	33.0	28.0	30.9
117613/15	10	43.2	42.2	42.7	16.2	15.3	15.8	32.4	9.8	7.9	8.8	143	84	111	41	33	38	33.0	26.5	30.2
117616/18	11	43.6	42.5	42.9	16.3	15.6	15.9	32.4	9.1	7.5	8.5	128	81	108	41	35	38	35.0	26.0	30.5
117619/21	12	43.2	41.9	42.8	16.4	15.6	16.1	31.9	9.8	6.4	7.8	148	80	107	42	35	38	33.5	29.0	30.8
117622/24	13	42.1	41.5	41.9	16.2	15.5	15.9	31.6	8.9	7.4	8.1	123	86	108	41	33	37	33.0	27.5	30.1
117625/27	14	42.7	41.6	42.3	16.0	15.1	15.6	32.5	8.5	6.3	7.4	135	82	114	38	33	36	34.5	27.0	31.1
Average				42.6			15.9	32.2			8.0			108			37			30.7

TABLE LXIX

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

Mill I

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
116732/34	1	43.0	41.8	42.5	15.9	14.9	15.3	33.3	9.1	8.3	8.7	128	93	111	42	37	40	33.5	23.5	30.5
116738/40	2	43.4	41.8	42.7	15.9	14.7	15.1	33.9	9.4	8.2	8.9	137	90	107	45	40	42	33.0	23.0	28.7
116741/43	3	43.1	41.6	42.5	15.9	14.4	15.3	33.3	8.7	8.4	8.5	147	85	109	45	40	42	31.5	26.0	28.7
116910/12	4	44.6	42.9	43.9	15.7	14.6	15.1	34.9	7.5	6.6	7.0	130	84	106	45	37	40	34.0	23.5	29.0
116913/15	5	44.2	42.6	43.5	15.8	14.3	15.2	34.3	7.7	6.1	7.1	124	86	105	45	37	41	31.5	21.5	26.7
116928/30	6	43.4	42.4	43.1	15.9	14.9	15.5	33.4	7.1	6.4	6.9	133	81	108	45	37	41	33.0	25.0	29.5
116943/45	7	44.2	42.6	43.5	16.1	14.8	15.5	33.7	7.5	6.3	7.0	129	80	104	45	37	41	35.0	25.5	30.0
116946/48	8	42.6	41.3	42.1	15.8	14.4	15.2	33.2	7.0	6.0	6.5	129	76	102	42	37	39	32.0	26.0	29.2
117423/25	9	43.8	42.7	43.4	16.1	15.0	15.5	33.6	10.3	9.8	10.0	132	83	106	43	37	40	34.0	25.5	29.9
117426/28	10	43.7	42.7	43.2	16.0	15.0	15.5	33.4	9.9	8.3	8.9	133	82	109	44	38	40	34.5	26.0	29.8
117429/31	11	44.6	42.7	43.6	15.9	13.8	15.3	34.2	9.0	8.5	8.8	131	96	114	43	38	41	35.0	27.0	31.0
117432/34	12	44.4	43.1	43.8	16.1	15.1	15.7	33.5	10.1	9.2	9.6	129	95	109	42	37	40	34.5	27.5	30.0
117435/37	13	44.0	42.5	43.3	16.7	15.1	15.9	32.7	10.5	8.0	9.4	126	77	100	45	38	41	33.0	26.0	29.7
117471/73	14	43.5	42.2	42.8	15.1	13.9	14.7	34.9	10.5	8.8	9.7	139	91	119	43	37	39	33.5	29.0	31.2
117474/76	15	45.9	45.1	45.4	15.9	14.5	15.1	36.1	11.5	9.7	10.8	147	94	121	46	39	42	39.0	27.0	32.3
117477/79	16	46.0	44.5	45.0	15.7	14.6	15.3	35.3	11.9	10.9	11.4	128	71	112	45	38	42	35.0	29.0	32.1
117495/97	17	42.7	42.4	42.6	15.6	14.4	15.0	34.1	9.0	7.6	8.2	120	67	104	42	35	38	35.0	30.0	32.1
117498/500	18	45.1	44.1	44.5	15.6	14.1	14.9	35.8	7.7	6.5	7.3	133	82	110	46	40	42	39.0	33.0	35.5
117501/03	19	43.7	42.6	43.3	15.2	14.1	14.9	34.9	6.7	6.3	6.6	142	91	107	47	38	42	42.0	27.5	34.5
117504/06	20	44.0	43.8	43.9	15.9	14.7	15.3	34.4	8.6	7.8	8.1	124	88	110	48	39	43	41.0	28.0	33.6
117507/09	21	45.6	44.0	45.0	16.4	15.0	15.6	34.6	8.5	6.4	7.6	143	85	108	46	40	43	40.0	30.0	34.5
117510/12	22	44.8	43.6	44.1	16.1	14.8	15.6	33.9	9.7	7.5	8.4	141	81	110	49	41	44	37.0	25.0	30.3
Average				43.5			15.3	34.2			8.4			109			41			30.9

TABLE LXVIII

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL H

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min	Av.	Roll
27.5	20.5	25.4	536	400	449	504	392	452	88.0	60.9	73.5	56.5	28.1	47.8	2.9	2.0	2.5	5.2	1.3	3.8	1
27.0	20.5	24.5	528	424	481	512	360	427	71.1	54.2	62.7	58.7	33.4	50.3	3.9	1.6	2.3	5.8	2.1	4.4	2
32.0	21.0	25.7	424	352	390	472	352	400	91.4	57.4	69.2	53.5	36.9	45.7	3.3	1.4	2.0	5.9	2.1	4.4	3
29.0	23.5	25.4	432	352	397	424	344	371	73.0	54.0	63.9	58.7	41.6	49.7	2.7	1.5	2.0	5.8	2.3	4.5	4
29.5	23.5	26.1	384	304	340	472	352	405	93.1	69.4	80.0	48.4	36.1	42.5	2.5	1.2	2.1	5.2	2.4	3.7	5
25.5	19.0	22.8	392	296	339	464	320	391	96.5	63.1	79.5	45.4	33.0	39.1	2.7	1.3	2.1	5.0	2.9	4.0	6
25.0	18.0	22.7	400	288	346	488	360	405	84.3	67.0	75.9	41.8	33.7	37.7	2.6	1.5	1.9	4.6	2.5	3.6	7
26.0	20.5	23.9	416	328	373	440	336	389	93.1	67.7	80.5	48.9	28.1	40.9	2.5	1.6	2.3	5.7	1.6	3.9	8
26.5	21.5	24.4	384	320	360	424	344	393	96.5	66.0	80.9	48.1	31.7	41.7	2.7	1.9	2.4	5.4	2.2	4.3	9
26.0	20.0	23.8	432	336	378	432	352	400	93.1	69.4	80.8	45.7	31.5	39.2	2.8	1.8	2.4	5.7	2.3	3.8	10
26.5	21.0	23.7	424	352	391	464	352	409	96.5	57.6	80.0	46.0	34.5	41.0	2.8	1.2	2.3	5.8	2.6	4.1	11
28.5	23.0	24.8	408	312	375	448	360	406	93.1	71.1	82.1	45.4	32.2	40.2	2.7	2.0	2.4	5.4	2.1	3.8	12
28.0	22.0	25.0	424	336	380	512	376	431	94.8	67.7	79.1	47.4	32.2	41.3	2.7	1.7	2.3	5.5	2.5	4.4	13
27.0	23.5	25.4	464	368	406	472	368	420	91.4	49.1	73.7	45.5	29.8	40.3	2.9	1.3	2.3	6.0	2.0	4.2	14
		24.5			386			407			75.8			42.7			2.2			4.1	

TABLE LXIX

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL I

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Mxa.	Min.	Av.	Roll
26.5	17.5	22.4	464	360	418	568	400	468	103.3	79.6	90.9	41.8	29.1	36.6	2.3	1.7	2.0	5.7	1.6	4.2	1
26.5	16.0	21.2	480	392	428	592	416	473	98.2	72.8	88.2	42.8	28.8	37.9	2.5	1.1	2.0	6.0	2.2	4.3	2
23.5	17.5	20.6	496	368	422	624	448	506	98.2	77.9	88.4	41.3	32.0	37.7	2.4	1.6	2.1	7.2	2.8	4.6	3
25.5	17.0	20.8	512	392	434	496	448	470	98.2	72.8	88.5	40.8	33.0	37.1	3.6	1.7	2.3	5.7	2.7	4.2	4
24.0	15.0	20.3	464	360	411	544	416	462	101.6	76.2	86.3	41.0	27.1	35.8	2.6	1.9	2.2	6.2	1.5	4.1	5
24.5	19.5	22.5	456	360	401	560	400	462	94.8	74.5	85.3	44.2	33.5	38.0	3.7	1.7	2.2	5.9	2.6	4.3	6
25.5	18.0	20.4	456	368	408	576	424	487	96.5	77.9	87.5	41.1	31.5	35.3	3.0	1.8	2.2	6.4	2.8	4.3	7
24.5	17.0	21.5	456	376	407	488	408	443	85.3	67.4	78.6	42.0	30.5	36.6	2.4	1.2	2.0	6.7	2.8	4.5	8
25.0	20.0	21.9	520	352	411	520	368	442	91.4	69.4	81.9	41.8	30.5	37.1	2.6	1.8	2.2	6.5	2.5	4.3	9
23.0	16.5	20.4	448	360	405	536	400	463	93.1	72.8	83.9	41.6	29.6	36.5	2.8	1.8	2.2	6.4	3.2	4.5	10
27.0	20.5	23.7	424	352	390	536	432	466	91.4	76.2	85.5	41.1	33.5	37.2	2.7	1.9	2.3	6.4	3.1	4.7	11
25.0	20.0	22.3	496	352	422	592	400	470	88.0	67.7	80.5	44.4	30.3	37.0	2.8	1.7	2.3	6.4	1.9	4.4	12
26.5	21.0	23.6	472	336	390	488	416	458	86.3	69.4	78.4	40.3	29.5	35.3	2.5	1.7	2.2	6.8	2.7	4.3	13
24.0	20.0	22.1	432	328	394	520	408	474	93.1	72.8	83.5	42.3	27.6	36.3	3.1	1.9	2.6	6.9	2.6	5.3	14
26.5	18.0	22.2	488	392	431	544	456	497	91.4	72.8	84.2	42.8	28.8	37.8	3.1	2.2	2.6	6.7	2.0	5.1	15
24.0	17.0	21.9	480	320	416	544	440	491	94.8	52.5	85.6	44.0	30.5	38.3	3.2	1.5	2.6	6.1	2.2	4.8	16
21.0	15.0	18.6	440	304	366	464	368	430	94.8	66.0	82.5	45.0	27.8	35.1	2.7	1.6	2.3	6.1	2.4	4.4	17
24.0	19.5	21.9	464	336	391	504	400	453	99.9	76.2	89.6	41.1	31.0	36.5	3.0	1.9	2.5	6.3	2.5	4.6	18
24.5	19.5	22.1	488	352	416	504	416	451	98.2	79.6	86.9	41.8	32.7	36.3	2.7	1.8	2.2	5.8	3.1	4.5	19
28.5	20.0	22.0	464	368	412	488	416	454	98.2	71.1	87.0	44.5	26.1	38.0	2.6	1.9	2.3	6.4	2.2	4.5	20
28.0	19.0	22.0	496	352	411	544	408	443	106.7	76.2	92.2	38.4	29.1	35.4	2.9	1.9	2.3	6.0	2.4	4.4	21
30.0	20.0	24.1	472	360	401	576	400	469	96.5	69.4	83.4	44.5	30.8	37.9	2.7	1.8	2.2	6.3	1.9	4.6	22
		21.8			408			465			85.4			36.8			2.3			4.5	

TABLE LXX

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

MILL J

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
116857/59	1	39.9	39.4	39.7	15.6	14.1	14.9	32.0	11.1	6.4	8.7	98	62	77	35	29	31	32.0	25.0	28.2
116860/62	2	43.6	43.1	43.4	14.8	11.8	13.3	39.2	9.6	7.0	8.6	107	65	88	32	28	31	35.0	21.5	27.9
116863/65	3	42.2	41.4	41.9	16.0	15.0	15.4	32.6	8.2	6.7	7.6	113	72	97	37	32	34	32.5	25.0	28.9
116866/68	4	42.1	40.9	41.5	15.9	14.5	15.3	32.5	9.7	6.9	8.4	121	81	99	35	30	33	33.5	25.5	29.5
116869/71	5	41.7	40.4	41.1	15.4	13.9	14.6	33.8	8.6	7.7	8.1	112	64	82	32	25	29	36.5	25.0	30.2
116984/86	6	41.5	41.3	41.4	16.0	14.8	15.2	32.7	9.1	7.1	8.4	100	68	78	31	25	28	35.0	27.0	30.0
116987/89	7	41.5	41.1	41.2	15.3	13.6	14.6	33.9	8.1	7.7	8.0	110	69	83	33	29	31	36.0	30.0	32.9
116999/7001	8	41.0	39.9	40.5	14.3	13.4	14.0	34.7	11.5	6.5	9.1	94	64	82	32	27	30	35.0	26.5	30.4
117096/98	9	42.2	41.0	41.7	14.9	14.1	14.5	34.5	6.2	4.9	5.7	98	63	79	31	27	29	35.0	29.5	32.2
117099/101	10	40.8	40.4	40.5	15.1	14.2	14.7	33.1	4.9	4.4	4.6	97	66	78	31	25	28	33.0	25.0	29.0
117129/31	11	42.1	41.8	41.9	16.0	14.6	15.2	33.1	8.8	6.8	7.7	124	72	96	37	31	34	36.0	26.5	30.6
117152/54	12	42.6	41.2	42.1	15.7	14.5	15.2	33.2	7.1	5.2	6.0	101	63	83	33	27	30	33.0	27.0	29.9
117155/57	13	42.0	41.8	41.9	15.5	14.7	15.1	33.3	8.2	6.7	7.5	106	80	92	32	27	30	33.5	29.5	31.7
117158/60	14	41.6	41.4	41.5	15.5	14.4	14.9	33.4	6.6	6.0	6.2	103	64	87	32	27	30	34.0	24.5	29.4
117161/63	15	42.4	41.0	41.7	15.5	14.5	14.9	33.6	8.9	7.7	8.2	121	75	100	33	30	31	37.0	30.5	33.4
117164/66	16	41.4	41.0	41.2	15.2	14.5	14.9	33.2	8.4	6.0	7.4	122	86	103	33	28	30	35.5	29.0	31.7
117305/07	17	42.8	42.6	42.7	14.9	14.2	14.6	35.1	9.4	7.5	8.4	124	68	106	46	37	39	36.0	28.0	31.2
117308/10	18	43.0	42.5	42.8	14.8	14.0	14.5	35.4	8.6	5.1	6.5	130	90	111	41	34	38	34.5	28.0	31.1
117311/13	19	42.5	41.7	42.2	14.6	13.6	14.1	35.9	9.7	9.2	9.4	140	85	109	41	35	38	38.5	25.0	30.5
117314/16	20	42.8	41.8	42.4	14.3	13.4	14.0	36.3	9.3	4.0	7.2	147	67	105	42	34	38	34.0	24.0	30.0
117317/19	21	42.6	41.8	42.2	14.6	13.7	14.1	35.9	11.4	8.5	10.2	123	83	108	42	34	38	38.5	25.5	30.3
Average				41.7			14.7	34.2			7.7			93			32			30.4

TABLE LXXI

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL S

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
117275/77	1	28.0	27.0	27.5	10.0	9.0	9.6	34.4	5.3	1.6	3.4	96	49	72	23	18	21	22.0	16.0	19.5
117278/80	2	28.1	27.2	27.8	10.2	9.4	9.9	33.7	7.2	5.2	6.2	85	46	66	22	19	20	26.0	17.0	21.2
117281/83	3	28.0	27.0	27.6	10.1	9.4	9.7	34.1	7.0	6.1	6.4	78	44	64	21	18	20	22.5	17.0	19.7
117323/25	4	27.6	26.6	27.1	10.9	10.0	10.5	31.0	12.0	11.1	11.5	95	54	71	23	19	21	26.0	14.5	19.7
117326/28	5	27.6	26.8	27.3	10.8	9.9	10.3	31.8	11.0	8.3	9.6	99	55	69	23	19	21	24.5	16.0	19.8
117329/31	6	28.0	26.2	27.1	10.7	9.4	10.1	32.2	10.7	8.9	9.8	95	43	71	23	19	21	22.0	16.0	18.5
117332/34	7	27.2	26.8	27.0	10.7	10.1	10.3	31.5	13.5	11.1	12.3	85	43	64	23	19	21	21.0	17.5	19.0
117335/37	8	27.6	26.6	27.2	10.6	10.1	10.4	31.4	12.0	11.8	11.9	86	45	70	21	18	19	21.5	17.0	19.4
117414/16	9	27.9	27.5	27.7	10.8	9.8	10.3	32.3	9.1	2.5	4.9	84	52	69	23	19	21	22.5	17.0	19.4
117417/19	10	27.2	26.4	26.8	10.5	9.8	10.1	31.8	10.0	7.3	8.5	84	50	67	21	18	19	20.5	16.0	18.4
Average				27.3			10.1	32.4			8.5			68			20			19.5

TABLE LXX

PHYSICAL CHARACTERISTICS OF 42-LB. D.F.B.S. FOURDRINIER KRAFT LINER

Mill J

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
27.0	23.5	24.9	384	256	320	384	280	339	67.0	51.1	59.1	45.2	30.8	38.3	2.9	1.2	1.9	4.7	1.6	3.1	1
25.0	18.0	21.6	376	248	288	400	288	344	78.7	58.7	70.6	37.2	31.5	34.3	2.6	1.1	1.7	3.6	2.0	2.8	2
26.5	19.5	23.8	408	240	319	456	320	378	83.3	69.1	76.5	42.3	33.9	38.2	2.3	1.6	2.0	4.0	1.9	2.8	3
27.5	22.0	24.1	392	256	324	408	320	368	83.5	63.5	75.5	42.8	35.6	38.2	2.4	1.4	2.0	3.5	2.0	2.7	4
25.0	20.5	22.4	320	232	277	384	288	334	75.3	60.9	68.8	38.1	30.8	34.4	2.5	1.2	1.6	3.0	1.7	2.4	5
28.5	21.0	24.1	296	184	247	344	240	294	69.4	55.9	64.2	37.4	26.6	33.5	2.9	1.7	2.1	3.0	1.0	2.4	6
26.0	20.5	22.6	336	232	288	384	272	324	78.0	62.6	69.2	34.5	27.9	32.0	2.4	1.3	2.0	3.8	2.0	3.0	7
27.5	19.5	23.4	320	224	274	368	272	313	77.7	58.4	68.5	36.9	29.6	33.1	2.5	1.3	2.1	4.6	2.6	3.3	8
25.0	20.5	22.7	272	208	236	360	256	291	74.0	59.4	68.2	36.7	30.6	33.6	2.3	1.5	1.9	4.2	2.0	3.1	9
29.5	22.0	24.3	256	168	214	304	240	276	73.1	58.4	66.8	39.3	27.1	34.1	2.3	1.6	2.0	3.4	1.8	2.5	10
26.5	19.0	22.7	328	248	290	400	328	370	84.7	63.8	75.7	38.4	30.5	34.3	2.4	1.4	2.0	3.8	1.8	3.0	11
28.5	20.5	24.8	352	256	301	408	296	352	79.6	60.4	68.6	38.4	30.8	34.7	2.3	1.6	2.0	3.3	1.6	2.3	12
26.5	24.0	24.9	352	256	298	352	304	331	76.9	57.6	67.5	43.3	35.7	38.6	2.3	1.5	2.0	3.7	2.3	3.0	13
25.5	22.0	24.2	352	224	302	384	296	339	76.0	59.8	69.2	40.6	31.0	36.6	2.1	1.5	1.8	3.7	2.1	2.9	14
26.5	22.5	24.4	352	280	318	448	352	381	86.3	67.7	77.8	41.3	33.9	36.9	2.6	1.7	2.3	4.5	1.8	3.2	15
26.5	22.0	24.3	360	264	318	416	328	361	94.8	71.1	80.0	39.6	33.0	36.2	2.6	1.8	2.2	4.8	1.9	3.1	16
27.0	21.5	23.7	392	328	362	456	392	423	99.9	79.6	92.2	45.0	33.0	37.2	4.7	1.9	2.4	6.2	3.5	4.3	17
26.0	21.5	23.3	368	320	338	456	352	403	99.9	76.2	92.0	40.6	34.0	37.8	2.8	1.9	2.3	5.8	3.5	4.4	18
25.5	18.0	23.2	368	296	331	424	384	400	93.1	66.0	84.3	40.8	30.5	36.4	2.8	1.8	2.2	6.2	1.9	4.2	19
29.5	20.5	24.8	400	304	344	456	352	412	96.5	62.6	85.8	40.5	31.3	36.1	3.1	1.4	2.3	5.2	2.8	4.3	20
27.0	21.0	23.5	384	304	338	448	376	412	101.6	67.7	90.8	41.8	34.5	39.3	2.6	1.4	2.2	5.5	2.9	4.1	21
		23.7			301			355			74.8			35.9			2.0			3.2	

TABLE LXXI

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill S

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
16.5	11.5	14.8	284	222	250	298	244	268	63.5	41.6	56.8	31.0	24.4	27.9	2.0	1.4	1.7	6.3	2.9	4.6	1
19.0	13.5	15.6	294	226	253	288	254	270	64.3	49.1	57.2	32.2	25.4	28.9	2.4	1.2	1.8	6.2	4.0	5.1	2
16.5	11.0	14.3	278	226	250	288	248	269	67.4	41.1	53.9	32.5	24.2	28.5	2.3	1.2	1.7	7.7	2.9	5.1	3
18.0	12.0	14.4	306	252	281	286	246	269	66.0	41.5	49.7	34.7	23.7	30.1	1.8	1.3	1.6	6.3	2.6	4.8	4
19.0	13.0	15.2	328	260	288	340	240	282	58.9	38.1	50.0	35.0	23.5	29.5	1.8	1.2	1.5	7.0	2.0	4.6	5
19.0	12.5	15.9	282	240	265	364	252	286	62.5	41.5	51.6	36.2	26.2	30.7	2.0	1.3	1.6	6.4	2.6	4.8	6
18.0	13.5	15.6	348	256	279	356	272	300	56.7	39.6	49.6	35.0	27.1	31.6	2.0	1.3	1.6	6.6	2.6	4.8	7
18.0	13.5	16.0	316	262	287	332	256	285	57.1	41.6	49.2	34.9	26.7	31.0	1.9	1.3	1.5	6.5	3.0	4.9	8
18.5	14.5	16.7	284	252	265	308	244	269	60.1	40.6	52.2	37.2	26.2	33.4	1.8	1.1	1.5	5.3	2.6	4.2	9
19.0	14.0	16.4	320	228	263	300	234	261	60.9	46.2	52.8	36.7	26.7	31.9	1.9	1.3	1.7	5.6	3.1	4.5	10
		15.5			268			276			52.3			30.4			1.6			4.7	

TABLE LXXII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill T

Institute File No.	Roll	Basis-Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
118078/80	1	30 9	28.0	29.5	11.9	10.7	11.2	31.6	11.6	9.4	10.8	60	36	47	24	19	22	16 0	11.5	14.2
118081/83	2	30.0	29.2	29.5	13.1	10.7	11.8	30.0	13.8	10.8	12.5	68	31	43	26	18	23	15.5	11.5	13.7
118084/86	3	26.3	25.2	25.9	10.2	8.9	9.5	32.7	14.4	12.4	13.3	74	43	61	22	17	20	22.0	14.0	18.1
118087/89	4	26.8	26.4	26.6	10.1	9.2	9.5	33.6	14.2	11.2	12.9	76	43	63	23	17	20	19.5	14.0	16.9
118090/92	5	27.7	26.0	26.6	10.2	9.4	9.8	32.6	13.0	11.8	12.5	72	42	59	22	17	19	21.0	13.0	16.7
118093/95	6	27.0	25.8	26.4	10.0	9.0	9.7	32.7	12.9	11.9	12.6	75	51	63	23	18	19	22.5	13.0	15.5
118096/98	7	28.3	26.3	27.1	10.4	9.4	9.9	32.8	13 8	9.1	10.8	76	41	55	20	14	18	21.0	13.0	17.1
118099/101	8	27.2	25.2	26.4	10.0	8.7	9.3	34.1	13.1	9.6	11.4	78	47	62	22	17	19	19.0	11.0	15.3
118102/04	9	27.0	24.4	25.9	10.4	9.0	9.7	32.0	12.1	9.5	10.9	74	32	58	23	17	20	20.0	11.0	15.9
118105/07	10	27.4	25.3	26.4	10.0	9.1	9.5	33.3	11.6	10.0	10.7	73	49	60	20	15	18	22.5	11.0	15.8
Average				27.0			10.0	32.5			11.8			57			20			15.9

TABLE LXXIII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill U

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116381/83	1	26.5	26.2	26.3	11.4	9 9	10.7	29.5	12.1	11 0	11.6	88	65	74	22	18	21	20.0	13.0	16.8
116384/86	2	25.4	24.5	25.0	11.5	9.1	9.7	30.9	12.0	10.5	11.3	90	52	70	19	17	18	20.5	12.5	16.6
117024/26	3	27.5	26.3	26.9	11.9	10.7	11.4	28 3	9.2	8.0	8.7	75	55	62	22	17	20	23.0	14.5	19.9
117027/29	4	27 5	26.4	26.9	10 1	9.4	9.9	32.6	9.6	8.1	9.0	71	54	63	23	20	22	24.5	18.0	20.1
117030/32	5	28 0	26.7	27.4	10.3	9.7	10 0	32.9	11.2	6.6	8.3	83	46	61	26	18	22	22.0	14.0	18.6
117033/35	6	27.8	26.8	27.2	12.2	10 7	11.5	28.4	11.8	8.1	9.7	74	54	64	23	18	21	27.0	16.5	21.5
117036/38	7	26.5	25.7	26.2	9.9	9.0	9.4	33.4	9.5	8.9	9.1	70	45	59	22	17	19	24 0	17.5	21.6
117513/15	8	26.8	24 7	26.0	10.8	9.5	10.1	30.9	9 4	7.9	8.8	85	19	65	20	17	19	22.5	17.0	19.3
117516/18	9	27.7	26.2	27.2	11 5	10.1	10.7	30.5	8.3	7.0	7.7	87	55	68	21	18	20	26.5	20.5	23.4
117519/21	10	27.7	26.6	27.1	11.5	9.9	10.4	31.3	10 0	9.0	9.4	84	55	68	22	16	19	24.0	19.5	22.0
117525/27	11	28.8	26.0	27.6	11.8	10.4	11.2	29.6	8.4	8.1	8.3	89	55	70	21	17	19	25.5	15.5	20.9
117522/24	12	28.8	27.9	28.5	12.0	11.1	11.6	29.5	11.0	7.8	9.5	89	49	66	23	19	21	29 0	15.5	21.1
117780/82	13	26 0	24.0	25.1	11.4	9.9	10.5	28.7	6.4	6.1	6.3	97	42	59	20	15	17	23.5	15.5	19.4
117783/85	14	28.6	27.2	27.8	11.5	10.3	10 9	30.6	7.9	5.5	6.7	76	42	61	23	18	20	24.0	18.5	20.5
117786/88	15	28.4	27.6	28.1	11.4	10.7	11.0	30.6	6.1	5.3	5.8	93	48	67	22	17	21	23.5	14.5	19.1
117789/91	16	27.5	26.4	26.8	10.8	9 9	10.4	30.9	8.0	6.5	7.4	83	23	64	25	18	20	21.0	15.0	18.2
117792/94	17	28.0	27.2	27.6	11.6	10.6	11.0	30.1	9 2	8.1	8.7	73	38	59	23	18	22	22.0	16.5	18.8
117795/97	18	26.2	26.0	26.1	11.2	9.9	10.3	30.4	8.7	6.1	7.6	70	43	54	21	17	19	22 0	14.0	18.1
117995/97	19	26 9	25.4	26.3	12.3	9.8	10 9	28.9	6.3	4.9	5.5	94	59	74	19	15	17	22.5	18.0	20.8
117998/8000	20	28 0	27.1	27.5	12.8	10.9	11.6	28.4	8.4	7.3	7.7	86	57	68	22	18	20	19.5	13 0	17.8
118001/03	21	27.6	26.8	27.3	12.0	10.5	11.4	28.7	9.1	7.9	8.7	86	50	69	23	18	20	21.5	15.0	18.4
Average				26.9			10.7	30.2			8.4			65			20			19.7

TABLE LXXII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill T

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
13.5	10.0	11.6	320	260	292	394	276	326	46.6	27.6	39.0	25.2	16.8	21.4	2.1	1.4	1.7	4.4	2.0	3.2	1
12.5	9.0	11.2	332	240	284	396	272	304	43.7	33.7	37.1	21.5	16.1	19.2	2.0	1.2	1.6	3.9	1.6	2.6	2
19.0	12.0	13.8	250	210	225	252	216	231	57.4	36.2	46.0	28.3	20.1	24.9	2.0	1.0	1.5	5.0	2.4	3.9	3
14.0	10.0	12.2	256	202	224	260	216	238	55.9	38.3	48.7	28.8	20.7	25.6	2.2	1.3	1.7	5.2	2.3	3.8	4
14.0	10.5	12.6	248	206	226	286	236	266	52.5	38.8	45.9	31.2	20.3	24.7	2.3	1.6	2.0	5.3	2.6	4.0	5
15.5	11.0	13.0	234	194	211	268	228	248	54.5	42.2	47.7	30.3	20.1	26.7	2.2	1.5	1.9	4.0	2.2	3.0	6
16.5	10.5	13.6	256	228	242	284	240	259	49.9	35.4	42.5	30.3	21.0	25.2	2.2	1.5	1.8	5.5	2.1	4.0	7
18.5	10.0	14.1	284	204	229	258	226	244	57.1	39.6	49.4	29.3	19.8	25.0	2.1	1.6	1.9	5.1	2.2	4.1	8
17.0	9.0	12.9	256	180	214	276	206	246	57.9	32.3	48.0	29.5	19.8	24.1	2.4	1.4	1.9	4.6	2.3	3.8	9
15.5	10.5	13.0	242	200	220	274	224	245	53.5	39.3	47.0	29.5	20.1	25.3	2.2	1.5	1.8	5.4	2.5	4.2	10
		12.8			237			261			45.1			24.2			1.8			3.7	

TABLE LXXIII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill U

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
15.5	11.5	12.9	278	250	264	310	264	291	58.4	42.3	51.7	34.4	20.7	28.5	3.4	1.7	2.5	6.0	2.0	4.8	1
15.0	11.5	13.0	272	206	225	284	220	239	55.9	41.3	48.1	34.9	20.7	29.6	2.7	1.9	2.4	6.4	2.5	5.2	2
15.0	12.0	13.2	240	206	224	294	244	272	57.9	44.7	52.0	23.4	19.0	21.0	2.4	1.7	2.0	6.4	3.4	5.1	3
17.5	13.5	14.9	300	244	276	308	254	280	57.6	36.4	47.8	34.9	18.6	28.8	2.1	1.1	1.6	5.7	1.7	4.0	4
17.0	13.0	14.5	294	240	264	308	250	268	56.2	35.0	48.5	36.1	23.0	29.1	2.0	0.9	1.6	5.1	2.4	4.2	5
15.5	11.0	13.1	270	200	239	304	236	277	61.5	47.6	54.1	21.8	17.1	20.7	2.3	1.4	1.9	6.4	3.6	5.0	6
16.0	12.0	14.3	258	218	241	284	224	254	53.8	38.1	45.3	35.2	24.0	29.5	1.9	1.3	1.6	5.7	2.9	4.6	7
16.5	11.5	13.2	268	186	223	286	224	246	61.3	48.9	55.4	28.3	18.6	24.1	2.4	1.5	2.1	6.7	2.5	5.1	8
17.0	11.5	14.2	248	208	226	322	238	275	64.3	50.1	57.7	29.6	19.0	25.0	2.2	1.5	1.9	6.8	3.0	5.0	9
19.0	10.0	14.0	246	184	221	338	218	258	62.3	45.0	54.6	30.3	17.1	24.2	2.4	1.5	2.0	6.4	3.7	5.1	10
18.0	11.0	14.9	270	212	238	280	230	255	63.8	44.4	54.4	30.5	20.1	26.3	2.6	1.8	2.2	6.7	3.1	4.9	11
17.0	12.0	13.9	292	208	256	318	278	295	67.2	45.7	58.0	28.1	17.6	23.3	1.7	1.2	1.5	5.7	2.8	4.3	12
16.5	9.5	13.5	246	186	209	272	212	238	62.1	23.2	49.6	26.2	19.0	22.6	2.5	0.9	2.1	6.6	3.3	4.9	13
17.5	11.5	15.0	248	206	229	308	256	283	67.4	48.6	57.7	29.0	21.3	24.1	2.5	1.5	1.9	7.0	3.6	5.0	14
15.5	12.0	13.2	276	212	244	292	252	271	65.5	47.1	56.5	31.0	21.8	26.6	2.3	1.7	2.0	5.1	2.9	4.1	15
18.0	12.0	14.4	280	232	256	258	230	243	49.8	38.1	44.2	42.2	27.4	35.7	3.0	1.9	2.5	7.2	3.4	5.8	16
14.0	8.5	11.8	266	216	239	298	242	272	69.4	42.3	55.3	27.9	21.2	24.3	2.1	1.5	1.9	7.1	3.3	5.2	17
14.0	10.0	12.1	240	200	220	274	242	259	57.7	40.5	51.1	25.1	16.6	21.7	2.4	1.9	2.2	7.8	2.8	5.0	18
16.5	10.0	12.9	234	194	210	270	220	243	69.8	50.8	59.4	32.2	21.8	26.7	2.4	1.8	2.1	5.9	2.5	4.3	19
14.0	9.0	11.9	248	224	236	298	260	280	64.7	47.4	55.2	27.1	20.8	23.9	2.6	1.6	2.0	5.9	2.9	4.4	20
15.5	10.5	12.7	322	214	258	346	244	284	61.5	44.7	55.6	27.9	20.8	24.3	2.2	1.3	1.8	6.4	2.8	4.6	21
		13.5			238			266			53.0			25.7			2.0			4.8	

TABLE LXXIV

PHYSICAL CHARACTERISTICS OF .009/26-LB. BOGUS CORRUGATING MEDIUM

MILL V

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116369/71	1	26.5	25.5	26.0	10.8	10.2	10.4	30.0	9.2	7.3	8.4	39	26	31	9	7	8	15.5	10.5	12.9
116378/80	2	28.3	26.4	27.3	9.8	8.9	9.4	34.8	9.1	7.7	8.4	49	29	39	14	10	12	16.0	8.0	13.1
116673/75	3	26.6	26.1	26.4	10.4	9.6	10.0	31.7	11.7	7.9	10.0	39	25	31	12	8	10	14.0	11.0	12.9
116676/78	4	24.6	23.8	24.3	10.5	9.6	9.9	29.4	12.3	11.1	11.7	35	20	29	15	8	11	13.0	10.0	11.3
116679/81	5	25.9	25.6	25.7	10.7	10.0	10.4	29.7	10.5	9.7	10.1	36	25	31	15	10	12	16.0	12.0	13.7
116682/84	6	26.8	25.4	26.1	10.1	9.6	9.9	31.6	10.7	9.0	10.0	45	31	36	15	10	11	17.5	13.0	14.7
116685/87	7	26.6	25.6	26.1	10.7	9.9	10.3	30.4	10.2	7.0	8.5	40	23	31	15	10	13	14.0	10.0	12.4
116966/68	8	27.3	26.6	26.9	9.9	9.1	9.5	34.0	6.5	5.2	5.9	41	26	33	13	10	12	17.0	12.5	14.4
116969/71	9	25.7	24.9	25.3	10.2	9.8	10.1	30.0	6.4	5.0	5.5	35	26	31	15	10	12	13.5	10.5	11.8
116972/74	10	25.6	24.3	25.0	10.6	10.0	10.3	29.1	8.1	7.3	7.6	39	26	30	13	9	11	17.5	12.0	14.7
117338/40	11	26.3	25.1	25.5	10.8	10.1	10.5	29.1	10.5	8.8	9.8	40	22	34	15	12	13	15.0	10.0	12.1
117341/43	12	25.6	23.7	24.4	10.6	9.7	10.1	29.0	18.0	13.5	15.5	44	31	38	16	12	13	15.5	9.5	12.9
117992/94	13	27.1	25.7	26.3	10.8	9.8	10.3	30.6	8.4	7.0	7.9	32	20	26	12	7	10	14.5	9.5	11.4
Average				25.8			10.1	30.7			9.2			32			11			12.9

TABLE LXXV

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL W

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000)			Caliper, 0.001 in.			Apparent Density, lb./cu.ft.	Moisture, %			Bursting Strength, points			G.E. Puncture, units			Riehle Compression, lb. In		
		Max.	Min.	Av.	Max.	Min.	Av.		Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
116411/13	1	28.6	27.1	28.0	10.2	9.5	10.0	33.6	12.6	11.4	12.0	95	56	77	22	17	20	23.0	12.5	18.7
116414/16	2	28.3	27.7	28.0	10.9	10.1	10.5	32.0	11.8	10.9	11.4	89	52	70	22	18	20	24.0	14.0	18.3
116417/19	3	27.6	27.3	27.5	10.5	9.7	10.2	32.4	12.1	9.9	11.2	90	58	74	21	18	19	21.5	14.0	18.2
116420/22	4	28.0	26.9	27.4	11.3	10.5	11.0	29.9	11.0	10.2	10.7	81	57	67	23	18	21	21.0	12.5	16.4
116423/25	5	28.3	27.1	27.6	12.3	10.1	10.9	30.4	13.2	12.1	12.5	91	41	68	24	18	21	24.0	15.5	19.7
116435/37	6	26.3	25.5	25.9	9.3	8.8	9.0	34.5	13.9	12.8	13.2	100	62	74	20	17	18	20.0	13.0	16.0
116438/40	7	25.7	25.1	25.4	9.4	8.8	9.1	33.5	12.4	12.0	12.2	91	53	71	19	16	18	19.0	12.5	15.8
116441/43	8	26.4	25.0	25.7	9.3	8.7	9.1	33.9	10.8	9.0	10.0	95	51	69	20	16	18	21.0	14.0	17.3
117057/59	9	27.6	26.9	27.4	10.9	10.1	10.4	31.6	14.5	11.7	13.5	82	53	66	22	18	20	22.5	16.0	18.9
117072/74	10	26.8	25.5	26.2	10.9	9.8	10.4	30.2	15.0	13.0	14.3	93	47	62	22	16	19	24.0	14.5	20.3
117081/83	11	26.7	25.6	26.0	9.9	8.9	9.4	33.2	12.9	9.3	11.0	90	46	65	21	17	18	22.0	15.5	18.3
117747/49	12	27.7	26.8	27.2	11.3	9.9	10.6	30.8	6.5	5.8	6.1	89	49	65	22	17	20	17.5	11.5	14.9
117750/52	13	27.7	25.8	26.5	11.0	9.0	10.2	31.2	7.4	4.9	6.2	73	49	63	20	17	18	20.5	13.5	16.7
Average				26.8			10.1	31.8			11.1			69			19			17.7

TABLE LXXIV

PHYSICAL CHARACTERISTICS OF .009/26-LB. BOGUS CORRUGATING MEDIUM

MILL V

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
11.5	8.5	10.0	112	80	95	130	98	112	33.0	26.6	30.3	16.8	13.0	15.2	1.6	1.1	1.4	2.6	1.2	1.9	1
12.0	8.5	10.1	158	128	143	184	116	165	43.7	33.9	37.6	22.7	15.7	18.0	2.6	1.4	1.8	3.8	1.9	2.6	2
11.0	7.0	9.3	154	100	123	142	116	128	34.2	27.9	30.3	18.8	13.9	16.5	1.8	1.1	1.5	4.1	2.0	2.7	3
10.0	8.0	9.0	110	94	101	138	106	123	30.6	22.3	28.2	16.6	12.9	14.1	1.7	1.0	1.4	3.2	1.6	2.6	4
12.0	7.5	10.1	132	102	113	142	110	125	36.1	27.6	31.0	19.3	15.1	17.0	1.6	0.8	1.3	2.8	1.6	2.2	5
13.0	10.0	11.4	142	116	128	208	130	159	41.1	33.0	36.1	22.0	17.3	20.0	2.0	1.2	1.5	3.0	1.7	2.5	6
12.5	8.5	10.3	136	100	115	164	108	129	36.4	25.7	31.4	19.8	14.6	18.0	1.7	0.5	1.2	3.2	1.6	2.4	7
11.5	6.5	9.9	150	118	133	194	136	157	40.0	29.6	35.5	17.6	14.4	16.4	1.2	0.8	1.0	3.9	1.8	2.5	8
15.0	11.0	12.6	170	120	146	152	106	132	27.3	21.7	24.3	26.6	19.0	23.8	1.6	1.0	1.3	3.4	1.4	2.7	9
11.0	7.5	9.5	128	96	109	152	116	127	37.9	25.6	31.8	16.9	11.2	14.4	1.6	0.9	1.3	3.8	1.8	2.2	10
12.5	10.0	11.2	162	112	133	160	124	144	32.2	23.7	28.8	20.3	16.4	17.8	2.0	1.1	1.6	2.9	1.2	2.2	11
12.5	9.0	10.9	180	116	141	160	120	140	32.2	28.8	30.9	20.8	15.4	18.2	2.2	1.4	1.8	3.0	1.6	2.3	12
11.0	7.0	9.3	102	74	89	112	90	100	30.8	22.5	27.1	15.7	12.4	13.7	1.6	1.0	1.4	2.5	1.6	2.1	13
		10.3			121			134			31.0			17.2			1.4			2.4	

TABLE LXXV

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL W

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Roll
15.0	10.0	12.4	276	218	240	356	270	315	74.5	57.6	64.4	28.8	19.8	23.6	2.8	2.0	2.4	4.7	2.4	3.7	1
15.5	10.0	12.0	250	224	236	350	274	316	69.4	49.1	61.1	26.9	17.3	22.1	2.6	2.0	2.3	4.6	1.8	3.4	2
14.0	10.0	12.1	250	206	229	370	286	323	64.3	55.9	60.2	26.4	17.4	22.3	2.9	1.8	2.3	4.4	2.6	3.5	3
14.0	8.5	10.9	296	242	260	364	276	321	62.3	46.7	54.0	24.4	16.8	20.5	2.3	1.5	1.9	4.5	2.4	3.2	4
15.0	10.0	12.5	288	218	249	354	274	301	64.5	37.1	51.4	24.4	17.4	20.8	2.6	1.4	2.1	5.3	3.0	4.1	5
14.0	8.0	11.5	238	202	214	330	256	293	67.7	45.4	59.6	26.2	17.9	22.4	2.9	2.2	2.5	4.9	3.3	4.1	6
13.0	7.0	10.3	232	194	213	338	262	292	67.0	50.3	56.5	23.2	19.1	20.9	2.7	1.8	2.2	4.9	2.5	3.6	7
13.0	7.5	10.7	254	200	226	372	270	310	68.7	46.6	55.5	27.3	19.5	22.6	3.1	2.1	2.5	5.1	2.7	3.7	8
14.5	10.0	11.9	238	190	215	336	274	300	59.3	42.7	52.9	25.7	18.6	22.2	1.5	0.7	1.2	5.9	2.5	3.9	9
12.5	10.0	11.7	242	202	221	346	264	304	63.7	40.8	54.2	24.4	17.6	20.9	2.4	1.1	1.9	3.6	2.2	3.0	10
15.0	9.0	11.7	264	184	214	304	244	269	62.8	45.5	54.8	25.1	17.6	22.0	2.4	1.6	1.9	6.2	2.9	4.5	11
12.5	7.5	10.3	272	204	231	308	234	277	64.7	42.8	55.3	24.5	17.3	21.6	2.2	1.4	1.9	6.8	2.6	4.1	12
14.0	8.5	11.7	234	192	212	304	248	276	65.0	48.9	55.8	24.5	18.6	21.8	2.4	1.8	2.1	5.8	2.9	4.3	13
		11.5			228			300			56.6			21.8			2.1			3.8	

TABLE LXXVI

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill X

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
117117/19	1	26.8	25.8	26.3	9.5	9.0	9.3	33.9	6.4	3.9	5.5	81	49	64	19	16	18	20.0	15.5	17.8
117120/22	2	28.4	26.2	27.1	9.9	9.1	9.5	34.2	7.5	6.3	6.7	83	52	67	21	17	19	23.0	13.0	18.1
117284/86	3	26.5	25.6	26.0	9.6	8.9	9.2	33.9	6.6	3.8	5.1	94	53	71	20	17	18	21.5	15.5	18.1
117287/89	4	27.1	25.3	26.4	9.9	8.9	9.3	34.1	6.2	4.3	5.3	89	44	70	21	17	19	21.0	15.5	18.7
118051/53	5	28.4	26.6	27.4	11.2	10.2	10.7	30.7	8.4	7.5	7.8	101	49	66	23	18	21	20.0	15.0	17.7
118054/56	6	29.3	26.2	27.3	12.0	10.2	10.7	30.6	10.8	6.9	9.0	86	52	68	25	18	21	21.0	14.5	17.5
118057/59	7	29.2	26.2	27.3	9.6	8.9	9.1	36.0	9.4	7.5	8.6	88	57	68	23	18	20	20.0	15.5	17.2
118060/62	8	29.3	28.9	29.1	10.6	9.0	10.1	34.6	9.8	8.4	9.1	75	48	63	26	21	24	18.0	13.0	15.7
118063/65	9	28.4	27.7	28.1	10.6	9.1	9.9	34.1	8.7	7.5	8.2	94	57	68	25	20	23	19.0	13.0	16.2
118127/29	10	28.5	27.1	27.7	10.5	9.3	10.0	33.2	12.8	11.5	12.0	79	47	67	24	18	21	18.5	13.0	14.7
118130/32	11	28.4	27.4	27.8	10.0	9.2	9.8	34.0	11.8	10.4	11.2	79	46	64	23	18	20	23.0	14.0	17.4
118133/35	12	29.5	26.8	28.1	10.3	9.0	10.0	33.7	11.3	10.7	11.0	97	57	75	23	19	22	19.0	15.0	16.8
118136/38	13	29.5	27.8	28.5	9.9	9.0	9.5	36.0	11.9	10.4	11.2	93	53	70	23	18	21	23.0	16.0	18.8
118139/41	14	28.3	25.0	26.7	10.7	9.2	9.9	32.4	11.3	10.7	11.1	86	58	68	24	20	22	20.5	12.5	15.3
Average				27.4			9.8	33.7			8.7			68			21			17.1

TABLE LXXVII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill Y

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in. Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
116990/92	1	26.0	24.6	25.4	9.4	8.9	9.1	33.5	7.5	6.6	7.2	55	40	48	17	12	15	22.5	15.5	18.5
116993/95	2	26.0	25.4	25.7	9.1	8.4	8.9	34.6	9.9	7.1	8.9	82	58	70	14	12	13	27.5	21.0	24.2
116996/98	3	25.8	25.0	25.3	9.5	8.9	9.1	33.4	10.2	3.9	6.8	61	39	48	16	13	14	20.0	13.5	17.0
117453/55	4	26.4	25.7	26.0	9.8	8.9	9.5	32.8	15.0	9.5	11.7	92	57	72	19	15	17	20.0	15.0	16.9
117456/58	5	27.2	26.0	26.8	10.6	9.1	9.8	32.8	8.0	6.0	7.3	98	58	73	19	15	18	23.0	16.0	18.7
118204/06	6	27.5	26.7	27.0	10.1	9.4	9.8	33.1	10.9	10.2	10.5	74	53	65	19	17	18	20.0	14.5	16.8
118207/09	7	27.1	25.2	26.1	9.8	9.0	9.4	33.3	12.3	10.0	10.8	53	39	47	16	12	14	19.0	12.5	15.7
118210/12	8	27.6	26.5	27.1	8.5	7.9	8.2	39.6	12.7	12.2	12.5	65	46	55	14	12	13	18.5	13.0	14.9
118213/15	9	26.8	25.5	26.1	9.5	9.0	9.2	34.0	11.8	10.1	11.1	58	42	51	18	12	13	19.0	13.5	16.0
118216/18	10	25.3	24.4	24.9	9.9	9.1	9.5	31.5	11.2	9.2	10.1	57	32	48	14	12	13	16.5	12.5	14.3
Average				26.0			9.3	33.9			9.7			58			15			17.3

TABLE LXXVIII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

Mill Z

Institute File No.	Roll	Basis Weight, lb. (12 x 12/1000) Max.	Min.	Av.	Caliper, 0.001 in Max.	Min.	Av.	Apparent Density, lb./cu.ft.	Moisture, % Max.	Min.	Av.	Bursting Strength, points Max.	Min.	Av.	G.E. Puncture, units Max.	Min.	Av.	Riehle Compression, lb. In Max.	Min.	Av.
116931/33	1	26.7	26.2	26.5	9.8	8.9	9.2	34.6	9.0	8.0	8.4	89	55	70	20	17	19	23.0	18.0	20.2
116934/36	2	27.9	26.2	27.3	9.4	8.6	8.9	36.8	8.1	7.5	7.8	105	56	78	20	17	19	33.0	18.0	21.4
116937/39	3	28.1	26.5	27.4	10.7	9.7	10.2	32.2	8.9	8.6	8.7	77	50	65	25	20	22	21.0	14.5	17.1
116940/42	4	28.1	27.5	27.9	10.3	9.0	9.5	35.2	10.1	8.3	9.1	104	43	85	22	20	21	33.0	16.0	21.0
117438/40	5	27.0	25.9	26.5	9.8	8.8	9.3	34.2	8.8	6.0	7.5	99	50	73	22	18	20	26.0	17.5	21.3
117441/43	6	27.2	25.9	26.5	9.6	8.7	9.1	34.9	10.1	8.8	9.5	102	36	77	20	17	19	24.0	15.5	20.8
117444/46	7	26.8	25.7	26.4	9.5	8.7	9.0	35.2	9.6	8.5	9.1	98	60	79	22	17	19	24.0	17.0	20.9
117447/49	8	26.9	25.5	26.4	9.5	8.7	9.0	35.2	10.6	9.5	9.9	96	62	75	21	17	19	24.0	16.0	20.1
117450/52	9	27.0	25.9	26.6	9.8	8.6	9.0	35.5	12.5	9.6	10.9	98	48	78	22	18	19	25.0	15.5	20.8
117465/67	10	26.9	26.4	26.6	9.9	9.0	9.4	33.9	10.5	7.3	8.6	84	56	74	22	17	19	22.0	15.5	18.5
117468/70	11	26.5	26.0	26.3	10.1	9.0	9.4	33.6	11.7	9.3	10.8	92	49	73	23	18	20	21.5	13.0	17.2
Average				26.8			9.3	34.7			9.1			75			20			19.9

TABLE LXXVI

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL X

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min	Av.	Max	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max	Min.	Av	Max.	Min	Av.	Roll
15.5	12.0	13.8	280	196	231	276	216	253	59.6	43.5	51.8	25.9	20.1	23.6	2.4	1.6	2.0	5.9	2.6	4.2	1
15.0	10.5	12.9	268	208	236	270	242	261	58.9	41.5	51.9	26.7	19.5	23.0	2.3	1.4	1.9	5.6	2.8	4.2	2
15.5	10.5	13.4	236	212	221	272	208	242	65.0	41.8	53.9	27.4	20.1	23.3	2.3	1.3	2.0	6.8	2.6	4.5	3
16.5	10.5	13.8	244	200	219	278	226	246	61.3	48.6	56.7	28.3	19.5	23.8	2.6	1.8	2.2	6.1	3.0	4.8	4
13.5	10.0	12.6	274	226	249	342	262	298	62.0	46.4	54.8	26.2	19.0	22.4	2.2	1.4	1.9	6.1	2.9	4.3	5
16.0	10.5	12.4	280	210	243	326	258	290	63.3	47.7	55.2	28.3	19.1	22.5	2.2	1.6	1.9	5.9	2.6	4.4	6
16.0	12.0	13.9	278	210	248	306	218	265	58.9	39.6	48.5	34.7	23.5	29.6	2.8	1.8	2.3	6.4	3.4	4.9	7
15.5	13.0	14.1	358	262	302	394	274	320	47.2	35.4	40.6	35.9	24.7	30.1	2.4	1.6	2.0	3.3	1.5	2.4	8
15.5	12.5	13.9	302	270	289	346	286	310	53.8	36.9	45.8	31.7	25.7	29.3	3.7	1.8	2.2	3.6	2.1	2.9	9
14.5	7.5	10.8	290	220	256	334	260	300	60.9	38.8	50.5	29.5	22.7	25.5	2.6	1.6	2.2	6.1	3.5	4.7	10
16.0	10.5	13.5	300	232	261	312	272	295	64.8	44.7	56.2	28.6	19.8	25.0	2.4	1.7	2.1	7.2	3.8	5.4	11
16.0	9.0	12.4	278	228	250	326	260	297	76.2	44.5	56.4	30.5	20.7	25.3	2.6	1.4	2.2	5.0	2.7	3.8	12
16.0	11.0	13.9	276	234	250	306	266	288	68.7	49.1	58.1	29.6	19.8	24.9	2.4	1.7	2.1	6.7	4.0	5.4	13
14.5	10.5	12.2	316	210	245	288	242	266	55.4	35.6	49.1	30.5	19.1	25.3	2.4	1.2	2.0	4.4	2.7	3.7	14
		13.1			250			281			52.1			25.3			2.1			4.3	

TABLE LXXVII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL Y

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min	Av.	Max	Min.	Av	Roll
12.0	8.5	11.0	240	164	186	232	170	205	51.6	37.6	45.4	22.3	14.7	19.5	2.8	1.6	1.9	6.0	2.4	3.8	1
17.5	12.0	15.1	200	136	161	216	170	188	64.3	52.0	59.0	30.5	24.0	27.4	3.2	2.0	2.3	4.4	2.3	3.1	2
14.5	10.5	12.2	198	168	183	202	160	185	50.8	41.3	46.3	22.0	17.1	19.9	2.5	1.5	2.1	3.9	2.0	3.1	3
16.0	11.5	13.7	220	174	194	260	226	243	62.3	43.0	55.4	25.1	19.1	22.3	2.5	1.6	2.2	5.4	2.6	3.7	4
16.0	11.5	13.7	236	190	206	280	192	238	64.5	45.5	55.5	22.7	19.3	21.1	2.2	1.3	1.9	6.0	3.4	4.6	5
15.5	10.0	13.1	258	202	238	300	240	270	63.0	49.8	54.0	31.3	21.7	26.6	2.5	1.6	2.1	5.4	2.2	3.7	6
13.0	9.5	11.3	214	148	183	224	192	206	53.8	40.8	46.6	22.2	17.6	19.4	2.4	1.6	2.0	5.4	2.7	3.9	7
12.5	9.0	10.6	188	160	176	238	210	220	57.9	42.0	49.6	25.6	20.1	22.4	2.4	1.6	2.1	4.7	3.0	3.8	8
14.0	9.0	11.9	200	164	180	274	188	219	54.5	45.2	49.0	24.7	19.3	22.1	2.4	1.3	1.9	4.2	2.0	3.3	9
12.5	8.5	10.0	200	162	182	230	176	214	52.3	37.6	45.9	21.8	17.4	20.2	2.2	1.2	1.8	3.8	1.9	3.0	10
		12.3			189			219			50.7			22.1			2.0			3.6	

TABLE LXXVIII

PHYSICAL CHARACTERISTICS OF .009/26-LB. FOURDRINIER KRAFT CORRUGATING MEDIUM

MILL Z

Riehle Compression, lb.			Elmendorf Tear, g./sheet						Amthor Tensile, lb./in.						Amthor Stretch, %						
Across			In			Across			In			Across			In			Across			
Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av	Roll
19.0	14.0	16.9	318	228	265	280	220	248	57.6	41.3	50.5	40.5	26.7	33.7	2.3	1.5	1.9	6.7	1.8	5.0	1
18.5	13.5	15.8	294	226	256	312	230	269	61.5	48.1	54.5	42.0	28.1	35.7	2.3	1.6	2.0	5.3	2.3	4.0	2
16.5	11.5	14.2	318	256	283	368	276	316	57.6	35.6	50.8	31.0	20.7	26.1	2.0	1.3	1.7	4.4	1.6	3.1	3
19.5	10.5	15.4	292	236	257	376	264	295	69.2	48.4	59.5	39.1	23.5	33.0	2.4	1.6	2.0	6.9	2.4	5.1	4
22.5	15.0	17.6	268	232	252	268	210	243	66.2	46.6	55.5	39.4	21.0	34.5	2.5	1.7	2.1	6.3	1.5	4.8	5
21.5	14.5	17.7	320	220	244	256	212	236	64.0	39.8	53.4	40.6	30.8	35.8	2.7	2.0	2.3	6.4	3.8	5.3	6
20.5	13.5	16.2	258	202	226	266	224	247	73.3	44.0	57.8	35.2	25.1	31.1	2.5	1.7	2.1	6.9	2.4	4.9	7
17.0	12.5	15.0	252	208	231	272	232	254	72.1	37.8	55.9	37.9	28.6	33.6	2.5	1.1	2.0	6.9	3.8	5.4	8
18.0	12.0	15.4	254	206	231	272	218	241	70.3	40.6	57.1	38.6	26.2	32.4	2.4	1.3	1.9	7.3	3.3	4.9	9
19.0	10.5	15.0	278	236	257	304	250	268	56.9	42.7	49.4	40.6	19.5	33.8	2.2	1.3	1.9	7.2	2.2	4.4	10
17.0	10.0	14.2	290	248	262	282	234	260	58.4	37.2	47.3	38.9	28.3	33.1	3.2	1.8	2.1	7.1	2.8	4.8	11
		15.8			251			262			53.8			33.0			2.0			4.7	