Sampling and accepting a single lot of paper, paperboard, containerboard, or related product

(Proposed revision of T 400 sp-02)

(Lines in text or margins indicate changes since last draft)

1. Scope

1.1 This method describes procedures for obtaining a representative sample for testing. It should be recognized that in an ideal situation the samples selected should represent a lot of paper or paperboard, containerboard, or related product, including converted paper products (all hereafter referred to as “paper”). However, in some situations the sample may be as small as a single sheet of paper that has been provided to the laboratory for testing and may not represent the lot from which it is obtained.

1.1.1 Procedures are described (see Section 4) for establishing the lot of paper to be sampled.

1.1.2 The rules for selecting a representative sample for testing from this lot are described in Sections 5.1 and 5.2. Specific sampling procedures are described (5.3) for large rolls or skids.

1.1.3 Specific procedures are described (5.4) for sampling from a single roll of containerboard for basis weight

Approved by the Standard Specific Interest Group for this Test Method
TAPPI
and burst strength.

1.1.4 A procedure is described (5.5) for the sampling and testing of a continuous strip of paper. In evaluating the performance of a process there may be advantages in measuring the cross or along machine variation in the product. An example could be the cross machine caliper profile to determine the processing variation caused by calendar roll loadings or crown. The evaluation of machine direction strips can provide information of performance of equipment, i.e., a blocked couch roll.

1.1.5 A procedure is described (5.6) for handling a sample that may consist of a limited quantity of paper; or, may be as small as a single sheet of paper. Situations may arise where the testing laboratory has no control of the quantity of paper that is supplied for testing. An example could be the return of a piece of paper that the customer perceives to be defective and the testing laboratory has been asked to quantify its properties. It must be recognized that in these situations the laboratory may not have control of the sampling procedure; and, the samples supplied and tested may not represent the lot of material from which they came.

1.2 Prior to purchase, there should be agreement between buyer and seller on the size of the lot to be sampled (3.1), on details of the sampling procedure, the required physical and chemical properties, dimensional tolerances, etc., and the testing methods to be employed.

1.3 The appendices, which provide useful, statistical criteria for accepting individual lots of paper on the basis of the number of defective test units, can assist the buyer and the seller in selecting an agreed upon sampling and acceptance procedure.

2. Significance

The significance of this practice is that it provides sampling procedures for a majority of TAPPI Test Methods.

3. Definitions

3.1 Lot, a quantity of paper of a single type, grade, grammage, thickness, and composition, about which it is desired to make a judgment (usually as to conformance to specification) by examining or testing a small fraction called the sample.

3.2 Sample, a specified number of test units selected according to a prescribed procedure to represent the lot. It should also be recognized that in some situations the sample to be tested may consist of a limited quantity, or be as little as one sheet of paper.

3.3 Sublots, a natural subdivision of a lot consisting of discrete quantities such as carloads, pallets, rolls, etc.

3.4 Test unit, an area of paper sufficient to obtain a single adequate set of test results for all the properties to be measured.

3.5 Test specimen, a test unit, or a portion of a test unit, upon which (for a specified property) a single test determination is to be made.

3.6 Test determination, (1) the process of carrying out the series of operations specified in the test method
whereby one or more readings (observations) are made on a test specimen and the observations combined to obtain the value of a property of the test specimen, or (2) the value obtained by the process.

3.7  **Test result**, the value obtained for one test unit of the sample by carrying out the complete protocol of the test method, the value being (as specified in the test method) either a single test determination or a specified combination of a number of test determinations.

3.8  **Test strip, cross machine strip**, continuous strip of paper that represents the width of either a roll or reel as specified by the buyer/seller. **Machine direction strip** - continuous strip of paper of a length and machine position to reflect the measurement of interest.

4.  **Establishing the lot**

4.1  **General considerations.** Avoid grouping together different manufactures as a lot. Batches of paper are likely to differ significantly from each other in raw materials or manufacture. If the shipment is small or consists of a large number of batches, it may be uneconomical or impracticable to form lots conforming with the definition (3.1). If this is the case, divide the shipment into portions, to be designated “sublots,” in which each portion conforms with the definition of lot. Before starting the sampling, obtain a complete understanding of the paper to be sampled, including the composition and size of lots and sublots, rolls, skids, etc.

4.2  **Location of sampling.**

4.2.1  **Sampling at the paper mill.** When paper is to be delivered in large rolls or skids, if agreed, have the sample taken at the paper mill and delivered to the purchaser for examination and testing. Include in the purchase agreement a definition of the number of rolls or skids constituting a lot and details of the sampling procedure to ensure compliance with the rules in selecting the sample under Section 5. Specifically indicate whether the sample was taken from mill reels or from the finished rolls or skids.

4.2.2  **Sampling in transit or warehouse.** It may be necessary to take a sample at a dock or warehouse in route between the supplier and the purchaser, especially for international shipments or in sampling for referee testing. Sampling in transit or warehouse can be quite expensive and should be avoided whenever possible, because of the problem of resealing. Arranging to inspect the shipment prior to unloading is recommended on inspection in transit. Establish the size of each lot and determine which rolls or skids will be sampled, and arrange to sample and reseal the rolls or skids as they are loaded or unloaded to minimize additional handling. Obtain the sample in accordance with Section 5.

4.2.3  **Sampling after receipt.** This type of sampling has the obvious disadvantage of delaying evaluation of the shipment and of providing the least favorable conditions for disposal of a rejected lot. Other considerations are the same as above for sampling in transit.

4.3  **Representativeness of the sample.** The test units of the sample usually cannot be taken at random from anywhere within a large roll or skid, but must be taken near the outer layers so as not to destroy the roll or skid. If such test units are regularly taken at the paper mill (4.2.1) and a reasonably uniform quality of production is being maintained, then the test units will, in the long run, be quite representative of average production, even though not randomly selected.
Sampling and accepting a single lot of paper, / 4 paperboard, containerboard, or related product

and therefore not “representative” from a statistical viewpoint. Such test units, however, taken when the lot is in transit or warehouse (4.2.2) or after receipt (4.2.3), cannot be said with certainty to be representative of the shipment; for example, rolls shipped to a customer may have been selected because their outer layers met the customers specification, with no knowledge as to whether properties vary from the outer layers to the core of the roll. Such test units therefore may be neither random nor “representative,” but they are all that is available “to represent” the lot, which experience shows they do fairly well unless non-uniform manufacture or aging has occurred.

5. Selecting the sample

5.1 Determine the area of paper required for each test unit (see definition 3.4) and the number of test units required. Take a sample consisting of the required number of test units in accordance with a predetermined procedure, designed to eliminate deliberate selection of any particular area of paper, and, as far as practicable, conforming to the following rules:

5.1.1 Rule 1: Take test units in proportion to the sizes of the sublots. When a lot divides naturally into sublots consisting of discrete quantities such as carloads, pallet loads, rolls, etc., or when certain portions of the lot (3.1) differ from one another and are segregated as “sublots” (3.3), take the test units in such a way that the number of test units taken from a given sublot is proportional to the size of the sublot.

5.1.2 Rule 2: Take the test units so that each area of paper in the lot or sublot has an equal probability of being selected. It is recognized that difficulties of handling may not permit the taking of test units from locations scattered throughout the lot, but this should be done to the greatest practicable extent.

5.1.3 Rule 3: Take test units indiscriminately. Take the units without regard to their condition or quality but do not sample the outermost sheets of a roll or skid. Also do not sample from inner sheets which have been damaged by handling, abrasion, etc., unless it is evident that similarly damaged areas occur throughout the lot.

5.2 Compliance with rules 2 and 3 may be assured by sampling according to the following plan: Divide the lot or sublot into “locations” (carloads, skids, cartons, etc.) in such a way that each location contains an equal quantity of paper. Assign a number to each location and select the locations to be sampled by drawing numbers at random from a hat or from a table of random numbers. Next assign and select the sublocations or areas within a location by the same procedure. In order to minimize handling during sampling, observe the precautions of Section 6.

5.2.1 When test units are to be taken from small rolls, reams, bundles, cartons or shipping containers of completed paper products, divide the lot or sublot into “locations,” etc., and proceed as described above.

5.2.2 When test units are to be taken from large rolls or skids, divide the lot or sublot into “locations” and “sublocations” no smaller than a roll or unopenable skid (see 5.3.2), assign and select numbers as described above, then proceed as described in 5.3 below.
NOTE 1: In ISO and British Standards, the word “reel” is used for a continuous sheet or board wound on a core and the word “roll” for the same when wound without a core. In the United States, the distinction is between the “reel” at the end of the paper machine and the “rolls” (with or without the cores) made therefrom.

5.3 Large rolls or skids.

5.3.1 When taking a test unit from a large roll remove all damaged layers from the outside of the roll and, in addition, discard at least three undamaged layers for sheets having a nominal grammage of less than 250 g/m² (51.2 lb/1000 ft²) or at least one undamaged layer for heavier sheets. Cut the roll across its full width and to a sufficient depth to enable the requisite number of sheets to be taken. Let the cut sheets fall to each side and remove the roll.

5.3.2 When taking a test unit from a skid or roll that may not be opened at the time of sampling, cut a window 300 by 450 mm (12 x 18 in.) or larger if larger test specimens are required. Cut the window with its longer side parallel to the machine direction when this is known, or if not known, cut the window at least 450 by 450 mm (18 x 18 in.) with sides parallel to those of the skid. For paper that has been sheeted simultaneously from several rolls, take a sufficient number of adjacent sheets to assure representation of all the rolls used. Cut the sheets to sufficient depth to enable the requisite number of sheets to be taken and remove them. Remove all outside sheets that are damaged and, in addition, discard at least the three outermost undamaged sheets for paper having a nominal grammage less than 250 g/m² (51.2 lb/1000 ft²) or at least one outmost undamaged sheet of heavier paper. Vary the position of the window at random among the skids or rolls from which test units are to be drawn, making sure that the sides of the window are parallel to those of the skid or to the roll edge and axis.

5.3.3 In either of the above, if a test for moisture content is to be made, it may be necessary to discard considerably more than three undamaged sheets of paper and one undamaged sheet of board. In one case reported in the literature, it was necessary to discard 40 sheets of manila board to obtain the moisture content of the major portion of the roll. Moisture content sample must be placed in sealed, moisture tight containers at time of sampling.

5.4 Sampling a single roll of containerboard for basis weight and burst strength. The Fiberboard Shipping Container Testing Committee recommends the following uniform procedure for selecting samples for evaluation to meet requirements for freight or D.O.T. requirements.

5.4.1 Select roll for evaluation. Remove the steel, or other, bands and all damaged layers from outside of the roll, and in addition, discard at least three undamaged layers for containerboard with a nominal basis weight of less than 250 g/m² (51.2 lb/1000 ft²) or at least one undamaged layer for heavier containerboards.

5.4.2 Cut samples of full roll width of sufficient area required for each test (see TAPPI T 807 “Bursting Strength of Paper and Linerboard” and TAPPI T 410 “Grammage of Paper and Paperboard” (weight per unit area). Sample should be rolled to no less than 125 mm (5 in.) I.D. or cut into sheets approximately 300 mm x 300 mm, (12 in. x 12 in.) that are identified as to position relative to one another.

5.4.4 Protect samples from direct sunlight, moisture from hands, and extremes of temperature and humidity.

5.5 Selection of sample for strip feed measurements.

5.5.1 From rolls or reels selected for testing remove all damaged layers from the outside of the roll and, in addition, discard at least three undamaged layers for sheets having a nominal grammage of less than 250 g/m² (51.2 lb/1000 ft²) or at least one undamaged sheet of heavier paper. Sample should be rolled to no less than 125 mm (5 in.) I.D. or cut into sheets approximately 300 mm x 300 mm, (12 in. x 12 in.) that are identified as to position relative to one another.
Sampling and accepting a single lot of paper, paperboard, containerboard, or related product

lb/1000 ft\(^2\) or at least one undamaged layer for heavier sheets.

5.5.2 Cut the roll across its full width and to a sufficient depth to enable the requisite number of strips to be taken. The width of the strip shall not be less than the equivalent of the width of three equivalent test areas.

5.5.3 The cut strips shall be marked with the identification information of grade, roll number, mill, etc. If the strip is to be tested for across machine variability then identification of slice position, or other machine identifier in the cross machine direction, must be included if sampling is from rolls or drive side if sampling is from machine reels. Strips should be rolled to no less than 125 mm (5 in.) I.D., strips should never be folded.

5.5.4 Protect strips from direct sunlight, moisture from hands, and extremes of temperature and humidity.

5.6 Handling small size, or single sheet, samples.

5.6.1 If the quantity of sample provided is sufficient to discard the outer sheets this should be done to remove from the sample potentially damaged paper.

5.6.2 The sample sheet(s) shall be marked with identification information and source.

5.6.3 Protect samples from direct sunlight, moisture from hands, and extremes of temperature and humidity. When a limited sample has been provided for testing, careful planning must be used to minimize waste.

6. Care of samples

Keep the test units smooth and flat, except for transporting, when it may be better to ship the test unit in a tube. Protect the sample from exposure to direct sunlight, moisture of the hands, contact with liquids or other harmful influences such as extremes of temperature or humidities above 58% relative humidity. Consult the product specification and the test methods for directions as to any precautions to be taken or special handling necessary.

7. Cutting and marking

Trim test units with their edges parallel to the machine and cross directions. Avoid watermarks or creases for other than grammage determinations; also avoid any unusual flaws or blemishes that might subsequently affect the test results. Mark test units for identification, for example, the locations from which they were taken, and, if needed, their machine direction (see TAPPI T 409 “Machine Direction of Paper and Paperboard”) and top side (see TAPPI T 455 “Identification of Wire Side of Paper”).

8. Sampling report

8.1 When required, give a brief description of the shipment or lot and the sampling including:

8.1.1 Type and grade of paper, paperboard or containerboard with a reference to the specification, if available.

8.1.2 Form in which purchased (that is, dimensions of rolls or sheets; packaging; etc., if not covered in the product specification).
8.1.3 Total quantity (usually weight or area), or purchase order number, or both.
8.1.4 Lot number or other identification of specific lot sampled (if divided into sublots, identification or description of sublots).
8.1.5 Date of sampling.
8.1.6 Location of sampling (mill, warehouse, in transit, etc.).
8.1.7 Description and enumeration of any portions of the shipment excluded from sampling because of damage.
8.1.8 Deviations from the specified sampling procedure if it was found to be not reasonably possible to follow the prescribed directions.
8.1.9 Authority requesting the sample (if appropriate).

9. Precision

A precision statement is not applicable for this standard practice.

10. Keywords

Acceptability, Quality control, Sampling, Paper, Paperboard, Container boards, Fiberboards

11. Additional information

11.1 Effective date of issue: to be assigned.
11.2 Related methods: ASTM D 585 (technically identical); ISO 186 (uses essentially an engineered sampling plan); PAPTAC A.3.
11.3 The 1994 version of the method incorporates the use of strip feed sampling procedures. The 1990 revision involves reorganization and clarification and elimination of certain errors introduced in the 1975 version. The 1975 version also added the appendixes, which are to be used only when no other acceptance plan has been specified.
11.4 Deliberate non-representative or semi-representative selection of rolls or skids for sampling may be desirable to emphasize expected stock problems. Use the bills of lading to select skids or rolls at the beginning and near the end of the run, then randomly through the run but stressing front and back positions. These are the areas from which production problems may be expected to arise. This approach is non-random, not statistical, but may be more economical when extremes and not averages are sought; however, it cannot be said to be “in accordance with TAPPI T 400.”
11.5 The 1997 revision includes the procedures for handling samples of limited size that may be provided to the laboratory for testing. Included in this revision is the warning that in such cases, these samples may not represent the lot of paper from which they came.
Appendix A: Useful acceptance plans

A.1 Individual lot acceptance. The appropriate sampling-acceptance plan provided in the following sections is to be used only for individual lot acceptance when no other plan has been specified and this method has been referenced. A plan that is tailored to the specific paper product, grade, type of defects, end use, etc., is preferable to a general plan. However, the general plans provided here are considered to be a good compromise between costs of testing and the risks of wrong decisions, and are applicable to a wide range of paper products.

A.1.1 The acceptance plans given here are called “attribute” acceptance plans because a test unit fails if it fails to conform to one or more of the requirements for which it is tested and acceptance of the lot is based on an acceptably low number of units failing. Maltenfort and Boedeker (3) describe a “variables” acceptance plan in which acceptance is based on the average of the values obtained for the test units and the variability among these values.

A.1.2 When a continuing series of lots is being obtained from the same manufacturer, other plans (such as MIL-STD 105D and MIL-STD 414) are likely to be more efficient as they can provide for increasing or reducing inspection as experience with that manufacturer indicates.

A.2 Assumptions.

A.2.1 Since a lot (3.1) is presumed to be reasonably homogeneous, the plans presented below assume homogeneity and therefore provide only for acceptance or rejection of the lot as a whole. If the lot is not homogeneous, a test on one test unit of the sample might be so far off specification as to make at least the corresponding part of the lot unacceptable even though the proportion of off-specification test units would be so small as to indicate the whole lot should be accepted. Provision should be made for this situation in advance, for example, by calling for rejection of the lot as a whole because of its excess non-homogeneity or by requiring complete screening (that is, testing of each part and rejecting substandard parts) if non-homogeneity is found.

A.2.2 The plans are based also on the assumption that the properties of a test unit drawn from the outer layers or sheets (4.3) or at random (in 4.2.1) are identical with the properties throughout the roll, skid, ream, carton, etc., from which the test unit was taken. While this assumption is obviously not true, if the lot or sublot is reasonably uniform and the rules for selecting the sample are carefully followed, the acceptance plans will generally provide a satisfactory level of protection.

A.3 Level of protection. If the above assumptions are true, the plans provide the following:

A.3.1 Protection to producer. The lot will be accepted with a probability of at least 95% if the proportion of the defective items contained in it does not exceed 2.5%.
A.3.2 Protection to consumer. The lot will be rejected with a probability of at least 90% if the proportion of the defective items contained in it reaches 16 to 32% in Plan I, 19 to 68% in Plan II, and 37 to 68% in Plan III, the smaller figure in each case applying to the largest lot size.

A.4 Application of plans.

A.4.1 Plan I, for individual lots composed of large rolls that cannot be unwound or skids (pallets) that cannot be opened at the time of sampling (5.3.2).

A.4.2 Plan II, for individual lots composed of small rolls (as tapes, toweling), reams, bundles, cartons, or shipping containers from which test units may be selected at random.

A.4.3 Plan III, for “noncritical” chemical tests for individual lots composed as in A.4.1 or A.4.2. As used herein, “noncritical” means tests for which variability within the lot is of little or no significance and therefore the amount of testing called for by Plan I or II could not be justified.

Appendix B: Acceptance definitions

B.1 Lot size.

B.1.1 Plan I. The lot size \((N)\) is the number of rolls or skids of which the lot (3.1) is composed.

B.1.2 Plan II. The lot size \((N)\) is the number of small rolls, reams, bundles, cartons, or shipping containers of which the lot is composed, as appropriate for the test to be made. When a choice is possible (as in testing a property of the paper in a roll when an equal number of rolls are packed in each carton), select the unit (roll or carton) on which lot size is based so that the lot size will be greater than 25.

B.1.3 Plan III, as for Plan I or II, as appropriate.

B.2 Sample size, the number of test units (3.4) of which the sample (3.2) for test is composed, determined from lot size in accordance with Tables 1, 2, or 3.

B.3 Acceptance. A lot is either accepted or rejected as a whole on the basis of tests carried out on the sample. Each test unit of the sample is separately evaluated.

B.4 Defective test unit, a test unit that fails to conform to one or more of the requirements for which it has been tested.

B.5 Acceptance number, a number used in connection with a sampling plan (Tables 1, 2, or 3), such that if the number of defective test units in the sample is less than or equal to this number, the lot should be passed for the properties tested.

B.6 Rejection number, a number used in connection with a sampling plan (Tables 1, 2, or 3), such that if the number of defective test units in the sample is greater than or equal to this number, the lot should be rejected.
Table 1. Plan I for large rolls or skids.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample Size</th>
<th>Acceptance and rejection numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n_t</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3 to 5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6 to 10</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>11 to 100</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>101 to 300</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>301 to 1200</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>1201 and over</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

n_t = total sample size, that is, sum of test units in first and second part, of double sample.

Ac_t and Re_t = acceptance and rejection numbers for double sample.

Table 2. Plan II for small rolls, reams, bundles, etc.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample Size</th>
<th>Acceptance and rejection numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n_t</td>
</tr>
<tr>
<td>2 to 25</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>26 to 150</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>151 to 1200</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1201 to 35000</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>35001 and over</td>
<td>13</td>
<td>0</td>
</tr>
</tbody>
</table>

n_t = total sample size, that is, sum of test units in first and second part, of double sample.

Ac_t and Re_t = acceptance and rejection numbers for double sample.
Table 3. Plan III for noncritical chemical tests.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample size n'</th>
<th>Ac</th>
<th>Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 100</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>101 to 1200</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1201 to 35000</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>35001 and over</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Appendix C: Instruction for use of Tables 1, 2, 3

C.1 Select Table 1 or Table 2 according to the composition of the lot (A.4.1 and A.4.2).

C.2 Locate the lot size (B.1) in the first column of the selected table. The sampling and acceptance criteria to be used are those given on the line corresponding to this lot size.

C.3 Take a first sample consisting of the number of test units equal to the number in the column headed n. Sample according to the rules for selecting a sample to represent a lot (3.1), including in each test unit enough additional material for noncritical chemical tests (C.10 to C.13).

C.4 Subject each of the n test units of this sample to all of the required tests. For noncritical chemical tests follow instructions in C.10 to C.13.

C.5 Record the number of defective units thus found.

C.6 First sample criteria

C.6.1 If the number from C.5 does not exceed the number in column Ac, the lot should be considered to meet the requirements relating to the properties tested.

C.6.2 If the above number equals or exceeds the number in column Re, the lot should be considered as having failed to meet the requirements of the detail specification.

C.6.3 If the above number exceeds the acceptance number (Ac) but is less than the rejection number (Re), proceed to the next step.

C.7 Take a second sample equal in size to the first so that the total number of test units in the first and second sample is n. Again take this sample in accordance with the rules for selecting a sample to represent a lot.

C.8 Follow C.4 and C.5, and compute the total number of defective test units in the two samples.

C.9 Total sample criteria.

C.9.1 If the number in C.8 does not exceed the number in Ac, the lot is considered to meet the requirements relating to the properties tested.

C.9.2 If the above number equals or exceeds the number in column Re, the lot shall be considered as having failed to meet the requirements of the detail specification.
C.10 If the lot satisfies C.6.1 or C.9.1 and noncritical chemical tests are specified, determine the sample size \((nN)\) for these tests in accordance with Table 3.

C.11 Select the above \(nN\) test units at random from the \(n\) test units obtained according to instruction Section 5.10.3.

C.12 Subject each of the \(nN\) test units of this sample to all the required noncritical chemical tests, and record the number of defective test units thus found.

C.13 Chemical rest criteria

C.13.1 If the number of defective test units (C.12) is zero, the lot is considered to meet the requirements relating to noncritical chemical tests.

C.13.2 If the number is greater than zero, the lot shall be considered as having failed to meet the requirements of the detail specification.

Appendix D: Acceptance report

Report lot size, sample size, number of defective test units found, and the nature of the defects.

*Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Director of Quality and Standards.*
Sampling and accepting a single lot of paper, paperboard, containerboard, or related product
(Five-year review of T 400sp-02)

1. Scope

1.1 This method describes procedures for obtaining a sample for testing. It should be recognized that in an ideal situation the samples selected should represent a lot of paper or paperboard, container board, or related product, including converted paper products (all hereafter referred to as “paper”). However, in some situations the sample may be as small as a single sheet of paper that has been provided to the laboratory for testing and may not represent the lot from which it is obtained.

1.1.1 Procedures are described (see Section 4) for establishing the lot of paper to be sampled.

1.1.2 The rules for selecting a representative sample for testing from this lot are described in Sections 5.1 and 5.2. Specific sampling procedures are described (5.3) for large rolls or skids.

1.1.3 Specific procedures are described (5.4) for sampling from a single roll of containerboard for basis weight
and burst strength.

1.1.4 A procedure is described (5.5) for the sampling and testing of a continuous strip of paper. In evaluating the performance of a process there may be advantages in measuring the cross or along machine variation in the product. An example could be the cross machine caliper profile to determine the processing variation caused by calendar roll loadings or crown. The evaluation of machine direction strips can provide information of performance of equipment, i.e., a blocked couch roll.

1.1.5 A procedure is described (5.6) for handling a sample that may consist of a limited quantity of paper; or, may be as small as a single sheet of paper. Situations may arise where the testing laboratory has no control of the quantity of paper that is supplied for testing. An example could be the return of a piece of paper that the customer perceives to be defective and the testing laboratory has been asked to quantify its properties. It must be recognized that in these situations the laboratory may not have control of the sampling procedure; and, the samples supplied and tested may not represent the lot of material from which they came.

1.2 Prior to purchase, there should be agreement between buyer and seller on the size of the lot to be sampled (3.1), on details of the sampling procedure, the required physical and chemical properties, dimensional tolerances, etc., and the testing methods to be employed.

1.3 The appendices, which provide useful, statistical criteria for accepting individual lots of paper on the basis of the number of defective test units, can assist the buyer and the seller in selecting an agreed upon sampling and acceptance procedure.

2. **Significance**

The significance of this practice is that it provides sampling procedures for a majority of TAPPI Test Methods,

3. **Definitions**

3.1 *Lot*, a quantity of paper of a single type, grade, grammage, thickness, and composition, about which it is desired to make a judgment (usually as to conformance to specification) by examining or testing a small fraction called the sample.

3.2 *Sample*, a specified number of test units selected according to a prescribed procedure to represent the lot. It should also be recognized that in some situations the sample to be tested may consist of a limited quantity, or be as little as one sheet of paper.

3.3 *Sublots*, a natural subdivision of a lot consisting of discrete quantities such as carloads, pallets, rolls, etc.

3.4 *Test unit*, an area of paper sufficient to obtain a single adequate set of test results for all the properties to be measured.

3.45 *Test specimen*, a test unit, or a portion of a test unit, upon which (for a specified property) a single test determination is to be made.

3.5 *Test determination*, (1) the process of carrying out the series of operations specified in the test method
whereby one or more readings (observations) are made on a test specimen and the observations combined to obtain the value of a property of the test specimen, or (2) the value obtained by the process.

3.67 Test result, the value obtained for one test unit of the sample by carrying out the complete protocol of the test method, the value being (as specified in the test method) either a single test determination or a specified combination of a number of test determinations.

3.78 Test strip, cross machine strip, continuous strip of paper that represents the width of either a roll or reel as specified by the buyer/seller. Machine direction strip - continuous strip of paper of a length and machine position to reflect the measurement of interest.

4. Establishing the lot

4.1 General considerations. Avoid grouping together, as a lot. Batches of paper are likely to differ significantly from each other in raw materials or manufacture. If the shipment is small or consists of a large number of batches, it may be uneconomical or impracticable to form lots conforming with the definition (23.1). If this is the case, divide the shipment into portions, to be designated “sublots,” in which each portion conforms with the definition of lot. Before starting the sampling, obtain a complete understanding of the paper to be sampled, including the composition and size of lots and sublots, rolls, skids, etc.

4.2 Location of sampling.

4.2.1 Sampling at the paper mill. When paper is to be delivered in large rolls or skids, if agreed, have the sample taken at the paper mill and delivered to the purchaser for examination and testing. Include in the purchase agreement a definition of the number of rolls or skids constituting a lot and details of the sampling procedure to ensure compliance with the rules in selecting the sample under Section 45. Specifically indicate whether the sample was taken from mill reels or from the finished rolls or skids.

4.2.2 Sampling in transit or warehouse. It may be necessary to take a sample at a dock or warehouse in route between the supplier and the purchaser, especially for international shipments or in sampling for referee testing. Sampling in transit or warehouse can be quite expensive and should be avoided whenever possible, because of the problem of resealing. Arranging to inspect the shipment prior to unloading is recommended on inspection in transit. Establish the size of each lot and determine which rolls or skids will be sampled, and arrange to sample and reseal the rolls or skids as they are loaded or unloaded to minimize additional handling. Obtain the sample in accordance with Section 5.

4.2.3 Sampling after receipt. This type of sampling has the obvious disadvantage of delaying evaluation of the shipment and of providing the least favorable conditions for disposal of a rejected lot. Other considerations are the same as above for sampling in transit.

4.3 Representativeness of the sample. The test units of the sample usually cannot be taken at random from anywhere within a large roll or skid, but must be taken near the outer layers so as not to destroy the roll or skid. If such test units are regularly taken at the paper mill (34.2.1) and a reasonably uniform quality of production is being maintained, then the test units will, in the long run, be quite representative of average production, even though not
randomly selected and therefore not “representative” from a statistical viewpoint. Such test units, however, taken when
the lot is in transit or warehouse (34.2.2) or after receipt (34.2.3), cannot be said with certainty to be representative of the
shipment; for example, rolls shipped to a customer may have been selected because their outer layers met the customers
specification, with no knowledge as to whether properties vary from the outer layers to the core of the roll. Such test
units therefore may be neither random nor “representative,” but they are all that is available “to represent” the lot, which
experience shows they do fairly well unless non-uniform manufacture or aging has occurred.

5. Selecting the sample

5.1 Determine the area of paper required for each test unit (see definition 3.34) and the number of test units
required. Take a sample consisting of the required number of test units in accordance with a predetermined procedure,
designed to eliminate deliberate selection of any particular area of paper, and, as far as practicable, conforming to the
following rules:

5.1.1 Rule 1: Take test units in proportion to the sizes of the sublots. When a lot divides naturally into sublots
consisting of discrete quantities such as carloads, pallet loads, rolls, etc., or when certain portions of the lot (3.1) differ
from one another and are segregated as “sublots” (3.13), take the test units in such a way that the number of test units
taken from a given sublot is proportional to the size of the sublot.

5.1.2 Rule 2: Take the test units so that each area of paper in the lot or sublot has an equal probability of
being selected. It is recognized that difficulties of handling may not permit the taking of test units from locations
scattered throughout the lot, but this should be done to the greatest practicable extent.

5.1.3 Rule 3: Take test units indiscriminately. Take the units without regard to their condition or quality but
do not sample the outermost sheets of a roll or skid. Also do not sample from inner sheets which have been damaged by
handling, abrasion, etc., unless it is evident that similarly damaged areas occur throughout the lot.

5.2 Compliance with rules 2 and 3 may be assured by sampling according to the following plan: Divide the
lot or sublot into “locations” (carloads, skids, cartons, etc.) in such a way that each location contains an equal quantity of
paper. Assign a number to each location and select the locations to be sampled by drawing numbers at random from a
hat or from a table of random numbers. Next assign and select the sublocations or areas within a location by the same
procedure. In order to minimize handling during sampling, observe the precautions of Section 6.

5.2.1 When test units are to be taken from small rolls, reams, bundles, cartons or shipping containers of
completed paper products, divide the lot or sublot into “locations,” etc., and proceed as described above.

5.2.2 When test units are to be taken from large rolls or skids, divide the lot or sublot into “locations” and
“sublocations” no smaller than a roll or unopenable skid (see 5.3.2), assign and select numbers as described above, then
proceed as described in 5.3 below.
5.3 Large rolls or skids.

5.3.1 When taking a test unit from a large roll remove all damaged layers from the outside of the roll and, in addition, discard at least three undamaged layers for sheets having a nominal grammage of less than 250 g/m² (51.2 lb/1000 ft²) or at least one undamaged layer for heavier sheets. Cut the roll across its full width and to a sufficient depth to enable the requisite number of sheets to be taken. Let the cut sheets fall to each side and remove the roll.

5.3.2 When taking a test unit from a skid or roll that may not be opened at the time of sampling, cut a window 300 by 450 mm (12 x 18 in.) or larger if larger test specimens are required. Cut the window with its longer side parallel to the machine direction when this is known, or if not known, cut the window at least 450 by 450 mm (18 x 18 in.) with sides parallel to those of the skid. For paper that has been sheeted simultaneously from several rolls, take a sufficient number of adjacent sheets to assure representation of all the rolls used. Cut the sheets to sufficient depth to enable the requisite number of sheets to be taken and remove them. Remove all outside sheets that are damaged and, in addition, discard at least the three outermost undamaged sheets for paper having a nominal grammage less than 250 g/m² (51.2 lb/1000 ft²) or at least one outmost undamaged sheet of heavier paper. Vary the position of the window at random among the skids or rolls from which test units are to be drawn, making sure that the sides of the window are parallel to those of the skid or to the roll edge and axis.

5.3.3 In either of the above, if a test for moisture content is to be made, it may be necessary to discard considerably more than three undamaged sheets of paper and one undamaged sheet of board. In one case reported in the literature (1), it was necessary to discard 40 sheets of manila board to obtain the moisture content of the major portion of the roll. Moisture content sample must be placed in sealed, moisture tight containers at time of sampling.

5.4 Sampling a single roll of containerboard for basis weight and burst strength. The Fiberboard Shipping Container Testing Committee recommends the following uniform procedure for selecting samples for evaluation to meet requirements for freight or D.O.T. requirements.

5.4.1 Select roll for evaluation. Remove the steel, or other, bands and all damaged layers from outside of the roll, and in addition, discard at least three undamaged layers for containerboard with a nominal basis weight of less than 250 g/m² (51.2 lb/1000 ft²) or at least one undamaged layer for heavier containerboards (2).

5.4.2 Cut samples of full roll width of sufficient area required for each test (see TAPPI T 807 “Bursting Strength of Paper and Linerboard” and TAPPI T 410 “Grammage of Paper and Paperboard” (weight per unit area)).

5.4.3 Identify sample with grade, roll number, mill, etc. Sample should be rolled to no less than 125 mm (5 in.) I.D. or cut into sheets approximately 300 mm x 300 mm, (12 in. x 12 in.) that are identified as to position relative to one another.

5.4.4 Protect samples from direct sunlight, moisture from hands, and extremes of temperature and humidity

5.5 Selection of sample for strip feed measurements.

5.5.1 From rolls or reels selected for testing remove all damaged layers from the outside of the roll and, in addition, discard at least three undamaged layers for sheets having a nominal grammage of less than 250 g/m² (51.2
Sampling and accepting a single lot of paper, paperboard, containerboard, or related product

5.5.2 Cut the roll across its full width and to a sufficient depth to enable the requisite number of strips to be taken. The width of the strip shall not be less than the equivalent of the width of three equivalent test areas.

5.5.3 The cut strips shall be marked with the identification information of grade, roll number, mill, etc. If the strip is to be tested for across machine variability then identification of slice position, or other machine identifier in the cross machine direction, must be included if sampling is from rolls or drive side if sampling is from machine reels. Strips should be rolled to no less than 125 mm (5 in.) I.D., strips should never be folded.

5.5.4 Protect strips from direct sunlight, moisture from hands, and extremes of temperature and humidity.

5.6 Handling small size, or single sheet, samples.

5.6.1 If the quantity of sample provided is sufficient to discard the outer sheets this should be done to remove from the sample potentially damaged paper.

5.6.2 The sample sheet(s) shall be marked with identification information and source.

5.6.3 Protect samples from direct sunlight, moisture from hands, and extremes of temperature and humidity. When a limited sample has been provided for testing, careful planning must be used to minimize waste.

6. Care of samples

Keep the test units smooth and flat, except for transporting, when it may be better to ship the test unit in a tube. Protect the sample from exposure to direct sunlight, moisture of the hands, contact with liquids or other harmful influences such as extremes of temperature or humidities above 58% relative humidity. Consult the product specification and the test methods for directions as to any precautions to be taken or special handling necessary.

7. Cutting and marking

Trim test units with their edges parallel to the machine and cross directions. Avoid watermarks or creases for other than grammage determinations; also avoid any unusual flaws or blemishes that might subsequently affect the test results. Mark test units for identification, for example, the locations from which they were taken, and, if needed, their machine direction (see TAPPI T 409 “Machine Direction of Paper and Paperboard”) and top side (see TAPPI T 455 “Identification of Wire Side of Paper”).

8. Sampling report

8.1 When required, give a brief description of the shipment or lot and the sampling including:

8.1.1 Type and grade of paper, paperboard or containerboard with a reference to the specification, if available.

8.1.2 Form in which purchased (that is, dimensions of rolls or sheets; packaging; etc., if not covered in the product specification).
8.1.3 Total quantity (usually weight or area), or purchase order number, or both.
8.1.4 Lot number or other identification of specific lot sampled (if divided into sublets, identification or description of sublets).
8.1.5 Date of sampling.
8.1.6 Location of sampling (mill, warehouse, in transit, etc.).
8.1.7 Description and enumeration of any portions of the shipment excluded from sampling because of damage.
8.1.8 Deviations from the specified sampling procedure if it was found to be not reasonably possible to follow the prescribed directions.
8.1.9 Authority requesting the sample (if appropriate).

9. Precision

A precision statement is not applicable for this standard practice.

10. Keywords

Acceptability, Quality control, Sampling, Paper, Paperboard, Container boards, Fiberboards

11. Additional information

11.1 Effective date of issue: to be assigned.
11.2 Related methods: ASTM D 585 (technically identical); ISO 186 (uses essentially an engineered sampling plan); PAPTAC A.3..
11.3 The 1994 version of the method incorporates the use of strip feed sampling procedures. The 1990 revision involves reorganization and clarification and elimination of certain errors introduced in the 1975 version. The 1975 version also added the appendixes, which are to be used only when no other acceptance plan has been specified.
11.4 Deliberate non-representative or semi-representative selection of rolls or skids for sampling may be desirable to emphasize expected stock problems. Use the bills of lading to select skids or rolls at the beginning and near the end of the run, then randomly through the run but stressing front and back positions. These are the areas from which production problems may be expected to arise. This approach is non-random, not statistical, but may be more economical when extremes and not averages are sought; however, it cannot be said to be “in accordance with TAPPI T 400.”
11.5 The 1997 revision includes the procedures for handling samples of limited size that may be provided to the laboratory for testing. Included in this revision is the warning that in such cases, these samples may not represent the lot of paper from which they came.
Literature cited


Appendix A: Useful acceptance plans

A.1 Individual lot acceptance. The appropriate sampling-acceptance plan provided in the following sections is to be used only for individual lot acceptance when no other plan has been specified and this method has been referenced. A plan that is tailored to the specific paper product, grade, type of defects, end use, etc., is preferable to a general plan. However, the general plans provided here are considered to be a good compromise between costs of testing and the risks of wrong decisions, and are applicable to a wide range of paper products.

A.1.1 The acceptance plans given here are called “attribute” acceptance plans because a test unit fails if it fails to conform to one or more of the requirements for which it is tested and acceptance of the lot is based on an acceptably low number of units failing. Maltenfort and Boedeker (3) describe a “variables” acceptance plan in which acceptance is based on the average of the values obtained for the test units and the variability among these values.

A.1.2 When a continuing series of lots is being obtained from the same manufacturer, other plans (such as MIL-STD 105D and MIL-STD 414) are likely to be more efficient as they can provide for increasing or reducing inspection as experience with that manufacturer indicates.

A.2 Assumptions.

A.2.1 Since a lot (3.1) is presumed to be reasonably homogeneous, the plans presented below assume homogeneity and therefore provide only for acceptance or rejection of the lot as a whole. If the lot is not homogeneous, a test on one test unit of the sample might be so far off specification as to make at least the corresponding part of the lot unacceptable even though the proportion of off-specification test units would be so small as to indicate the whole lot should be accepted. Provision should be made for this situation in advance, for example, by calling for rejection of the lot as a whole because of its excess non-homogeneity or by requiring complete screening (that is, testing of each part and rejecting substandard parts) if non-homogeneity is found.

A.2.2 The plans are based also on the assumption that the properties of a test unit drawn from the outer layers or sheets (4.3) or at random (in 4.2.1) are identical with the properties throughout the roll, skid, ream, carton, etc., from which the test unit was taken. While this assumption is obviously not true, if the lot or sublot is reasonably uniform and the rules for selecting the sample are carefully followed, the acceptance plans will generally provide a satisfactory level of protection.

A.3 Level of protection. If the above assumptions are true, the plans provide the following:

A.3.1 Protection to producer. The lot will be accepted with a probability of at least 95% if the proportion of the defective items contained in it does not exceed 2.5%.
A.3.2 Protection to consumer. The lot will be rejected with a probability of at least 90% if the proportion of the defective items contained in it reaches 16 to 32% in Plan I, 19 to 68% in Plan II, and 37 to 68% in Plan III, the smaller figure in each case applying to the largest lot size.

A.4 Application of plans.

A.4.1 Plan I, for individual lots composed of large rolls that cannot be unwound or skids (pallets) that cannot be opened at the time of sampling (5.3.2).

A.4.2 Plan II, for individual lots composed of small rolls (as tapes, toweling), reams, bundles, cartons, or shipping containers from which test units may be selected at random.

A.4.3 Plan III, for “noncritical” chemical tests for individual lots composed as in A.4.1 or A.4.2. As used herein, “noncritical” means tests for which variability within the lot is of little or no significance and therefore the amount of testing called for by Plan I or II could not be justified.

Appendix B: Acceptance definitions

B.1 Lot size.

B.1.1 Plan I. The lot size \( N \) is the number of rolls or skids of which the lot (3.1) is composed.

B.1.2 Plan II. The lot size \( N \) is the number of small rolls, reams, bundles, cartons, or shipping containers of which the lot is composed, as appropriate for the test to be made. When a choice is possible (as in testing a property of the paper in a roll when an equal number of rolls are packed in each carton), select the unit (roll or carton) on which lot size is based so that the lot size will be greater than 25.

B.1.3 Plan III, as for Plan I or II, as appropriate.

B.2 Sample size, the number of test units (3.34) of which the sample (3.2) for test is composed, determined from lot size in accordance with Tables 1, 2, or 3.

B.3 Acceptance. A lot is either accepted or rejected as a whole on the basis of tests carried out on the sample. Each test unit of the sample is separately evaluated.

B.4 Defective test unit, a test unit that fails to conform to one or more of the requirements for which it has been tested.

B.5 Acceptance number, a number used in connection with a sampling plan (Tables 1, 2, or 3), such that if the number of defective test units in the sample is less than or equal to this number, the lot should be passed for the properties tested.

B.6 Rejection number, a number used in connection with a sampling plan (Tables 1, 2, or 3), such that if the number of defective test units in the sample is greater than or equal to this number, the lot should be rejected.
**Table 1.** Plan I for large rolls or skids.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample Size</th>
<th>Acceptance and rejection numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>nₜ</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3 to 5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6 to 10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>11 to 100</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>101 to 300</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>301 to 1200</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>1201 and over</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

nₜ = total sample size, that is, sum of test units in first and second part, of double sample.

Acₜ and Reₜ = acceptance and rejection numbers for double sample.

**Table 2.** Plan II for small rolls, reams, bundles, etc.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample Size</th>
<th>Acceptance and rejection numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>nₜ</td>
</tr>
<tr>
<td>2 to 25</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>26 to 150</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>151 to 1200</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1201 to 35000</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>35001 and over</td>
<td>13</td>
<td>26</td>
</tr>
</tbody>
</table>

nₜ = total sample size, that is, sum of test units in first and second part, of double sample.

Acₜ and Reₜ = acceptance and rejection numbers for double sample.
Table 3. Plan III for noncritical chemical tests.

<table>
<thead>
<tr>
<th>Lot size, N</th>
<th>Sample size n’</th>
<th>Ac</th>
<th>Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 100</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>101 to 1200</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1201 to 35000</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>35001 and over</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Appendix C: Instruction for use of Tables 1, 2, 3

C.1 Select Table 1 or Table 2 according to the composition of the lot (A.4.1 and A.4.2).

C.2 Locate the lot size (B.1) in the first column of the selected table. The sampling and acceptance criteria to be used are those given on the line corresponding to this lot size.

C.3 Take a first sample consisting of the number of test units equal to the number in the column headed n. Sample according to the rules for selecting a sample to represent a lot (53.1), including in each test unit enough additional material for noncritical chemical tests (C.10 to C.13).

C.4 Subject each of the n test units of this sample to all of the required tests. For noncritical chemical tests follow instructions in C.10 to C.13.

C.5 Record the number of defective units thus found.

C.6 First sample criteria

C.6.1 If the number from C.5 does not exceed the number in column Ac, the lot should be considered to meet the requirements relating to the properties tested.

C.6.2 If the above number equals or exceeds the number in column Re, the lot should be considered as having failed to meet the requirements of the detail specification.

C.6.3 If the above number exceeds the acceptance number (Ac) but is less than the rejection number (Re), proceed to the next step.

C.7 Take a second sample equal in size to the first so that the total number of test units in the first and second sample is n. Again take this sample in accordance with the rules for selecting a sample to represent a lot.

C.8 Follow C.4 and C.5, and compute the total number of defective test units in the two samples.

C.9 Total sample criteria

C.9.1 If the number in C.8 does not exceed the number in Ac, the lot is considered to meet the requirements relating to the properties tested.

C.9.2 If the above number equals or exceeds the number in column Re, the lot shall be considered as
having failed to meet the requirements of the detail specification.

C.10 If the lot satisfies C.6.1 or C.9.1 and noncritical chemical tests are specified, determine the sample size \((nN)\) for these tests in accordance with Table 3.

C.1211 Select the above \(nN\) test units at random from the \(n\) test units obtained according to instruction Section 5.10.3.

C.12 Subject each of the \(nN\) test units of this sample to all the required noncritical chemical tests, and record the number of defective test units thus found.

C.13 Chemical rest criteria

C.13.1 If the number of defective test units (C.12) is zero, the lot is considered to meet the requirements relating to noncritical chemical tests.

C.13.2 If the number is greater than zero, the lot shall be considered as having failed to meet the requirements of the detail specification.

**Appendix D: Acceptance report**

Report lot size, sample size, number of defective test units found, and the nature of the defects.

*Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Director of Quality and Standards.*