Chapter 4. Test Procedures – Packages Labeled by Count, Linear Measure, Area, Thickness, and Combinations of Quantities

4.1. Scope

The following procedures should be used to determine the net contents of products sold by count, area, thickness, and linear measure. If a package includes more than one declaration of quantity, each declaration must meet the package requirements.

A gravimetric procedure may be used to test products sold by measure or count if the density of the product does not vary excessively from one package to another. If the gravimetric procedure cannot be used, each package in the sample must be opened to measure or count the contents.

Note: If Multiunit or Variety Packages are to be inspected, refer to Chapter 5. "Specialized Test Procedures" for guidance in testing. If a total quantity declaration is being verified and the MAV to be applied is not based on a percentage of the labeled quantity, refer to Section 1.2.4.1. "Total Quantity MAV for Multiunit and Variety Packages."
(Note Added 2022)

4.2. Packages Labeled by Count

If the labeled count is 50 items or fewer, use Section 4.2.1. "Packages Labeled with 50 Items or Fewer." If the labeled count is more than 50 items, see Section 4.2.2. "Packages Labeled by Count of More than 50 Items." If the labeled count is more than 50 items for corn, soybeans, field beans, and wheat seeds, see Section 4.9. "Procedure for Checking the Contents of Specific Agricultural Seed Packages Labeled by Count."

4.2.1. Packages Labeled with 50 Items or Fewer

4.2.1.1. Test Equipment

None.

4.2.1.2. Test Procedure

1. Follow Section 2.3.1. "Define the Inspection Lot." Use "the sampling plans in Appendix A. Tables, Table 2-11. "Sampling Plans and Accuracy Requirements for Packages Labeled by Low Count (50 or Fewer) and Packages Given Tolerances (Glass and Stemware)" for the inspection and select a random sample.

2. Open the packages and count the number of items in each. Record the number of packages that contain fewer than the labeled count.

4.2.1.3. Evaluation of Results

1. Refer to Column 2 to determine the number of packages that are allowed to contain fewer than the labeled count.

2. If the number of packages in the sample that contain fewer than the labeled count exceeds the number permitted in Column 2, the sample and the lot fail to meet the package requirement.

Note: For statistical reasons, the average requirement does not apply to packages labeled by count of 50 or fewer items, **and the MAV does not apply to the lot**. It only applies to the packages in the sample.

3. Maximum Allowable Variations: The MAVs listed in Appendix A, Table 2-7. "Maximum Allowable Variations (MAVs) for Packages Labeled by Count" define the limits of reasonable variation for an individual package even though the MAV is not directly used in the sampling plan. Individual packages that are undercount by more than the MAV are considered defective. Even if the sample passes, these should be repacked, relabeled, or otherwise handled.

Example:
If testing a lot of 160 packages of pencils labeled "50 pencils," choose a random sample of 12 packages from the lot. If the scale cannot discriminate between differences in count, open every package and count the pencils. For example, assume the 12 package counts are: 50, 52, 50, 50, 51, 53, 52, 50, 50, 50, 47, and 50.

Because only one package contains fewer than 50 pencils, the sample passes the test (refer to Appendix A. Table 2-11. "Accuracy Requirements for Packages Labeled by Low Count [50 or Fewer] and Packages Given Tolerances [Glass and Stemware]"). However, the package containing 47 pencils should not be introduced into commerce even though the lot complies with the package requirements because it is undercount by more than the MAV (1 item) permitted in Appendix A, Table 2-7. "Maximum Allowable Variations (MAVs) for Packages Labeled by Count."

(Amended 2010)

4.2.2. Packages Labeled by Count of More than 50 Items

There are two procedures to determine count without opening all packages in the sample. The first is an audit procedure and the second is recommended for determining compliance and taking legal action. Both use the weight of a counted number of items in the package. If the weight of discrete items or numbers of items in a package varies excessively, the packaged items must be counted rather than weighed.

To determine if a gravimetric procedure can be used to inspect packages labeled by count, follow the steps below.

4.2.2.1. Test Equipment

Scale that meets the requirements in Section 2.2. "Measurement Standards and Test Equipment."

Scale Sensitivity:

First, determine if the scale being used is sensitive enough to determine the weight of individual items by doing the following:

1. For packages labeled with a count of 84 or higher, calculate the weight equivalent for the MAV/6 for the labeled count of the package. MAV/6 must be at least equal to one-half scale division on a mechanical scale or one division on a digital scale.

2. For packages with a labeled count of 83 or fewer, when each unit weighs at least two-scale divisions, consider the scale acceptable.

   Example:
   According to Appendix A, Table 2-7. "Maximum Allowable Variations (MAVs) for Packages Labeled by Count," the MAV is 7 for a package labeled with a count of 250 items. The scale should be capable of measuring differences corresponding to MAV/6 or, in this example, the weight of one item.

   - If the scale meets the appropriate requirement, gravimetric testing can be used to determine package count or,

   - If the scale does not meet the criteria, count the content in each package in the sample.

4.2.2.2. Test Procedures

a. Audit Procedure

Use this procedure to audit lots of packages labeled by count of more than 50 items but not for determining lot compliance. Determine the lot compliance based on actual count or by using the "Violation Procedure" (b).

Note: The precision of this procedure is only ± 1 %.

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; and select a random sample.

2. Select an initial tare sample according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

3. Gross weigh the first package in the tare sample and record this weight.

4. Select the number of items from the first tare package that weighs the greater:

   - 10 % of the labeled count; or

   - a quantity equal to at least 50 minimum divisions on the scale.

Example:
Using a scale with 1 g divisions, the selected count must weigh at least 50 grams. If a scale with 0.001 lb divisions is used, the selected count must weigh at least 0.05 lb. Record the count and weight.

5. Calculate the weight of the labeled count using the following formula:

$$\textit{Weight of the Labeled Count} = \textit{(labeled count} \times \textit{weight of items in Step 4)} \div \textit{(Count of items in Step 4)}$$

Record the result as "labeled count weight."

6. Gross weigh the remaining packages of the tare sample and keep contents of opened packages separated in case all of the items must be counted.

7. Determine the Average Used Dry Tare Weight of the sample according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

8. Record the nominal gross weight by adding the weight of the labeled count and the average tare weight.

9. Subtract the nominal gross weight from the gross weight of the individual packages and record the errors.

$$\textit{(Package error [weight])} = \textit{(actual package gross weight)} - \textit{(nominal gross weight)}$$

10. Convert the package errors in units of weight to count using the following formula:

$$\textit{Package error (count)} = \textit{(Package error [weight]} \times \textit{labeled count)} \div \textit{(labeled count weight)}$$

Round any fractional counts up to whole items in favor of the packager. Record the package error in units of count.

11. Compute the average error.

- If the average error is minus, go to the "Violation Procedure" below.
- If the average error is zero or positive, the sample is presumed to conform to the package requirements.

b. Violation Procedure

If possible, use the gravimetric procedure to determine compliance, to minimize the number of packages to be opened. This procedure combines the measurement of the weight of the number of units in the package with the determination of tare. Therefore, it will not be necessary to open more packages than the tare sample. If the audit procedure in this section has been used, the procedure below can be followed with the same sample if package contents have been kept separate and can still be counted. Use the following procedure to determine if the sample passes or fails.

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2. Select an initial tare sample according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

3. Gross weigh the packages selected for the tare sample and record these weights. Open these packages and determine the tare and net weights of the contents, and count the exact number of items in the packages. Record this information.

4. Calculate and record the weights of the labeled counts for the first two packages using the formula:

   Weight of labeled count = (labeled count) × (contents weight ÷ contents count)

   To avoid round off errors, carry at least two extra decimal places in the calculation until the weight of the labeled count is obtained. To use the gravimetric procedure, the difference in weights of the labeled counts of the two packages must not exceed one scale division.

   - If the difference in weights exceeds this criterion, determine the actual count per package for every package in the sample recording plus and minus errors. Then, follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

   - If the difference is within the criterion, average the weights of the labeled count and go on to Step 5.

5. Determine the Average Used Dry Tare Weight of the sample according to provisions in Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

6. Determine and record the nominal gross weight by adding the average weight of the labeled count of items in the package Step 4 to the average tare weight Step 5.

7. Weigh the remaining packages in the sample, subtract the nominal gross weight from the gross weight of the individual packages, and record the errors.

   Package Error (weight) = (Actual Package Gross Weight) − (Nominal Gross Weight)

8. Look up the MAV for the package size from Appendix A, Table 2-7. "Maximum Allowable Variations (MAVs) for Packages Labeled by Count" and convert it to weight using the formula:

   MAV (weight) =
   (MAV (count) × Average Weight of Labeled Count [from Step 4]) ÷ (Labeled Count)

9. Convert the MAV to dimensionless units by dividing the MAV (weight) by the unit of measure and record.

4.2.2.3. Evaluation of Results

Follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

Convert back to count when completing the report form, using the following formula:

Average Package Error (count) = (Avg. Pkg. Error [dimensionless units]) × (Unit of Measure) × (Labeled Count) ÷ (Average Weight of Labeled Count)

4.3. Paper Plates and Sanitary Paper Products

The following procedure is used to verify the size of paper plates and other sanitary paper products. It may also be used to verify the size declarations of other disposable dinnerware.

Note: Do not distort the item's shape during measurement.

The count of sanitary paper products cannot be adequately determined by weighing. Variability in sheet weight and core weight requires that official tests be conducted by actual count. However, weighing can be a useful audit method. These products often declare total area as well as unit count and sheet size. If the actual sheet size measurements and the actual count comply with the average requirements, the total area declaration is assumed correct.

4.3.1. Test Equipment

- Steel tapes and rulers. Determine measurements of length to the nearest division of the appropriate tape or ruler.
  - Metric units:

    For labeled dimensions 400 mm or less, linear measure: 300 mm in length, 1 mm divisions; or a 1 m ruler with 0.1 mm divisions, overall length tolerance of 0.4 mm.

    For labeled dimensions greater than 400 mm, 30 m tape with 1 mm divisions.
  - U.S. customary units:

    For labeled dimensions 25 in or less, use a 36 in ruler with $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ in divisions and an overall length tolerance of 0.1 in.
- Measuring Base

  Note: A measuring base may be made of any flat, sturdy material approximately 38 cm (15 in) square. Two vertical side pieces approximately 30 mm (1 in) high and the same length as the sides of the measuring base are attached along two adjoining edges of the measuring base to form a 90° corner. Trim all white borders from two or more sheets of graph paper (at least 380 mm, 10 divisions per centimeter or 20 divisions per inch). Place one sheet on the measuring base and position it so that one corner of graph paper is snug in the corner of the measuring base and vertical sides. Tape the sheet to the measuring base. Overlap other sheets

on the first sheet so that the lines of top and bottom sheet coincide, expanding the graph area to a size bigger than plates to be measured; tape these sheets to the measuring base. Number each line from the top and left side of base plates: 1, 2, 3, etc.

4.3.2. Test Procedure

1.* Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2.* Select an initial tare sample according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

3. Open each package and select one item from each.

Notes:

(1) Some packages of plates contain a combination of different-sized plates. In this instance, take a plate of each declared size from the package to represent all the plates of that size in the package. For example, if three sizes are declared, select three different plates from each package.

(2) Occasionally, packages of plates declared to be one size contain plates that can be seen by inspection to be of different sizes in the same package. In this instance, select the smallest plate and use the methods below to determine the package error. If the smallest plate is not short measure by more than the MAV, measure each size of plate in the package and calculate the average dimensions.

Example:
If five plates measure 21.41 cm (8.43 in) and 15 measure 21.74 cm (8.56 in), the average dimension for this package of 20 plates is 21.66 cm (8.53 in).

4. For paper plates: Place each item on the measuring base plate (or use the linear measure) with the eating surface down so two sides of the plate touch the sides of the measuring base.

5. For other products: Use either the measuring base or a linear measure to determine actual labeled dimensions (e.g., packages of napkins, rolls of paper towels). If testing folded products, be sure that the folds are pressed flat so that the measurement is accurate.

6. If the measurements reveal that the dimensions of the individual items vary, select at least 10 items from each package. Measure and average these dimensions. Use the average dimensions to determine package error in Step 7 below.

7. The package error equals the actual dimensions minus the labeled dimensions.

4.3.3. Evaluation of Results

Follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

4.4. Special Test Requirements for Packages Labeled by Linear or Square Measure (Area)

Products labeled by length (such as yarn) or area, often require the application of tension to the ends of the product in order to straighten the product before measuring. When testing yarn and thread, apply tension and use the specialized equipment as defined by the latest version of ASTM D1907/D1907M, "Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method," in conjunction with the sampling plans and package requirements described in this handbook. Use Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

4.5. Polyethylene Sheeting, Bags, and Liners

Most polyethylene products are sold by length, width, thickness, area, and net weight. Accordingly, this procedure includes steps to test for each of these measurements.
(Amended 2017)

4.5.1. Test Equipment

- A scale that meets the requirements in Section 2.2. "Measurement Standards and Test Equipment."
- Steel tapes and rulers. Determine measurements of length to the nearest division of the appropriate tape or ruler.
  - Metric units:

    For labeled dimensions 400 mm or less, linear measure: 300 mm in length, 1 mm divisions; or a 1 m ruler with 0.1 mm divisions, overall length tolerance of 0.4 mm.

    For labeled dimensions greater than 400 mm, 30 m tape with 1 mm divisions.
  - U.S. customary units:

    For labeled dimensions 25 in or less, use a 36 in ruler with $^{1}/_{64}$ in or $^{1}/_{100}$ in divisions and an overall length tolerance of $^{1}/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^{1}/_{16}$ in divisions and an overall length tolerance of 0.1 in.
- Deadweight dial micrometer (or equal) equipped with a flat anvil, 6.35 mm or ($^{1}/_{4}$ in) diameter or larger, and a 4.75 mm ($^{3}/_{16}$ in) diameter flat surface on the head of the spindle.
  - The mass of the probe head (total of anvil, weight 102 g or [3.6 oz], spindle, etc.) must total 113.4 g (4 oz).
  - The anvil and spindle head surfaces should be ground and lapped, parallel to within 0.002 mm (0.0001 in), and should move on an axis perpendicular to their surfaces.
  - The dial spindle should be vertical, and the dial should be at least 50.8 mm (2 in) in diameter.

- The dial indicator should be continuously graduated to read directly to 0.002 mm (0.0001 in) and should be capable of making more than one revolution. It must be equipped with a separate indicator to indicate the number of complete revolutions. The dial indicator mechanism should be fully jeweled.

- The frame should be of sufficient rigidity that a load of 1.36 kg (3 lb) applied to the dial housing, exclusive of the weight or spindle presser foot, will not cause a change in indication on the dial of more than 0.02 mm (0.001 in).

- The indicator reading must be repeatable to 0.001 2 mm (0.000 05 in) at zero.

- The micrometer should be operated in an atmosphere free from drafts and fluctuating temperature and should be stabilized at ambient room temperature before use.

- Gage blocks covering the range of thicknesses to be tested should be used to check the accuracy of the micrometer

- T-square

4.5.2. Test Procedure

a. Test Procedure for Polyethylene Sheeting

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2. Be sure the product is not mislabeled. Check the label declaration to confirm that all of the declared dimensions are consistent with the required standards. The declaration on sheeting, film, and bags shall be equal to or greater than the weight calculated by using the formulas below.

   - For values less than 453.6 kg (1000 lb), the final value shall be calculated to at least four digits and declared to three digits, truncating the final digits as calculated (e.g., a calculated value of 943.1 g [2.079 lb] is truncated to 943 g [2.07 lb]), a calculated value of 14.92 kg (32.89 lb) is truncated to 14.9 kg (32.8 lb), a calculated value of 124.4. kg (274.2 lb) is truncated to 124 kg (274 lb).

   - For values of 453.6 kg (1000 lb) or more, the final value shall be calculated to at least five digits and declared to four digits, truncating the final digits as calculated (e.g., a calculated value of 570.44 kg [1257.6 lb] is truncated to 570.4 kg [1257 lb]).

Example:

Label –

Polyethylene Sheeting

1.82 m (6 ft) × 30.48 m (100 ft)

101.6 µm (4 mil)

5.03 kg (11.1 lb*)*

3. Use the following formulas to compute a target net weight. The labeled weight shall equal or exceed the target net weight or the package is not in compliance and shall be considered a NIST Handbook 130, Uniform Method of Sale, Section 2.13. "Polyethylene Product" violation.

   - SI (metric) Dimensions:

$$Target\ Mass\ in\ Kilograms = (T \times A \times D) \div 1\ 000$$

Where: *T = nominal thickness in centimeters*

A = nominal length in centimeters × nominal width (the nominal width for bags is twice the labeled width) in centimeters

*D = minimum density in grams per cubic centimeter**

Check the label for a density declaration and type of polyethylene. If the density (D)* value is not declared, use the following as appropriate:

- For linear low density polyethylene plastics (LLPDE), the minimum density (D) shall be 0.92 g/cm^3 (when D is not known).
- For linear medium density polyethylene plastics (LMDPE), the minimum density (D) shall be 0.93 g/cm^3 (when D is not known).
- For high density polyethylene plastics (HDPE), the minimum density (D) shall be 0.94 g/cm^3 (when D is not known).

*Determined by the latest versions of ASTM Standard D1505, "Standard Test Method for Density of Plastics by the Density-Gradient Technique" and the ASTM Standard D883, "Standard Terminology Relating to Plastics."

   - U.S. Customary Dimensions:

$$Target\ Weight\ in\ Pounds = T \times A \times D \times 0.036\ 13$$

Where: T = nominal thickness in inches;

A = nominal area; that is the nominal length in inches × nominal width (the nominal width for bags is twice the labeled width) in inches;

D = minimum density in grams per cubic centimeter; 0.036 13 is a factor for converting g/cm³ to lb/in³

4. Perform the calculations as shown in the following example. If the product complies with the label declaration, go to Step 5.

   Example:

   - *For metric units:*

     $$(0.010\ 16\ \text{cm} \times [(1.82\ \text{m} \times 100\ \text{cm/m}) \times (30.48\ \text{m} \times 100\ \text{cm/m})] \times 0.92\ \text{g/cm}^3) \div 1000\ \text{g/kg} = \text{a target weight of } 5.18\ \text{kg}$$

     In this example, the labeled net mass of 5.03 kg does not meet the target net mass, so the product is not in compliance.

   - *For U.S. customary units:*

     $$(0.004\ \text{in}) \times [(6\ \text{ft} \times 12\ \text{in/ft}) \times (100\ \text{ft} \times 12\ \text{in/ft})] \times 0.92\ \text{g/cm}^3 \times 0.03613 = \text{a target weight of } 11.48\ \text{lb}$$

     In this example, the labeled net weight of 11.1 lb does not meet the target net weight, so the product is not in compliance.

5. Select packages for tare samples according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

6. Determine and record the gross weights of the initial tare sample.

7. Extend the product in the sample packages to their full dimensions and remove by hand all creases and folds.

8. Measure the length and width of the product to the closest 3 mm ($^1/_8$ in). Make all measurements at intervals uniformly distributed along the length and width of the sample and record the results. Compute the average length and width, and record.

   - With rolls of product, measure the length of the roll at three points along the width of each roll and measure the width at a minimum of 10 points along the length of each roll.

   - For folded products, such as drop cloths or tarpaulins, make three length measurements along the width of the sample and three width measurements along the length of the sample.

9. Determine and record the average tare weight according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

10. Follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine the lot conformance requirements for length, width, and weight.

11. If the sample failed to meet the package requirements for any of these declarations, no further measurements are necessary. The lot fails to conform.

Note: If the sample meets the package requirements for the declarations of length, width, and weight proceed to Step 12 to verifying the thickness declaration.

12. Measure the thickness of the plastic sheet with a micrometer using the following guide. Place the micrometer on a solid level surface. If the dial does not read zero with nothing between the anvil and the spindle head, set it at zero. Raise and lower the spindle head or probe several times; it should indicate zero each time. If it does not, find and correct the cause before proceeding.

13. Take measurements at five uniformly distributed locations across the width at each end and five locations along each side of each roll in the sample. If this is not possible, take measurements at five uniformly distributed locations across the width of the product for each package in the sample.

14. When measuring the thickness, place the sample between the micrometer surfaces and lower the spindle head or probe near, but outside, the area where the measurement will be made. Raise the spindle head or probe a distance of 0.008 mm to 0.01 mm (0.000 3 in to 0.000 4 in) and move the sheet to the measurement position. Drop the spindle head onto the test area of the sheet.

15. Read the dial thickness two seconds or more after the drop, or when the dial hand or digital readout becomes stationary. This procedure minimizes small errors that may occur when the spindle head or probe is lowered slowly onto the test area.

16. For succeeding measurements, raise the spindle head 0.008 mm to 0.01 mm (0.000 3 in to 0.000 4 in) above the rest position on the test surface, move to the next measurement location, and drop the spindle head onto the test area. Do not raise the spindle head more than 0.01 mm (0.000 4 in) above its rest position on the test area. Take measurements at least 6 mm (1/4 in) or more from the edge of the sheet.

17. Repeat Steps 12 through 16 above on the remaining packages in the sample and record all thickness measurements. Compute and record the average thickness for the individual package and apply the following MAV requirements.

(Amended 2012, 2017, and 2018)

b. Test Procedure for Polyethylene Bags and Liners

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2. Follow the steps in Section 4.5.2.a. "Test Procedure for Polyethylene Sheeting" for calculating the weight of polyethylene sheeting. Multiply the calculated weight times the count (the number of bags or liners), then multiply by two (to account for both sides of each bag or liner) to obtain your target net weight.

3. To determine the target net weight for bags with a cutout, (i.e., t-shirt or specialty bags), subtract from the target net weight the weight of the cutout. Use the following method to calculate the weight of the cutout:

   - Trace the cutout on ruled graph paper with 0.5 cm (1/4 in) squares as shown in the diagram that follows. (see Figure 4-1. T-Shirt Bag.)

- For t-shirt bags with a fold or gusset, you will need to draw an extra line up from the gusset to the edge of the graph paper. This will aid in accounting for the additional plastic layers within the bag. (see shaded area in Figure 4-1. T-Shirt Bag.)

- Count the squares and divide this number by the number of squares per square inch (sq in) (i.e., $16^{1}/_{4}$ inch squares = 1 sq in) to determine the total area of the cutout. Adjust your total area by taking into account the number of layers for each region counted. (Figure 4-2. Polyethylene Bag Outline on Graph Paper.)

- Once the total area of the bag has been determined, take the total area of the cutout and divide it by the total area of the bag to calculate the percentage of the cutout.

- Compute and record the weight of the bag without the cutout by subtracting the calculated net weight of the cutout from the total target net weight of the bags being tested. The calculated net weight of the cutout is determined by multiplying the total target net weight of the bag by the percentage of the area of the cutout.

Figure 4-1. T-Shirt Bag.

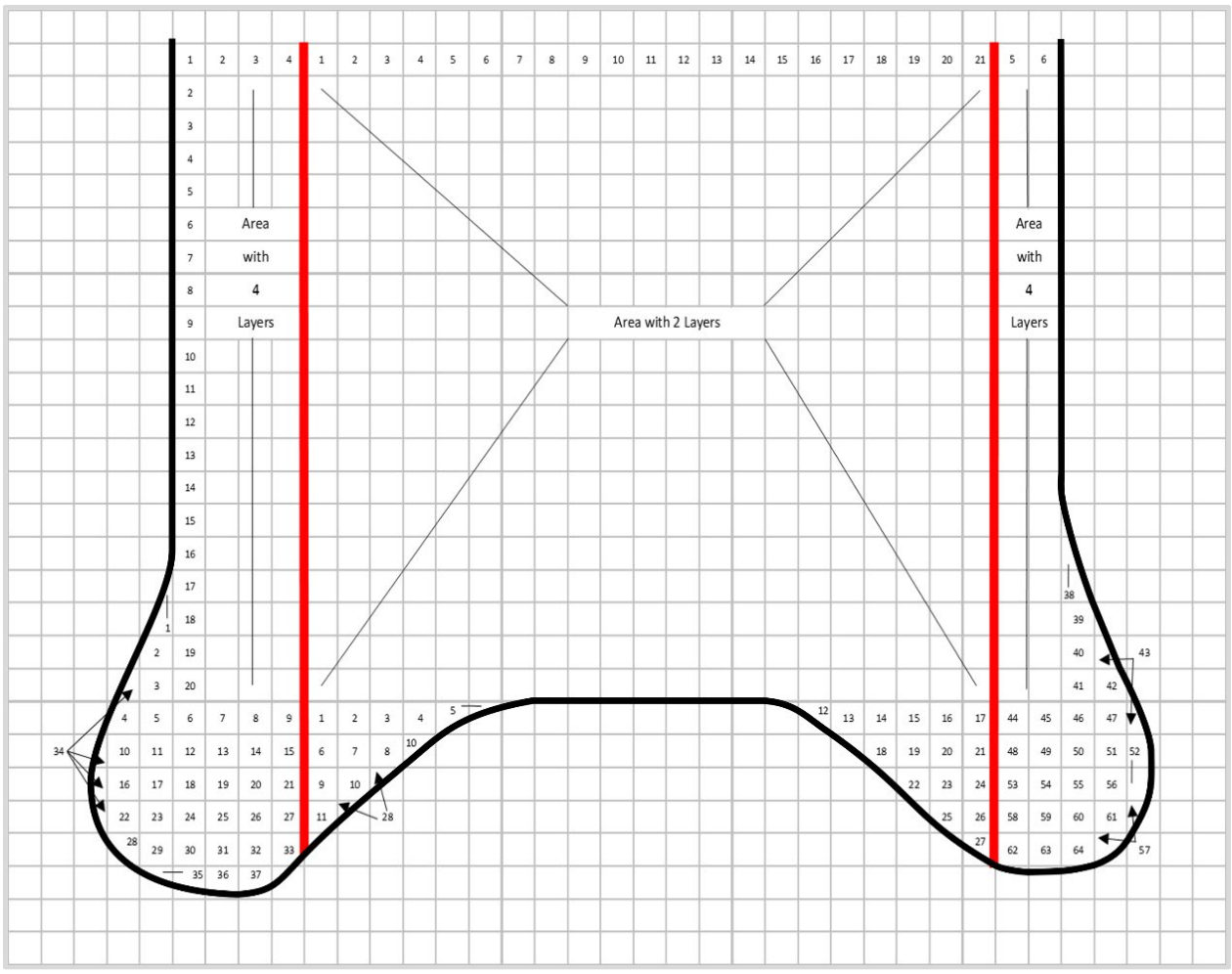

Figure 4-2. Polyethylene Bag Outline on Graph Paper

Example:

- *To find the total area of the cutout, determine the area for the four-layer region and the area for the two-layer region and add them together.*

  Four-Layer Area: 4 [(6 × 20) + 64 additional boxes] ÷ 16 squares/sq in = 46 sq in

  Two-Layer Area: 2 [(21 × 20) + 28 additional boxes] ÷ 16 squares/sq in = 56 sq in

  The area of the cutout = 46 sq in + 56 sq in = 102 sq in

- *If the total area for the bags prior to cutout is 836 sq in, then the percentage of the cutout is 12.2 %, (102 sq in ÷ 836 sq in = 0.1220 × 100)*

- *Multiply the theoretical weight by 12.2 % to determine the weight of the cutout for the bags, then subtract this from the target net weight to determine the weight of the bags.*

If the calculated target net weight for a box of bags is 11.57 lb, then 12.2 % would weigh 1.41 lb (11.57 lb × 12.2 % = 1.41 lb).

Therefore, the target net weight of the product is: 11.57 lb − 1.41 lb = 10.16 lb

(Added 2017)

4.5.3. Evaluation of Results

a. Individual Thickness

Note: Refer to Appendix A, Table 2-10. "Exceptions to the Maximum Allowable Variations (MAVs) for Textiles, Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood and Stovewood Labeled by Volume, and Packages Labeled by Count with 50 Items or Fewer, and Specific Agricultural Seeds Labeled by Count."

(Amended 2010)

- On polyethylene with a declared thickness greater than 25 µm (1 mil or 0.001 in): an individual thickness measured may be up to 20 % less than the declared thickness.

- On polyethylene with labeled thickness less than or equal to 25 µm (1 mil or 0.001 in), individual thickness measurements may be up to 35 % below the labeled thickness.

Count the number of values that are smaller than specified MAVs (0.8 × labeled thickness if 25 µm [1 mil] or greater or 0.65 × labeled thickness, if less than 25 µm [1 mil]). If the number of values that fail to meet the thickness requirement exceeds the number of MAVs permitted for the sample size, the lot fails to conform to requirements. No further testing of the lot is necessary. If the number of MAVs for thickness measurements is less than or equal to the number permitted for the sample size, go on to Evaluation of Results – Average Thickness.

b. Average Thickness

The average thickness for any single package should be at least 96 % of the labeled thickness. This is an MAV of 4 % (refer to Appendix A, Table 2-10. "Exceptions to the MAVs for Textiles, Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood and Stove Wood Labeled by Volume, and Packages Labeled by Count with 50 Items or Fewer, and Specific Agricultural Seeds Labeled by Count.") Circle and count the number of package average thickness values that are smaller than 0.96 × labeled thickness. If the number of package average thicknesses circled exceeds the number of MAVs permitted for the sample size, the lot fails to conform to requirements. No further testing of the lot is necessary. If the number of MAVs for package average thickness is less than or equal to the number of MAVs permitted for the sample size, proceed to Section 2.3.7. "Evaluate for Compliance" to determine if the lot meets the package requirements for average thickness.

(Amended 2010)

4.6. Packages Labeled by Linear or Square (Area) Measure

4.6.1. Test Equipment

- A scale or balance that meets the requirements in Section 2.2. "Measurement Standards and Test Equipment." Determine the suitability of the scale. Calculate the length or area of

packaged product corresponding to MAV/6. If there is no suitable weighing device, all of the packages in the sample must be opened and measured.

- Steel tapes and rulers – determine measurements of length to the nearest division of the appropriate tape or ruler.
  - Metric units:

    For labeled dimensions 400 mm or less, linear measure: 300 mm in length, 1 mm divisions; or a 1 m ruler with 0.1 mm divisions, overall length tolerance of 0.4 mm.

    For labeled dimensions greater than 400 mm, 30 m tape with 1 mm divisions.

  - U.S. customary units:

    For labeled dimensions 25 in or less, use a 36 in ruler with $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ in divisions and an overall length tolerance of 0.1 in.

- T-square

4.6.2. Test Procedure

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2. Select an initial tare sample according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

3. Gross weigh the first package in the tare sample and record this weight.

4. Determine and record the measurements (to the nearest division of the appropriate tape or ruler) of the packaged goods (length, width, area; depending upon which dimensions are declared on the label) and weigh the goods from the first package opened for tare determination.

   - Calculate and record the weight of the labeled measurements using the following formula:

     Weight of the labeled measurement =
     (labeled measurement) × (contents weight) ÷ (contents measurement)

   - Look up and record the MAV in units of length or area measure (given in Appendix A, Table 2-8. "Maximum Allowable Variations for Packages Labeled by Length, (Width) or Area."

Note: See Appendix A, Table 2-10. "Exceptions to the MAVs for Textiles, and Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood and Stove Wood

Labeled by Volume, and Packages Labeled by Count with 50 Items or Fewer, and Specific Agricultural Seeds Labeled by Count."

5. Determine and record the tare weight of the first package opened.

6. Determine and record the measurements (length, width, area; depending upon which dimensions are declared on the label) of the product in the second package chosen for tare determination (to the nearest division of the appropriate tape or ruler). Determine and record the tare weight of this package.

7. Calculate and record the weight of the labeled measurement for the second package using the following formula:

   Weight of the labeled measurement =
   (labeled measurement) × (contents weight ÷ contents measurement)

   The weights of the labeled measurement for two packages must not differ by more than one division on the scale. If they do, open all packages in the sample, measure individually, and compare them against the labeled measure to determine the package errors. If the criterion is met, go to Step 8.

8. Calculate the average weight of the labeled measurement and record.

9. Determine and record the average tare weight according to Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight."

10. Compute and record the nominal gross weight by adding the average weight of the labeled measurements to the average tare weight.

11. Compute package errors according to the following formula:

    Package error (weight) =
    (actual package gross weight) − (nominal gross weight)

12. Convert the MAV to units of weight using the following formula:

    MAV (weight) =
    (Avg. Wt. of label measurements × MAV [length]) ÷ (labeled measurements)

    Convert the MAV to dimensionless units by dividing the MAV (weight) by the unit of measure and record.

4.6.3. Evaluation of Results

Follow the procedure in Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

Convert back to dimensions when completing the report form using the following the formula:

Average Package Error (dimension) = (Avg. Pkg. Error [dimensionless units]) × (Unit of Measure) × (Labeled unit of measure) ÷ (Avg. Weight of Labeled dimension)

4.7. Baler Twine – Test Procedure for Length

4.7.1. Test Equipment

- A scale that meets the requirements in Section 2.2. "Measurement Standards and Test Equipment."

Note: A scale with 0.1 g (0.000 2 lb) increments must be used for weighing twine samples. The recommended minimum load for weighing samples is 20 divisions.

- Steel tapes and rulers – Determine measurements of length to the nearest division of the appropriate tape or ruler.
  - Metric units:

    For labeled dimensions 400 mm or less, linear measure: 300 mm in length, 1 mm divisions; or a 1 m ruler with 0.1 mm divisions, overall length tolerance of 0.4 mm.

    For labeled dimensions greater than 400 mm, 30 m tape with 1 mm divisions.

  - U.S. customary units:

    For labeled dimensions 25 in or less, use a 36 in ruler with $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ in divisions and an overall length tolerance of 0.1 in.

- A hand-held straight-face spring scale of at least 4.53 kg (10 lb) capacity or a cordage-testing device that applies the specified tension to the twine being measured. When measuring twine samples or total roll length, apply 1.0 kg (2.20 lb) of tension to the twine.

4.7.2. Test Procedure

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.

2. Select packages for tare samples. Determine gross weights of the initial tare sample and record.

3. Open the tare samples. Use the procedures for tare determination in Section 2.3.5.1. "Determination of Tare Sample and Average Tare Weight" to compute the average tare weight and record this value.

4. Randomly select four balls of twine from the packages that were opened for tare.

   From each of the four balls of twine:

   - Measure and discard the first 10.05 m (33 ft) of twine from each roll. Accurate measurement requires applying tension to the ends of the twine before measuring in order to straighten the product.

- Take two 30.48 m (100 ft) lengths of twine from inside each roll.

- Weigh and record the weight of each piece separately and record the values. Compare the weight values to determine the variability of the samples. If the individual weights of the eight twine samples vary by more than one division on the scale, use one of the following steps: (1) if the lot is short, determine the actual length of the lightest-weight roll found in the lightest-weight package of the lot to confirm that the weight shortages reflect the shortages in the length of the rolls; or (2) determine the average weight-per-unit of measure by taking ten 30.48 m (100 ft) lengths from inside the lightest weight package. Use this value to recalculate its length and determine lot compliance

5. Weigh all of the sample lengths together and record the total value. Determine the total length of the samples (243.8 m or 800 ft, unless more than eight sample-lengths were taken) and record the value. Compute the average weight-per-unit-of-length by dividing the total weight by the total length of the pieces.

6. Determine the MAV for a package of twine (refer to Appendix A, Table 2-8. "Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area").

   - Record the total declared package length.

   - Multiply the MAV from Appendix A, Table 2-8. "Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area" times the total package length to obtain the MAV for length and record this value.

   - Multiply the weight per unit of length (from Step 4) times the MAV for the total declared package length to obtain the MAV by weight and record this value.

   - Convert the MAV to dimensionless units and record.

7. Calculate the nominal gross weight and record.

   Follow Section 2.3.6. "Determine Nominal Gross Weight and Package Error" to determine individual package errors. Determine errors using the following formula:

   Package error (weight) = (package gross weight) – (nominal gross weight)

   - To convert the package error in weight back to length, divide the weight by the average weight-per-unit-of-length.

4.7.3. Evaluation of Results

Follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot compliance.

4.8. Procedure for Checking the Area Measurement of Chamois

Chamois is a natural leather made from skins of sheep and lambs that have been oil-tanned. Chamois are irregularly shaped, varying in thickness and density, which makes area measurement difficult.

The area of chamois is verified using either Section 4.8.1. "Graph Paper Audit Procedure" which is to identify chamois that are potentially short measure or Section 4.8.2. "Gravimetric Test Procedure for Area Measurement" which is used for compliance testing.

4.8.1. Graph Paper Audit Procedure

Chamois is typically labeled in uniform sizes in terms of square decimeters and square feet, and are sized in increments of 2.32 dm^2 ($^1/_4$ ft^2) (e.g., 9.29 dm^2 [1 ft^2], 11.61 dm^2 [$1^1/_4$ ft^2], and 13.93 dm^2 [$1^1/_2$ ft^2]).

4.8.1.1. Test Equipment

- Graph paper: 43.18 cm × 55.88 cm (17 in × 22 in) with 0.5 cm or $^1/_4$ in squares.
- Ruler or steel tape: 1 mm or $^1/_{16}$ in graduations.

4.8.1.2. Test Procedure

1. Select a random sample of chamois. It is recommended that a minimum of three packages be tested.

2. Place the graph paper on a smooth surface. Use a ruler or steel tape to verify the dimensions of squares at several random points across the page. Place the chamois on the graph paper and carefully draw around the outline of the chamois onto the paper.

   Note: Graph paper of an appropriate size that allows for tracing of the entire chamois shall be used. However, if a single sheet of appropriate-sized graph paper is not available, it may be necessary to tape sheets of graph paper together to create an area sufficient in size to measure the area for a chamois (e.g., chamois greater than 23.22 dm^2 [2.5 ft^2]).

3. Determine the area by counting the number of squares the chamois covers. Use a ruler or steel tape to help calculate the area. Add the number of partially covered squares. (see Figure 4-3. "Template for Checking the Area of a Chamois.")

4. Compute the total area and refer to Section 4.8.3. "Evaluation of Results" to determine if further action is necessary

First Stage – Decision Criteria

If the average of the samples is a plus error or a minus error that is 3 % or less of the labeled quantity, the audit test results should be accepted. Move on to inspect other chamois. If the average of the samples is a minus error that exceeds 3 % of the labeled area, the chamois may not be labeled accurately. To confirm the finding, use the gravimetric test procedure.

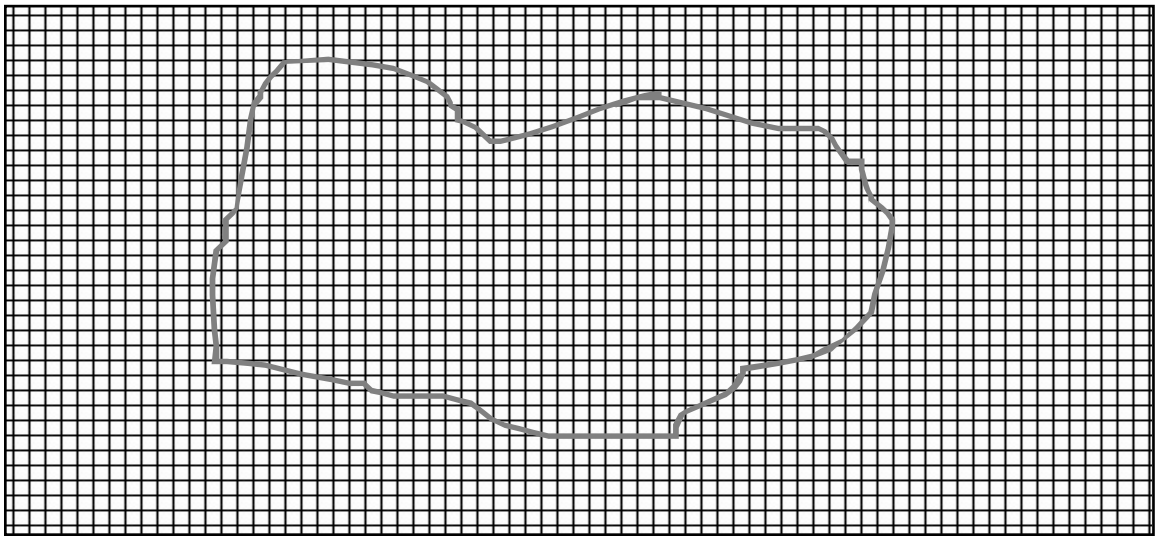

Figure 4-3. Template for Checking the Area of a Chamois.

4.8.2. Gravimetric Test Procedure for Area Measurement

This method is intended for use in checking full, cut, or pattern shaped chamois.

4.8.2.1. Test Equipment

- Scale with a capacity of 1 kg that is accurate to at least ± 0.01 g and a load-receiving element of adequate size to properly hold the chamois (record to 0.1 g).
- Medium weight drawing paper (e.g., drawing paper, medium weight (100 lb), regular surface or comparable)
- Household iron set on the lowest heat temperature settings (e.g., silk, nylon)
- Ruler or steel tape: 1 mm or $^{1}/_{16}$ in graduations
- Instrument for cutting paper (razor blade, scissors, x-acto® knife, or cutting board)
- Steel square

4.8.2.2. Test Procedure

1. Follow Section 2.3.1. "Define the Inspection Lot." "Use a Category A" sampling plan in the inspection; and select a random selection.

2. Use a household iron set on the lowest heat setting (e.g., silk, nylon) to remove wrinkles. Continuously iron the chamois from the center of the chamois to the outer edges in all directions, to spread and flatten out the wrinkles (some wrinkles may not flatten). Use a swift, steady motion, being careful to not let the iron stay in contact with the chamois surface for too long. Excessive heat will shrink the chamois. You may not be able to remove all wrinkles.

3. Immediately after ironing the sample, carefully draw around the outline of the chamois on the paper. Remove the chamois; carefully cut along the outline of the chamois.

4. Lay out the pattern and using a steel square, cut an accurately measured rectangle (verifying all four corners are at a 90° angle) of a size not less than one-half the area of the pattern. Do this for each sample. Weigh the cutout rectangle and record the weight to the nearest 0.1 g Sample Weight 2 (W_2).

5. Weigh the entire cutout pattern (the outline of the chamois which includes the cutout rectangle), and record to the nearest 0.1 g Sample Weight 1 (W_1).

Note: To ensure the proper weighing of the paper outline of the chamois and the cutout rectangle it is recommended that the pieces be folded in a way so that the entire pattern is centered and not hanging over the load receiving element.

6. Calculate the area of the rectangle cut from the pattern by multiplying the length by width and record as Area (A) in square centimeters or square inches.

7. Calculate the area of the original chamois.

   - For metric units – calculate the area of the original chamois being checked as follows:

$$W_1/W_2 \times A = \text{Chamois Area in } cm^2/100 = \text{Area in } dm^2$$

   - For U.S. customary units – calculate the area of the original chamois being checked as follows:

$$W_1/W_2 \times A = \text{Chamois Area in } in^2/144 = \text{Area in } ft^2$$

4.8.3. Evaluation of Results

Compute the average error for the sample and follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot conformance.

The MAV for area declarations on chamois is 3 % of the labeled area as specified in Appendix A, Table 2-8. "Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area".

(Amended 2019)

4.9. Procedure for Checking the Contents of Specific Agriculture Seed Packages Labeled by Count

The following method shall be employed when using a mechanical seed counter to determine the number of seeds contained in a sample of soybean (*Glycine max*), corn (*Zea mays*), wheat (*Triticum aestivum*) and field bean (*Phaseolus vulgaris*).

4.9.1. Test Equipment

- Mechanical seed counter
- Moisture proof container

4.9.2. Test Procedure

1. Testing samples shall be received and retained in moisture proof containers until the weight of the sample prepared for purity analysis is recorded. The sample shall be of at least 500 grams for soybean, corn, field beans, and 100 grams for wheat.

2. The seed counter shall be calibrated daily prior to use.

   - Prepare a calibration sample by counting 10 sets of 100 seeds. Visually examine each set to insure that it contains whole seeds. Combine the 10 sets of seeds to make a 1000 seed calibration sample. The seeds of the calibration sample should be approximately the same size and shape as the seeds in a sample being tested.

Note: If the seeds in a sample being tested are noticeably different in size or shape from those in the calibration sample, prepare another calibration sample with seeds of the appropriate size and shape. Periodically re-examine the calibration samples to insure that no seeds have been lost or added.

   - Carefully pour the 1000 seed calibration sample into the seed counter. Start the counter and run it until all the seeds have been counted.

Note: The seeds should not touch as they run through the counter. Record the number of seeds as displayed on the counter read out.

   - The seed count should not vary more than ± 2 seeds from 1000. If the count is not within this tolerance, clean the mirrors, adjust the feed rate and/or reading sensitivity. Rerun the calibration sample until it is within the ± 2 seed tolerance.

Note: If the seed counter fails the calibration procedure and sample has been checked to ensure that it contains 1000 seeds, do not use the counter until it has been repaired.

3. Immediately after opening the container, mix and divide the sample to obtain a sample for purity analysis (refer to Appendix D: AOSA Rules for Testing Seeds).

4. Record the weight of this sample in grams to the appropriate number of decimal places.

5. Conduct the purity analysis to obtain pure seed for the seed count test.

6. After the seed counter has been calibrated, test the pure seed portion from the purity test and record the number of seeds in the sample.

7. Calculation of results.

- Calculate the number of seeds per pound to the nearest whole number using the following formula:

Number of seeds per pound = 453.6 g/lb × no. of seeds counted divided by the weight (g) of sample analyzed for purity

8. Determine the Maximum Allowable Variation (MAV).

- Multiply the labeled seed count by 4 % for soybean, 2 % for corn, 5 % for field bean, and 3 % for wheat.

Note: Express the maximum allowable variation (the number of seeds) to the nearest whole number. Consider the results of two tests in accord with the maximum allowable variation if the difference, expressed as the number of seeds, is equal to or less than the maximum allowable variation.

Example:
Kind of seed: Corn
Label claim: 2275 seeds/lb

Lab Test: Purity working weight = 500.3 g
Seed count of pure seed = 2479 seeds

Number of seeds per pound = 453.6 g/lb × 2479 seeds divided by 500.3 g = 2247.6 seeds/lb
rounded to the nearest whole number = 2248 seeds/lb

Calculate maximum allowable variation value for corn:
multiply label claim by 2 %
2275 seeds/lb × 0.02 = 45.5 seeds/lb;
rounded to the nearest whole number = 46 seeds/lb

Determine the difference between label claim and lab test:
2275 seeds/lb – 2248 seeds/lb = 27 seeds/lb

The difference between the lab test and the label claim is less than the maximum allowable variation (27 < 46); therefore, the two results are in accord with the maximum allowable variation.

4.9.3. Evaluation of Results

Follow the procedures in Section 2.3.7. "Evaluate for Compliance" to determine lot compliance. (Added 2010)

4.10. Structural Plywood and Wood-Based Structural Panels

4.10.1 Test Equipment

- Steel linear measure

- For labeled dimensions exceeding 304 mm (12 in), use a measure with 0.05 mm or $^1/_{32}$ in graduations.

- Calculator
- Worksheet for Plywood Sheet and Wood-Based Structural Panels (see Appendix C. Model Inspection Reports)
- Micrometer, caliper, or dial gauge 25 mm to 50 mm (1 in to 2 in) with 19.1 mm (3/4 in) anvils
  - A mechanism that applies constant pressure between 34 kPa (5 psi) and 69 kPa (10 psi) during the measurement.
- For "tongue and groove" (e.g., floor panels) and "shiplap" (e.g., exterior siding panels), a micrometer with a 152 mm (6 in) throat; 19.1 mm (3/4 in) anvils may be necessary.
  - A mechanism that applies constant pressure between 34 kPa (5 psi) and 69 kPa (10 psi) during the measurement.
- Gage blocks
  - The latest version of U.S. Department of Commerce (DOC), Voluntary Product Standard PS 1- 19, "Structural Plywood."
  - The latest version of U.S. Department of Commerce (DOC), Voluntary Product Standard PS 2- 18, "Performance Standard for Wood-Based Structural-Use-Panels."
- Aluminum foil and plastic bags
- Saw

4.10.2. Test Procedure

Use this procedure to verify the length, width, and thickness of structural plywood and wood-based structural panels.

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection. Select a random sample.
2. Identify the Performance Category and actual size of each piece (e.g., 1.2 m × 2.4 m) (4 ft × 8 ft) from the latest version of Voluntary Product Standards PS 1-19, "Structural Plywood" or PS 2-18, "Performance Standard for Wood-Based Structural-Use-Panels".
3. Conduct a visual inspection of each piece to ensure there are no signs of water or other damage. Remove any pieces (e.g., top, sides) that have damage or have been exposed to the elements (e.g., weather, rain, moisture, sun) from the lot.

   Note: Overlapping (e.g., shipped siding) or interlocking panels (e.g., tongue and groove floor panels) shall be measured according to the exposed face. Measurements are taken on the surface that will be exposed after installation and shall not include the overlap tab.
4. Determining Length

- For sheet lengths up to 3 m (10 ft), take at least two measurements along the sheet's length about one-quarter of the distance from the center line to each edge of the sheet (see Figure 4-4. Determining Length). Average the results to obtain the Average Length.

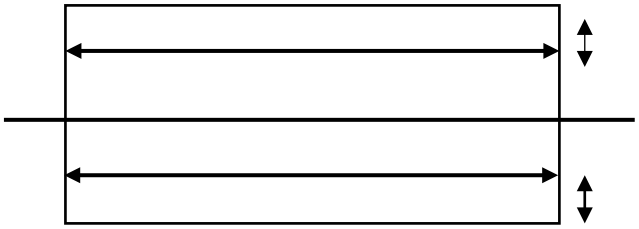

Figure 4-4. Determining Length.

Note: Measurements should not be made across the ends of the board or where there is a knot or surface defect that may affect the measurement. Measurements should not be taken within 150 mm (6 in) from the edges of the sheet.

5. Determining Width

- For sheet lenths up to to 3 m (10 ft), take at least two measurements across the sheet's width about one-quarter of the distance from each end of the sheet (see Figure 4-5. Determining Width). Average the results to obtain the Average Width.

Note: Measurements should not be made anywhere across the sheet where there is a knot or surface defect that may affect the measurement. Measurements should not be taken within 150 mm (6 in) from the ends of the sheet.

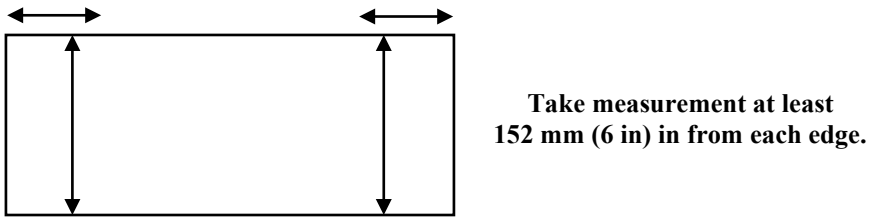

Figure 4-5. Determining Width.

6. Determining Thickness

- Verify the accuracy of the micrometer, caliper, or dial gauge using the gage blocks. Use the micrometer, caliper, or dial gauge 25 mm to 50 mm (1 in to 2 in); 19.1 mm (3/4 in) anvils to measure thickness and record the actual dimensions on the "Worksheet for Plywood Sheets." For "tongue and groove" (e.g., floor panels) and "shiplap" (e.g., exterior siding panels) a micrometer with a 152 mm (6 in) throat; 19.1 mm (3/4 in) anvils may be necessary.

- Panel thickness shall be measured with a micrometer having 19.1 mm (3/4 in) (minus 0, plus 1.3 mm [0.050 in]) diameter anvils.

- Measurements shall be taken at an applied anvil pressure of not less than 34 kPa (5 psi) or more than 69 kPa (10 psi) with the anvil center at 19 mm to 25 mm (3/4 in to 1 in) from the panel edge.

  - The location of the measurements shall be representative of general panel thickness at approximate mid-length, ± 50 mm (2 in) along each edge of the panel and the average of the four measurements shall be taken as the thickness of that panel (see Figure 4-6. Determining Thickness). If a measurement point contains a permissible grade characteristic that affects panel thickness, then the measurement point shall be shifted from that point.

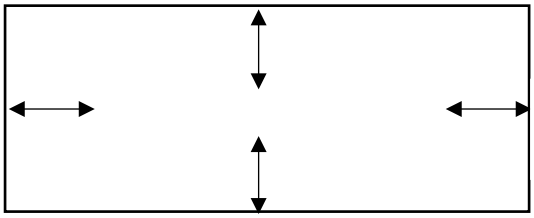

Figure 4-6. Determining Thickness.

4.10.2.1. Labeling and Other Requirements for Structural Plywood and Wood-based Structural Panels

a. Structural Plywood Sheets

1. Shall be labeled in accordance with the latest version of Voluntary Product Standard PS 1-19 "Structural Plywood."

2. Includes grade, performance category (abbreviations: PERF CAT, CAT or Category are permitted), thickness, and mill number.

3. Panel sizes are typically 1.2 m (4 ft) × 2.4 m (8 ft), or 2.7 m (9 ft) or 3 m (10 ft) on a nominal basis.

4. Panel length and width information may be included on the label, tag, or printed directly on the unit.

5. Panels shall bear the stamp of a qualified inspection and testing agency in accordance with the latest version of Voluntary Product Standard PS 1-19, "Structural Plywood," Table 10, "Plywood Thickness"

6. Panels shall bear the stamp of a qualified inspection and testing agency in accordance with the latest version of Voluntary Product Standard PS 1-19, "Structural Plywood," Section 7.1. Certification.

b. Structural Panels

1. Shall be labeled in accordance with the latest version of Voluntary Product Standard PS 2-18 "Performance Standard for Wood-based Structural-Use Panels" for grade, span rating, performance category (abbreviations PERF, CAT, CAT or Category are permitted), thickness and mill number.

2. Performance category, such as 23/32 PERF CAT, means the sheet shall comply with thickness tolerances for 23/32 PERF CAT in the latest verson of Voluntary Product Standard PS 2-18 "Performance Standard for Wood-based Structural-Use Panels," Table 1 – Panel Thickness Requirements.

3. Panels shall bear the stamp of a qualified inspection and testing agency in accordance with the latest version of Voluntary Product Standard 2-18 "Performance Standard for Wood-based Structural-Use Panels," Section 8.1. Certification.

Notes:

(1) When structural plywood sheets or structural panels are tested in retail stores, it is recommended that they be sorted by mill and then panel type (grade, thickness).

(2) If a lot consists of mixed sheets or panels from different production runs and/or productions lots, be sure to record the codes for all sheets in the sample so the inspector and other interested parties can follow up on the information.

(3) Record or attach a photograph of the information located on the grade stamp including the manufacturer, grade, standard (i.e., PS 1), mill number, and agency.

4.10.2.2. Moisture Shrinkage Allwance for Structural Plywood and Wood-based Structural Panels

Structural Plywood and Oriented Strand Board (OSB) shrink and swell with changes in moisture content. The standardized moisture content for Structural Plywood is 9 % (PS 1-19, "Structural Plywood," Section 5.10. "Dimensional Tolerances and Squareness of Panels)." The equivalent standardized moisture content of OSB is 8 %.

1. If the average error is a minus value, determine the moisture content on each piece using the latest version of ASTM D4442, "Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials," Method B. "Secondary Oven-Drying Method".

   Note: The inspection lot shall be put on hold (i.e., "inspection hold," not permitted to be moved, sold, or otherwise distributed pending testing completion) while a determination is being made.

2. Using a saw, cut a 15.24 cm × 15.24 cm (6 in × 6 in) piece from each sample at least 50 mm (2 in) from any edge.

3. Tightly wrap each piece in aluminum foil and place each sample in a plastic bag to preserve moisture content during transport to the laboratory.

a. Moisture Shrinkage Allowance – Thickness for Structural Plywood and OSB

1. For structural plywood: 0.35 % adjustment per 1 % moisture content below 9 %. (see Table 4-1. "Determining Moisture Shrinkage Allowance for Structural Plywood")

2. For OSB: 1.0 % adjustment per 1 % moisture content below 8 %. (see Table 4-2. "Determining Moisture Shrinkage Allowance for OSB")

b. Moisture Shrinkage Allowance – Length and Width for Structural Plywood and OSB

1. For Structural plywood: 0.04 % adjustment per 1 % moisture content below 9 %. (see Table 4-1. "Determining Moisture Shrinkage Allowance for Structural Plywood")

2. For OSB: 0.04 % adjustment per 1 % moisture content below 8 %. (see Table 4-2. "Determining Moisture Shrinkage Allowance for OSB")

Table 4-1.
Determining Moisture Shrinkage Allowance for Structural Plywood

If the Moisture Content is	Allow the Following Moisture Shrinkage Allowance for Thickness	Allow the Following Moisture Shrinkage Allowance for Length and Width
8.00 % - 8.99 %	0.35 %	0.04 %
7.00 % - 7.99 %	0.70 %	0.08 %
6.00 % - 6.99 %	1.05 %	0.12 %
5.00 % - 5.99 %	1.40 %	0.16 %
4.00 % - 4.99 %	1.75 %	0.20 %
3.00 % - 3.99 %	2.10 %	0.24 %
2.00 % - 2.99 %	2.45 %	0.28 %
1.00 % - 1.99 %	2.80 %	0.32 %
0.00 % - 0.99 %	3.15 %	0.36 %

Table 4-2. Determining Moisture Shrinkage Allowance for Oriented Strand Board (OSB)		
If the Moisture Content is	**Allow the Following Moisture Shrinkage Allowance for Thickness**	**Allow the Following Moisture Shrinkage Allowance for Length and Width**
7.00 % - 7.99 %	1.00 %	0.04 %
6.00 % - 6.99 %	2.00 %	0.08 %
5.00 % - 5.99 %	3.00 %	0.12 %
4.00 % - 4.99 %	4.00 %	0.16 %
3.00 % - 3.99 %	5.00 %	0.20 %
2.00 % - 2.99 %	6.00 %	0.24 %
1.00 % - 1.99 %	7.00 %	0.28 %
0.00 % - 0.99 %	8.00 %	0.32 %

*It is recommended that the inspector notify APA – The Engineered Wood Association, if any lots fail compliance.

APA
7011 S. 19th Street
Tacoma, WA 98466
Phone: (253) 565-6600 URL: **www.apawood.org**

4.10.3. Evaluation of Results

1. To determine lot conformance, return to Section 2.3.5. "Evaluate for Compliance."

2. Compliance with the Average Requirement and with the MAV in Appendix A., Table 2-8 "MAVs for Packages Labeled by Length, Width, or Area" is based on the average of multiple measurements on each sheet in the sample.

   - Length – two measurements
   - Width – two measurements
   - Thickness – four measurements

3. If the sample from the lot fails the Average Requirement, a statistical test is applied to a negative average error prior to determining if the sample passes or fails.

(Added 2019)

4.11. Softwood Lumber

4.11.1. Test Equipment

- For labeled dimension up to 304 mm (12 in) use a caliper with 0.01 mm (0.0005 in) graduations (or digital equivalent).
- For labeled dimensions exceeding 304 mm (12 in), a steel linear measure with 1 mm or 1/16 in graduations.
- Set of gage blocks.
- Calculator
- Dimensional Lumber Worksheet
- Wood moisture meter (i.e., A meter equipped with a probe or dual probes and a hammer head handle for inserting the probes into the sample and that can have the moisture values manually or automatically corrected for different species of wood.)
- The latest version of U.S. Department of Commerce (DOC), Voluntary Product Standard PS- 20 "American Softwood Lumber Standard."

4.11.2. Test Procedure

This procedure may be used to verify the width, length, and thickness of regularly shaped dimensional lumber. Softwood lumber is generally represented by both the nominal dimension and the minimum dressed sizes. Testing is based on the minimum dressed sizes for both unseasoned (green) and dry lumber as found in the latest version of Voluntary Product Standard PS-20 "American Lumber Softwood Standard." Lumber substitutes (i.e., composite) are not covered under Voluntary Product Standard PS-20 "American Lumber Softwood Standard." and must be labeled by actual dimensions.

1. Follow Section 2.3.1. "Define the Inspection Lot." Use a "Category A" sampling plan in the inspection; select a random sample.
   - The lot must be sorted by like items (i.e., species, grade, dry) including dimensions and mill number. Identify the nominal size of each piece (e.g., 38 mm × 89 mm [2 in × 4 in], 38 mm × 286 mm [2 in × 12 in], or 19 mm × 140 mm [1 in × 6 in]) and the minimum dressed size using the latest version of Voluntary Product Standards PS-20, "American Softwood Lumber Standard."
   - Conduct a visual inspection of each piece to ensure there are no signs of water or other damage. Remove any pieces (e.g., top, sides) that have damage or have been exposed to the elements (e.g., weather, rain, moisture, sun) from the lot.
2. Verify the accuracy of the calipers using the gage blocks. Use the calipers to measure thickness and width and record the actual dimensions on the "Worksheet for Softwood Lumber."
   - For commodities labeled 3 m (10 ft) or less in length, take a minimum of three measurements across the thickness and three measurements across the width.

Measurements should be evenly spaced at equal intervals (i.e., at locations approximately $^1/_4$, $^1/_2$, and $^3/_4$ across the thickness and width). Calculate the average thickness and width measurement of each piece of wood.

- For commodities labeled greater than 3 m (10 ft) in length, take one additional measurement per every additional 1.8 m (6 ft) or portion thereof.

Note: Do not take measurement within 150 mm (6 in) from the ends or in areas where the lumber has a knot or damage, this would affect the measursement.

3. Use a steel linear measure to determine the length of the piece of wood and record the actual length on the worksheet.

   - Take a minimum of three measurements across the length. Measurements should be evenly spaced at equal intervals (i.e., at locations across the length at approximate intervals of $^1/_4$, $^1/_2$, and $^3/_4$ distance). Calculate the average length measurement of each piece of wood (see Figure 4-7. "Example of Lumber Dimensions Measured.")

Note: Do not take measurements in areas where the lumber has a knot or damage, this would affect the measurement.

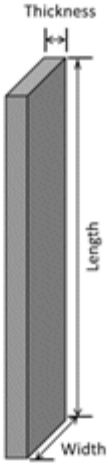

Figure 4-7. Example of Lumber Dimensions Measured.

4.11.2.1. Shrinkage Allowance

Lumber is a product that shrinks and swells with changes in moisture content. The thickness and width of the lumber changes approximately 1 % for each 4 % change in moisture content and moisture shrinkage allowances shall be considered. The length of lumber changes only minimally (0.1 % to 0.2 %) when going from green to oven-dry, therefore no measurement adjustment or allowance is applicable to length measurements.

a. Dry Lumber

The latest version of Voluntary Product Standard PS-20 "American Softwood Lumber Standard" defines dry lumber as being 19 % or less in moisture content.

1. Compare the actual dimensions of thickness, width, and length of each piece to the minimum dressed sizes in NIST Handbook 130, Uniform Regulation for the Method of Sale of Commodities, Table 1. Softwood Lumber Sizes and record the differences as errors on the worksheet.

2. Calculate the average errors for thickness, width, and length. The dressed size can exceed the nominal value for an individual piece.

3. If the average error for any thickness or width measurement is a minus value, or if the MAV is exceeded, perform a moisture test on each piece using a wood moisture meter to determine if a moisture shrinkage allowance should be applied. Apply the appropriate allowance to each piece, then re-calculate the average error and re-determine compliance with the MAV. If the average error is a minus value for any length measurement, or if the MAV is exceeded for any length measurement the lot fails. No moisture shrinkage allowance is applied to length. (see Table 4-3. "Determining Moisture Shrinkage Allowance for Dry Lumber Thickness and Width Dimensions Only")

   - If the moisture content of the piece is equal to or greater than 19 %, the sample piece fails. No moisture shrinkage allowance is provided.

Table 4-3.
Determining Moisture Shrinkage Allowance for Dry LumberThickness and Width Dimensions Only

If the Moisture Content is:	Allow the Following Moisture Shrinkage Allowance:
15.00 % - 18.99 %	1.00 %
	0.70 % for Redwood, Western Red Cedar, and Northern White Cedar
11.00 % - 14.99 %	2.00 %
	1.40 % for Redwood, Western Red Cedar, and Northern White Cedar
7.00 % - 10.99 %	3.00 %
	2.10 % for Redwood, Western Red Cedar, and Northern White Cedar
3.00 % - 6.99 %	4.00 %
	2.80 % for Redwood, Western Red Cedar, and Northern White Cedar

b. Unseasoned (Green) Lumber

The latest version of Voluntary Product Standard PS 20 "American Lumber Softwood Standard" defines unseasoned (green) lumber as being over 19 % in moisture content.

1. Compare the actual dimensions of thickness, width, and length of each piece to the minimum dressed sizes in NIST Handbook 130, Uniform Regulation for the Method of Sale of Commodities, Table 1. "Softwood Lumber Sizes" and record the differences as errors on the worksheet.

2. Calculate the average errors for thickness, width, and length. The dressed size can exceed the nominal value for an individual piece.

3. If the average error for any thickness or width measurement is a minus value, or if the MAV is exceeded, perform a moisture test on each piece using a wood moisture meter to determine if a moisture shrinkage allowance should be applied. Apply the appropriate allowance to each piece, then re-calculate the average error and re-determine compliance with the MAV. If the average error is a minus value for any length measurement, or if the MAV is exceeded for any length measurement the lot fails. No moisture shrinkage allowance is applied to length.

   - If the moisture content of the piece is equal to or greater than 30 % the sample piece fails. No moisture allowance is provided. (see Table 4-4. "Determining Moisture Shrinkage Allowance for Unseasoned (Green) Lumber Thickness and Width Dimensions Only")

Table 4-4.
Determining Moisture Shrinkage Allowance for Unseasoned (Green) Lumber Thickness and Width Dimensions Only

If the Moisture Content is	Allow the Following Moisture Shrinkage Allowance
26.00 % - 29.99 %	1.00 %
	0.70 % for Redwood, Western Red Cedar, and Northern White Cedar
22.00 % - 25.99 %	2.00 %
	1.40 % for Redwood, Western Red Cedar, and Northern White Cedar
18.00 % - 21.99 %	3.00 %
	2.10 % for Redwood, Western Red Cedar, and Northern White Cedar
14.00 % - 17.99 %	4.00 %
	2.80 % for Redwood, Western Red Cedar, and Northern White Cedar
10.00 % - 13.99 %	5.00 %
	3.50 % for Redwood, Western Red Cedar, and Northern White Cedar
6.00 % - 9.99 %	6.00 %
	4.20 % for Redwood, Western Red Cedar, and Northern White Cedar
2.00 % - 5.99 %	7.00 %
	4.90 % for Redwood, Western Red Cedar, and Northern White Cedar

4.11.3. Evaluation of Results

1. To determine lot conformance, return to Section 2.3.7. "Evaluate for Compliance."

2. If the sample pieces do not meet the average and MAV requirement based on the minimum dressed sizes after the shrinkage (moisture) allowances are considered, the lot fails. Place the Inspection Lot on hold.

*Inspectors should notify the American Lumber Standard Committee (ALSC) of any lots that fail compliance.

American Lumber Standard Committee, Inc.
7470 New Technology Way, Suite F.
Frederick, MD 21703
(301) 972-1700 or (301) 540-8004
E-mail: **alsc@alsc.org** URL: **www.alsc.org**

(Added 2019)

THIS PAGE INTENTIONALLY LEFT BLANK