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.

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:

   Weight of the Labeled Count =
   (labeled count × weight of items in Step 4) ÷ (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.

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

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

    Package error (count) = (Package error [weight] × labeled count) ÷ (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 (¼ in) diameter or larger, and a 4.75 mm ($^3/_{16}$ in) diameter flat surface on the head of the spindle. 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 mass of the probe head (total of anvil, weight 102 g or [3.6 oz], spindle, etc.) must be 113.4 g (4 oz). 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:

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

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 Method of Test 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 × A × D × 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/cm^3 to lb/in^3

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 cm × [(1.82 m × 100 cm/m) × (30.48 m × 100 cm/m)] × 0.92 g/cm^3) ÷ 1000 g/kg = a target weight of 5.18 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:*

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

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 (⅛ 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 (¼ 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.)

   - 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.

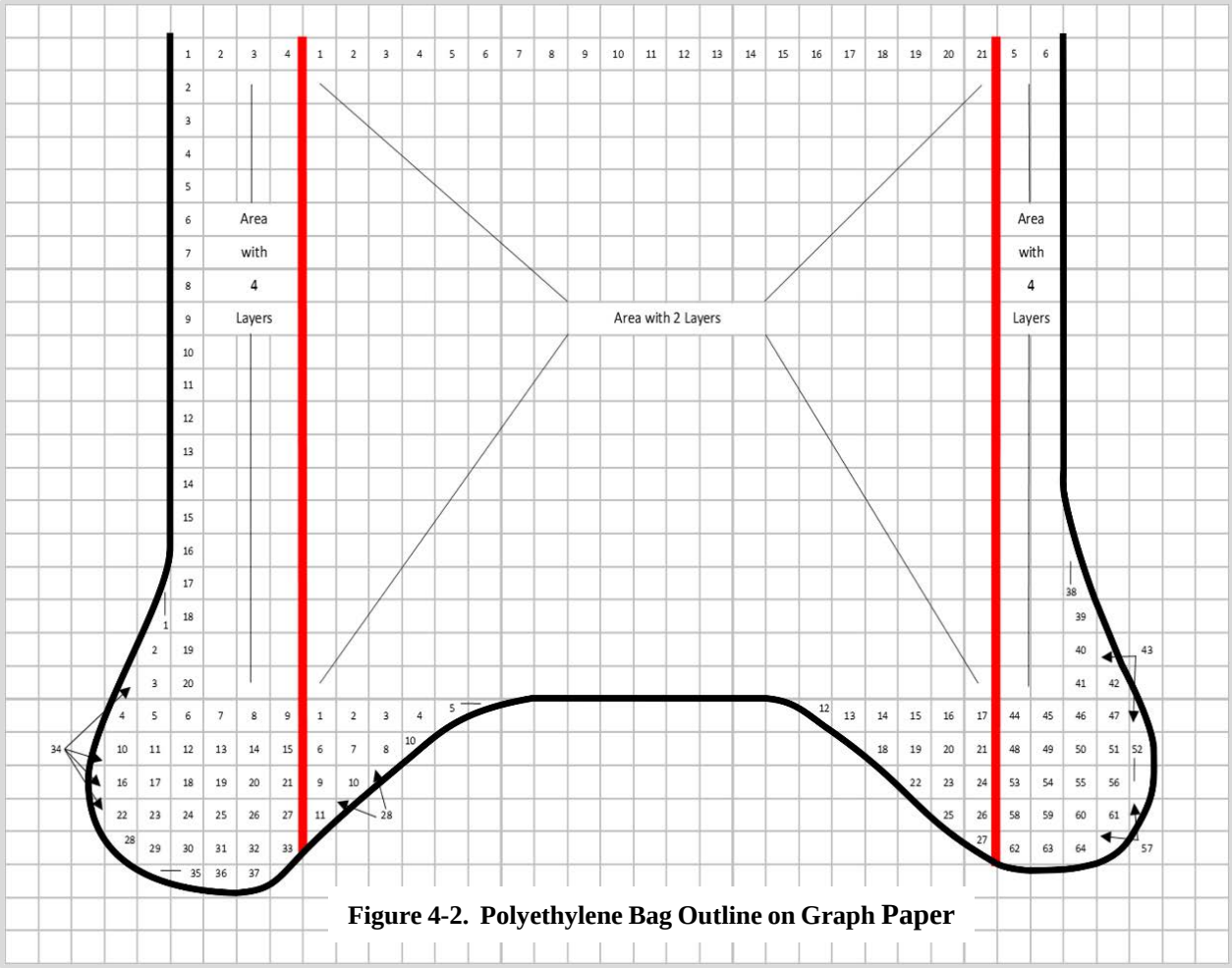

Figure 4-2. Polyethylene Bag Outline on Graph Paper

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 $\frac{1}{64}$ in or $\frac{1}{100}$ in divisions and an overall length tolerance of $\frac{1}{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $\frac{1}{16}$ 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 natural leather made from skins of sheep and lambs that have been oil-tanned. Chamois are irregularly shaped, which makes area measurement difficult. Because of these characteristics, an accurate area determination can only be made using an internationally recognized method of conditioning (rehydrating) and measurement. Chamois is produced in a wet manufacturing process, so it has high moisture content at time of measurement. Chamois is hydroscopic; therefore, its dimensions and total area change as it loses or absorbs moisture. It is also subject to wrinkling. Because of the variation of the thickness and density, and therefore the weight per unit area of chamois, an estimated gross weight procedure cannot be used to verify the labeled area declaration.

Standard Test Conditions: As with all hydroscopic products, reasonable variations in measure must be allowed if caused by ordinary and customary exposure to atmospheric conditions that normally occur in good distribution practice. Both federal and international standards specify procedures to restore the moisture content of chamois so that tests to verify dimensions and area can be conducted.

Federal Test Method Standard 311, "Leather, Methods of Sampling and Testing," (January 15, 1969) defines the standard atmospheric condition for chamois as 50 ± 4 % relative humidity and 23 ± 2 °C (73.4 ± 3.6 °F). The chamois is considered to be at equilibrium moisture when the difference in two successive weighings, made at 1 hr intervals, is no greater than 0.25 % (e.g., the maximum change in weight on a 100 g sample in two successive weighings is less than 0.25 g (250 mg).

The area of chamois is verified using a two-stage test procedure. The first stage is a field audit using the template test procedure. This test is used for field audits because it is simpler to perform and does not require the chamois to be conditioned. The field audit is used to identify chamois that are potentially under measure. It is not as accurate as the gravimetric procedure because some error results from reading the area from the template. The gravimetric procedure should be used for compliance testing because it includes conditioning (rehydrating) the chamois.

4.8.1. Template Test Method (for field audits)

Chamois is typically labeled in uniform sizes in terms of square decimeters and square feet, and are sized in increments of ¼ ft^2 (e.g., 1 ft^2, 1¼ ft^2, and 1½ ft^2).

4.8.1.1. Test Equipment

Use a transparent, flexible template that is graduated in square centimeters or square inches and that has been verified for accuracy. The template must be large enough to completely cover the chamois under test.

4.8.1.2. Test Procedure

1. Select a random sample of chamois. Separate the chamois into different sizes and define the inspection lot by specific sizes.
2. Place the template over the chamois specimen on a smooth surface. Determine the area by counting the number of squares that cover the surface of the chamois. Estimate parts of the template that do not completely cover the chamois by adding the number of partially covered blocks. (See Figure 4-3. "Template for Checking the Area of a Chamois") 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 minus error exceeds 3 % of the labeled area, the chamois may not be labeled accurately. To confirm the finding, the sample must be taken to a laboratory for conditioning and testing using the gravimetric test procedure.

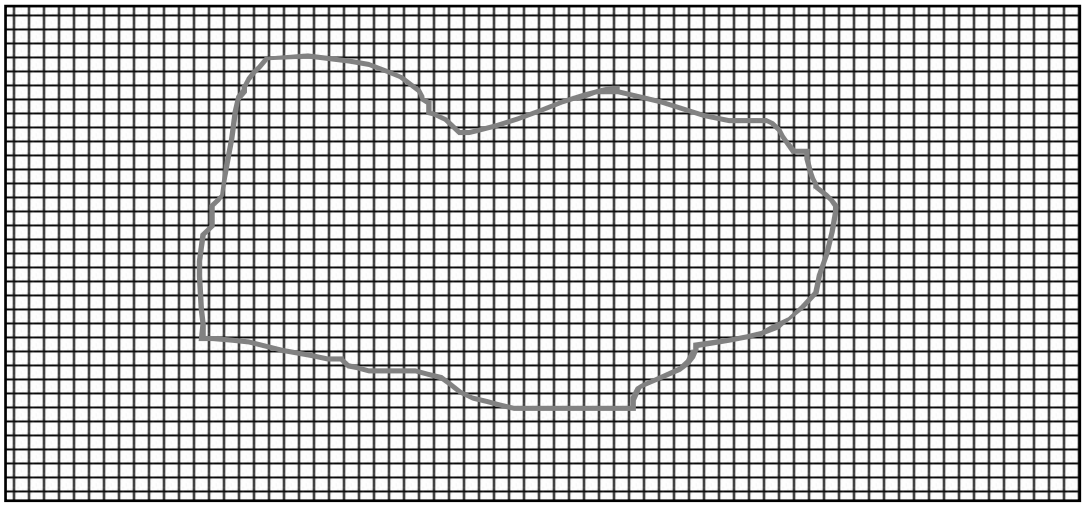

Figure 4-3. Template for Checking the Area of Chamois.

4.8.2. Gravimetric Procedure for Area Measurement

This test cannot be performed in the field because the samples must be conditioned with water before testing. This method is intended for use in checking full or cut skins, or pattern shapes. Open and condition all of the packages in the sample before determining their area on the recommended paper. Conditioning and verifying chamois can be accomplished without destroying the product. When successful tests are completed, the chamois may be repackaged for sale, so do not destroy the packaging material.

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
- Atomizer or trigger-type sprayer and sealable, airtight polyethylene bags
- Medium weight drawing paper (e.g., drawing paper, medium weight (100 lb), regular surface or comparable)

- Household iron with low temperature settings 30 °C to 40 °C (86 °F to 104 °F)
- Ruler or tape that is graduated in centimeters or inches
- Instrument for cutting paper (razor blade, scissors, or cutting board)

Sample Conditioning

1. Remove each sample from its package and weigh and record each weight. Using an atomizer-type sprayer, spray water in the amount of 25 % of the weight of each skin uniformly over its area. Place wetted chamois in an airtight polyethylene bag; seal the bag, and leave it in this condition at room temperature for 24 hours.

2. Open the bag, remove the chamois, and reweigh the chamois to confirm that it retained maximum moisture. (This is done by confirming that the difference in the two consecutive weighings conducted an hour apart does not exceed 0.25 %.)

3. Place the chamois flat on a continuous piece of drawing paper. To remove wrinkles and make the chamois lie flat, use a normal domestic iron that is heated to a maximum of 30 °C to 40 °C (86 °F to 104 °F). Place the iron on the bottom of the skin, and iron the skin up from the center to the top. Then, iron the skin from the center out to each side. Iron until the skin is fully extended and perfectly flat.

4.8.2.2. Test Procedure

1. Immediately after ironing, carefully draw around the outline of the skin on the paper. Remove the skin; carefully cut along the outline of the skin; weigh the cutout pattern, and record to the nearest 0.1 g Sample Weight 1 (W_1).

2. Lay out the pattern and cut an accurately measured rectangle of a size not less than one-half the area of the pattern. Weigh the cutout rectangle and record the weight to the nearest 0.1 g Sample Weight 2 (W_2). Calculate the area of the rectangle cut from the patterns by multiplying length by width and record as Area (A) in centimeters or square inches.

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

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

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

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

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".

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.

4.2.3. Evaluation of Results

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