

September 11, 2013

Package Testing Based on the Largest of Declared Quantities

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Dual Units

When an inspector looks to test the net quantity of a consumer package, he/she will notice that most package net content statements contain both metric and inch-pound (equivalent) units. Which unit should the inspector verify, metric, inch-pound or both? The answer can be found by further examining the requirements of the Uniform Packaging and Labeling Regulation (UPLR) in NIST Handbook 130, Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality.

Since February 14, 1994, both metric and inch-pound (or other customary units) have been required to be represented in the quantity statement of a consumer package. The requirement for having dual units, as it is often referred to, came from the Fair Packaging and Labeling Act (FPLA).

Conversion from one system of units to the other is needed to determine the equivalent metric/inch-pound quantity. Rounding is permitted. It is the packers' responsibility to round converted values and select the appropriate number of significant digits to use in the quantity declaration so that accuracy is neither sacrificed nor exaggerated. For the metric declaration, this is generally either two or three digits (see 6.5 (g) of the UPLR). Guidance on rounding, rounding rules, and significant digits are provided to packers in Appendix B of the UPLR. Rounding is not determined by Handbook 130, but instead is based on the packers' knowledge of the accuracy of the original measurement that is being converted.

Inspectors should always verify the largest unit declared on the package to ensure its accuracy when determining whether a package contents meets or exceeds the labeled quantity. Reference to this can be found in Appendix B of the UPLR, in NIST Handbook 130.

NIST Handbook 133, *Checking the Net Contents of Packaged Goods*

Handbook 133 is used to enforce the requirements of the UPLR in Handbook 130. The handbook has, as part of its test procedures for filling out an official inspection report, steps to determine and verify the largest unit declared. This can be found in Chapter 2, Section 2.3.3.1. "Procedure for Recording Data."

The steps require the inspector to:

- Record the labeled net quantity on the report form in both metric and inch-pound units if they are provided on the package label.
- Determine the larger of the values by converting the metric declaration to inch-pound units or vice versa.

- Indicate on the report form which of the declarations is being verified.

HOW TO DETERMINE THE LARGER OF THE TWO UNITS?

The first step is to find the appropriate conversion factors. It is recommended that you use Handbook 130, “Uniform Packaging and Labeling Regulation, UPLR Appendix A: SI/Inch-pound Conversion Factors,” or the conversion factors from the tables in “Appendix E. General Tables of Units of Measurement” in Handbook 133. Additional unit conversion resources can be found on our website www.nist.gov/pml/wmd/metric/unit-conversion.cfm. These are trusted and reliable sources that ensure the conversion factors are given to six or more significant digits in the event such accuracy is necessary. Caution should be used when using conversion software from alternate sources (i.e., websites, laptops, and calculators) unless it is first tested and the conversion factors and rounding rules are verified and deemed reliable.

Below are two examples of the process an inspector would use to determine the larger of the two units.

EXAMPLE 1 - Package A is labeled 25.5 oz (723 g)

1. Determine the appropriate conversion factor. In this example, conversion factors in “Uniform Packaging and Labeling Regulation, Appendix A: SI/Inch-pound Conversion Factors” of Handbook 130 are used. The conversion factors are: 1 oz = 28.349 5 g or 1 g = 0.035 274 oz.
2. To convert the labeled quantity of 25.5 oz into grams, multiply 25.5 oz by the conversion factor of 28.349 5 g (25.5 oz × 28.349 5 g = 722.91225 g).
3. Compare the two labeled units to determine which is larger of the two. Is 25.5 oz (or 722.91225 g when converted) larger than 723 g? The 723 g is the larger of the two units, so this quantity would be used to verify the net contents and the test should be done in grams.

EXAMPLE 2 - Package B is labeled 8 fl oz (236 mL)

1. Determine the appropriate conversion factor. In this example, conversion factors in both “Appendix E. General Tables of Units of Measurement” of Handbook 133 and “Uniform Packaging and Labeling Regulation, Appendix A: SI/Inch-pound Conversion Factors” in Handbook 130 were used. The conversion factors are: 1 fluid ounce = 29.573 mL or 1 mL = 0.033814 fl oz.
2. To convert the labeled quantity of 8 fluid ounces to milliliters, multiply 8 fl oz by the conversion factor of 29.573 mL to convert fluid ounces into milliliters (8 fl oz × 29.573 mL = 236.584 mL).
3. Compare the two labeled units to determine which is larger of the two. Is 8 fl oz (or 236.584 mL when converted) larger than 236 mL? Since 8 fl oz is the larger of the two units, this quantity would be used to verify the net contents and the test would be done in fluid ounces.

WHAT IF THE PACKAGE HAS MULTIPLE DECLARATIONS SUCH AS A BI-DIMENSIONAL PRODUCT OR A COMBINATION DECLARATION WITH UNITS OF LENGTH, WIDTH, AREA, AND THICKNESS?

The same principle applies. The inspector must look at each distinct unit or type of measure (i.e., length, width, area, thickness) and determine the larger of the two units (metric or inch pound).

Below are two examples of the process an inspector would use to determine the larger of the two units in these cases.

EXAMPLE 1 - Plastic Wrap is labeled 4.88 m × 45.7 cm (16 ft × 18 in) Total 2.23 m² (24 ft²)

The inspector would be required to make a number of calculations and might follow these steps:

1. Compare the length units of 4.88 m to 16 ft and determine the larger of the two units using the appropriate conversion factor.
2. Compare the width units of 45.7 cm to 18 in and determine the larger of the two units using the appropriate conversion factor.
3. Compare the area of 2.23 m² to 24 ft² and determine the larger of the two units using the appropriate conversion factor.
4. Verify the net quantity based on the larger of the two units (metric or inch-pound) for each type of measurement (i.e., length, width, and area).

In this example the units to be verified (largest of the two) would be 4.88 m for length, 18 in for width, and 2.23 m² for area.

EXAMPLE 2 - Kitchen Bags are labeled 13 gal (49 L) 2 ft × 2 ft 3 in (60.9 cm × 68.5 cm) 0.90 mil (22.8 μm)

The inspector would be required to make a number of calculations and might follow these steps:

1. Compare the volume units of 13 gal to 49 L and determine the larger of the two units using the appropriate conversion factor.
2. Compare the length units of 2 ft to 60.9 cm and determine the larger of the two units using the appropriate conversion factor.
3. Compare the width units of 2 ft 3 in to 68.5 cm and determine the larger of the two units using the appropriate conversion factor.
4. Compare the thickness of 0.90 mil to 22.8 μm and determine the larger of the two units using the appropriate conversion factor.
5. Verify net quantity based on the larger of the two units (metric or inch-pound) for each type of measurement (i.e., volume, length, width, and thickness).

In this example the units to be verified (largest of the two) would be 13 gal for volume, 2 ft for length, 2 ft 3 in for width, and 0.90 mil for thickness.

Routine verification of the net contents of packages is an important part of any weights and measures program to ensure consumer protection and fair competition among business. Consumers have the right to expect packages to bear accurate net content information. Manufacturers also have a right to expect that their competitors will be required to adhere to the same laws and regulations that they follow. Enforcement based on the larger of the two units helps provide added protection under the law.

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