

NCWM Form 15: Verifying the Net Quantity of Contents of Multiunit and Variety Packages

This proposal is to add test procedures for multiunit and variety packages in NIST Handbook 133 “Checking the Net Contents of Packaged Goods” (NIST HB 133)¹. This will also add guidance on applying the average requirement and the individual package requirements (i.e., MAV or Maximum Allowable Variations) to multiunit and variety packages.

When the current test procedures in NIST HB 133 are used and an MAV is applied to the total quantity declaration on some multiunit and variety packages the MAV allowed for the individual inner packages can indirectly be reduced as much as 50 % or more, depending on the number of individual items in the package. This can occur when a packer fills multiple individual inner packages to comply with the MAV for the net contents and produces several packaging sizes (e.g., count 6, 12, 24, or 48) into a multiunit package and specifies a total quantity declaration on the label. Typically, the MAV allowed for the total quantity declaration is less than the sum of the MAVs allowed for the individual inner packages. A packer may be required increase package fill levels or reduce the variations in the individual inner packages to ensure that the variation in the total quantity declarations remains within the limit of the MAV.

The reduction of the MAV occurs most often when the fixed MAV values located in NIST Handbook 133, Appendix A. are used. No reduction of the MAV occurs when the MAV’s used with the total quantity declarations on multiunit and variety packages are based on a percentage of the labeled quantity (e.g., packages with a net weight greater than 4.53 kg that are subject to U.S. Department of Agriculture (USDA) requirements; packages sold by net weight greater than 24.67 kg; packages sold by liquid or dry volume greater than 26.73 L; packages sold by count of 1334 or greater; some packages labeled by length, width [or area]; and packages of polyethylene sheeting and film, mulch, textiles, firewood and animal bedding.)

When a total quantity declaration on a multiunit or variety package is verified the proposed amendments will require the inspector, except when the MAV is based on a percentage of the labeled quantity, to calculate and use a “Total Quantity MAV.” This calculation will determine if minus package errors for total quantity declarations are unreasonable (an unreasonable error is a minus package error that exceeds an MAV specified in the NIST HB 133, Appendix A. MAV “Tables”). A “Total Quantity MAV” is calculated by multiplying the number of individual inner packages by the MAV value, which is based on the declared quantity of the individual inner packages. It is found by looking up the MAV for the individual inner package quantity and then calculating the “Total Quantity MAV” as follows:

$$\text{Total Quantity MAV} = \text{Number of Individual Inner Packages} \times \text{MAV for Individual Inner Package Quantity}$$

The Office of Weights and Measures (OWM) recommends adding this corrective step to NIST HB 133 to ensure that reasonable variations in package fill are allowed and to avoid imposing a reduced (unreasonable) MAV to total quantity declarations. OWM has also developed test procedures for use with any multiunit or variety package. The first test procedure is for use with package which do not have a total quantity declaration, a second procedure is for use with multiunit packages with total quantity declarations.

In addition, a language edit will be required in the Uniform Packaging and Labeling Regulation (UPLR) in NIST HB 130 “Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality”². for Section 2.8. Multiunit Packages to eliminate conflicts between the UPLR and Federal Trade Commission (FTC) regulation for multiunit packages cited in 16 CFR Part 500.27.

2.8. Multiunit Package – A package containing two or more individual packages of the same commodity, in the same quantity, intended to be sold as a multiunit package ~~but where the component packages are labeled individually in full compliance with all requirements of this regulation~~.

¹ The latest edition of NIST Handbook 133 is available at: <https://doi.org/10.6028/NIST.HB.133-2018>

² The latest edition of this NIST Handbook is available at: <https://doi.org/10.6028/NIST.HB.130-2018>

OWM proposes six amendments to the current edition of NIST HB 133:

Amendment 1:

Revise the definition for 2.8. “Multiunit Package.” from the NIST Handbook 130, Uniform Packaging and Labeling Regulation. Place the definitions for Multiunit Package and Variety Package into NIST HB 133, Appendix F. “Glossary”:

2.8. Multiunit Package. - A package containing two or more individual packages of the same commodity, in the same quantity, intended to be sold as a multiunit package, ~~but where the component packages are labeled individually in full compliance with all requirements of this regulation.~~

2.10. Variety Package. – A package intended for retail sale, containing two or more individual packages or units of similar, but not identical, commodities. Commodities that are generically the same, but that differ in weight, measure, volume, appearance, or quality, are considered similar, but not identical.

Amendment 2:

Add a new definition for “Total Quantity MAV” to NIST HB 133, Appendix F. “Glossary”:

Total Quantity MAV. – **A calculated value used to determine if each minus Total Quantity Package Error found in multiunit and variety packages are unreasonable. A Total Quantity MAV is based on the declared quantity and count of the individual inner packages. It is determined by looking up MAV for the individual inner package quantity (See appropriate table of MAVs in Appendix A “Tables” of NIST HB 133) and then calculating the “Total Quantity MAV” as follows:**

Total Quantity MAV = Number of Individual Inner Packages × MAV for Individual Inner Package Quantity

NOTE: A Total Quantity MAV is not used when the MAV to be applied is based on a percentage of the labeled quantity on a multiunit or variety package.

NOTE: The Total Quantity Package Error is the sum of the errors found in the individual inner packages.

Total Quantity Package Error = Sum of Individual Inner Package Errors

Amendment 3:

Add a subsection 1.2.4.1. “Total Quantity MAV for Multiunit and Variety Packages” Chapter 1. “General Information” in NIST HB 133:

1.2.4. Maximum Allowable Variation

The limit of the “reasonable minus variation” for an under filled package is called a “Maximum Allowable Variation” (MAV). An MAV is a deviation from the labeled weight, measure, or count of an individual package beyond which the deficiency is considered an unreasonable minus error. Each sampling plan limits the number of negative package errors permitted to be greater than the MAV. **Packages are offered for sale individually or in multiunit packages which may contain two or more individual inner packages. When the individual packages are tested the MAV is applied to each package in the sample which has a minus package error. When a total quantity declaration on a multiunit or variety package is verified, and the MAV is not determined in terms of a percent of the labeled quantity, a “Total Quantity MAV” is compared to the minus Total Quantity Package Error(s) to determine if they are unreasonable.**

Note: The Total Quantity Package Error is the sum of the errors found in the individual inner packages.

Total Quantity Package Error = Sum of Individual Inner Package Errors

1.2.4.1. Total Quantity MAV for Multiunit and Variety Packages (See also Chapter 5. “Specialized Test Procedures”)

- a. **Multiunit Package.** – When a total quantity declaration appears on a multiunit package compare a Total Quantity MAV to each minus Total Quantity Package Error to determine if the error is unreasonable. Calculate the Total Quantity MAV using the following formula:

$$\text{Total Quantity MAV} = \text{Number of Individual Inner Packages} \times \text{MAV for Individual Inner Package Quantity}$$

Terms are defined as:

Number of Individual Inner Packages. – The total number or individual inner packages having uniform weight, measure and or count.

MAV for Individual Inner Package Quantity. – The MAV for the quantity declared for the individual inner packages specified in the proper table of MAVs in Appendix A. “Tables.”

- b. **Variety Package.** – When a total quantity declaration appears in a variety package compare a Total Quantity MAV to each minus Total Quantity Package Error to determine if the error is unreasonable.

Calculate the Total Quantity MAV using the following formula:

$$\text{Total Quantity MAV} = \text{Number of Individual Inner Packages} \times \text{MAV for Individual Inner Package Quantity}$$

Variety packages typically include several different types of similar products with various net quantity declarations. While the commodities may be generically similar, they can differ in weight, measure, volume, or appearance. For these packages a Total Quantity MAV is calculated for each product type and the results are added to obtain a Total Quantity MAV for comparison to each minus Total Quantity Package Error.

Terms are defined as:

Number of Individual Inner Packages. – The total number of similar but not identical individual inner packages with differing and/uniform weight or measure.

MAV for Individual Inner Package Quantity. – The MAV for the quantity declared for the individual inner packages specified in the proper Table of MAVs in Appendix A. “Tables.”

Amendment 4:

Add a Chapter 5. “Specialized Test Procedures” to NIST HB 133 to give specific test procedures for these types of packages.

5.1. Scope

The following procedures are for use in verifying the net quantity of contents of multiunit packages with individual inner packages that have the same commodity and identical quantities and variety packages with individual inner packages that differ in weight, measure or volume. The procedure used is determined by the package label. If a total net quantity of contents is not declared on the package label, use Section 5.2. Individual Package Quantity. If a total net quantity of contents is declared on the package, use Section 5.3. Total Quantity. If the packages are labeled with other or additional quantities (i.e., dry volume, area, length, width, or thickness) added steps or, when proper, additional Total Quantity MAVs may be required.

5.2. Individual Package Quantity

This procedure is used to test open or transparent multiunit packages with no total net quantity declaration on the package label. For these packages the net quantity is visible on each individual inner package and they are identical (See Figure 1. Multiunit Package with Individual Quantity Declarations [which contains two rows of packages]).

Figure 1. Multiunit Package with Individual Quantity Declarations (which contains two rows of packages)

Cereal	Cereal	Cereal	Cereal	Cereal
Net Wt 100 g	Net Wt 100 g	Net Wt 100 g	Net Wt 100 g	Net Wt 100 g

5.2.1. Test Procedure

1. Follow Section 2.3.1. “Define the Inspection Lot” which is the total number of individual inner packages in the multiunit packages (e.g., if there are 120 packages and each contains 12 individual inner packages the Inspection Lot size is 1440). Use this number with Category A or Category B. to find the sample size (See Section 2.3.2. “Select Sampling Plans”). Select a random sample (See Section 2.3.4. “Random Sample Selection”).
2. At least two of the individual inner packages are opened to determine an average tare weight (See Section 2.3.5. “Procedures for Determining Tare”). The Average Tare Weight is added to the labeled quantity to obtain a Nominal Gross Weight (See Section 2.3.6. “Determine Nominal Gross Weight and Package Errors”) which is used to determine package errors.
3. The net quantity of each individual inner package in the sample is determined. If a count declaration appears on the multiunit packages it should be verified (See Section 4.2. “Packages Labeled by Count”) and the appropriate MAV for the count from Table 2-7. MAV for Packages Labeled by Count applied.
4. If minus package errors are found in the sample, the value of the MAV to be applied is determined by looking up the quantity for the individual inner packages (See Appendix A “Tables”). The MAV for the labeled quantity is compared to the minus package errors in the individual inner packages to determine if any are unreasonable (See Section 2.3.7.1. “MAV Requirement”). If the number of unreasonable errors exceeds the amount allowed for the sample size (See Appendix A. Tables 2-1 or 2-2, Column 4) the sample fails. If the sample passes go to Step 5.
5. Apply Section 2.3.7.2. “Average Requirement.” The sample passes or fails depending on the results of the evaluation conducted according to Section 2.3.7. “Evaluation for Compliance.”

5.3. Total Quantity

Use this procedure to test multiunit packages with a count and/or total net quantity declaration. This procedure can be used to verify the total net quantity declared on open or closed multiunit packages or multiunit packages with transparent or opaque packaging. If the quantities of the individual inner packages vary (which is allowed in Variety Packages) or, if the quantity of the individual inner packages is not declared, see Section 5.4. Exceptions.

Test Procedure

1. Follow Section 2.3.1. “Define the Inspection Lot” which is the number of multiunit packages. Use this number with Category A or Category B. to find the sample size (See Section 2.3.2. “Select Sampling Plans”). Select a random sample (See Section 2.3.4. “Random Sample Selection”).
2. Determine the tare of at least two multiunit packages using Section 2.3.5. “Procedures for Determining Tare”. The average tare weight is added to the labeled quantity to obtain a nominal gross weight (See Section 2.3.6. “Determine Nominal Gross Weight and Package Error”). This is used to determine errors in the total package quantity declaration.
3. Determine the net quantity of each multiunit package and calculate the the Total Quantity Package Error for each multiunit package.

NOTE: The Total Quantity Package Error is the sum of the errors found in the individual inner packages.

$$\textit{Total Quantity Package Error} = \textit{Sum of Individual Inner Package Errors}$$

If needed, verify the count declaration of the individual inner packages. For the MAV for count use Appendix A. Table 2-7. “MAV for Packages Labeled by Count”.

4. If minus package errors are found in the sample, look up and use the MAV for the individual inner package quantity. (See Section 1.2.4.1. “Total Quantity MAV for Multiunit and Variety Packages” and the appropriate MAVs in Appendix A “Tables”). Calculate the MAV to be applied to the total quantity of contents declaration as follows:

$$\textit{Total Quantity MAV} = \textit{Number of Individual Inner Packages} \times \textit{MAV for Individual Inner Package Quantity}$$

Note: A “Total Quantity MAV” is not required when the MAV to be applied is based on a percent of a labeled quantity of a multiunit or variety package.

5. The “Total Quantity MAV” is compared to the minus Total Quantity Package Errors to determine if any of the errors are unreasonable (See Section 2.3.7.1. “MAV Requirement”). If the number of unreasonable errors exceeds the amount allowed for the sample size the sample fails. (See Section 2.3.1. “Define the Inspection Lot” and Tables 2-1 or 2-2, Column 4). If the sample passes go to Step 6.
6. Apply Section 2.3.7.2. “Average Requirement.” The sample passes or fails depending on the results of the evaluation conducted according to Section 2.3.7. “Evaluation for Compliance.”

5.4. Exceptions

5.4.1. Multiunit Packages with Only a Total Quantity Declaration

In NIST HB 130, Uniform Packaging and Labeling Regulation (UPLR) Section 10.4. Multiunit Packages states unlabeled individual packages not intended for individual retail sale are only required to declare a total quantity declaration [See Figure 2. Multiunit Package (three packages) with only a Total Quantity Declaration]. Section 10.4. Multiunit Packages also permits multiunit packages to include an optional statement of the count of the individual inner packages even when the regulations do not require such a statement.

Figure 2. Multiunit Package (three packages) with only a Total Quantity Declaration

<u>Floor Cleaner</u>	<u>Floor Cleaner</u>	<u>Floor Cleaner</u>
	<u>NET WEIGHT 15 kg</u>	

5.4.1.1. MAV Application

When multiunit package labels do not include a quantity for the individual inner packages (e.g., only a total quantity appears) a Total Quantity MAV cannot be not applied because the quantities in the individual inner packages is unknown. In these cases, the MAV value for the total quantity declaration in the MAV tables (See Appendix A. Tables) is compared to the Total Quantity Package Error to determine if any of the errors are unreasonable (See Section 2.3.7.1. “MAV Requirement”).

5.4.2. Variety Packages: Non-Uniform Quantity Declarations

In NIST HB 130, “Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality.” In UPLR Section 10.6. Variety Packages it states a variety packages is required to have total quantity declaration. While the commodities may be generically similar, they can differ in weight, measure, volume, or appearance. When the quantity of the weight, measure or count varies the value of the MAV can also vary. When variety packages are tested the procedure used to calculate a Total Quantity MAV requires the summing of the MAV values over the number of inner packages of all types. An example label for a variety package of candy bars is shown in Figure 3. Variety Package – Four Similar but Different Products with Varying Net Weights, to illustrate a total quantity declaration, count, and the weight of the individual inner packages.

Figure 3. Variety Package – Four Similar but Different Products with Varying Net Weights

<u>30 Candy Bar – Variety Pack</u>	
<u>Total Net Weight 1.33 kg</u>	
<u>10 – 55 g Peanut Butter Cups</u>	<u>6 – 30 g Dark Chocolate Bars</u>
<u>6 – 46 g Milk Chocolate Bars with Almonds</u>	<u>8 – 41 g Milk Chocolate Bars</u>

5.4.3. Test Procedure:

1. When this type of variety package is tested the average tare weight (e.g., packaging from the individual inner packages and the outer package combined) is determined and a nominal gross weight is used to determine the error in the total quantity declaration.

Note: The Total Quantity Package Error is the sum of the errors found in the individual inner packages.

$$\textit{Total Quantity Package Error} = \textit{Sum of Individual Inner Package Errors}$$

The MAV used to determine if any minus Total Quantity Package Errors are unreasonable is calculated. The MAVs selected are based on the labeled quantities on each product types and are calculated (i.e., the number of individual inner packages of each product type is multiplied by their count) and added together to obtain the Total Quantity MAV (See example shown in Table 1. Steps in Calculating a MAV for a Variety Package).

5.4.3.1. MAV Application:

A Total Quantity MAV must be applied because the quantities and MAVs of the individual inner packages vary. For example, based on the quantity of the total net weight the MAV for 1.33 kg is 42.6 g but the “Total Quantity MAV” to be applied is 122.4 g (See example shown reflected in Table 1. Steps in Calculating a MAV for a Variety Package).

<u>Table 1. Steps in Calculating a MAV for a Variety Package (Based on Figure 3. Variety Package – Four Similar but Different Products with Varying Net Weights)</u>					
<u>Item</u>	<u>Product</u>	<u>Number in Package</u>	<u>Net Weight</u>	<u>MAV for Net Quantity</u>	<u>Total Quantity MAV</u>
<u>1</u>	<u>Peanut Butter Cups</u>	<u>10</u>	<u>55 g</u>	<u>5.4 g</u>	<u>$10 \times 5.4 = 54 \text{ g}$</u>
<u>2</u>	<u>Dark Chocolate Bars</u>	<u>6</u>	<u>30 g</u>	<u>10 % of labeled quantity</u>	<u>$6 \times (0.1 \times 30) = 18 \text{ g}$</u>
<u>3</u>	<u>Milk Chocolate Bars</u>	<u>8</u>	<u>41 g</u>	<u>3.6 g</u>	<u>$8 \times 3.6 = 28.8 \text{ g}$</u>
<u>4</u>	<u>Milk Chocolate Bars with Almonds</u>	<u>6</u>	<u>46 g</u>	<u>3.6 g</u>	<u>$6 \times 3.6 = 21.6 \text{ g}$</u>
				<u>Total Quantity MAV</u>	<u>122.4 g</u>

Amendment 5:

Add a Note to HB133, Chapter 2, Section 2.1. “Scope;” Section 3.1. “Scope;” and Section 4.1. “Scope” that refers users to the Chapter 5. “Specialized Test Procedures” for these types of packages.

Note: If Multiunit or Variety Packages are to be inspected see Chapter 5. “Specialized Test Procedures” for guidance in testing these types of packages. If a total quantity declaration is to be verified, and the MAV to be applied is not based on a percentage of the labeled quantity, (See Section 1.2.4.1. Total Quantity MAV for Multiunit and Variety Packages.)

Amendment 6:

Add the following note to HB133, Chapter 2, Section 2.3.7.1 “Maximum Allowable Variation (MAV) Requirement” and Section 2.7.3. “Evaluation of Results – Compliance Determinations.”

Note: If a total quantity declaration on a multiunit or variety package is verified, and the MAV applied is not based on a percentage of the labeled quantity. (See Section 1.2.4.1. Total Quantity MAV for Multiunit and Variety Packages.)

Background

This memorandum provides information to support the proposals described above. It describes how to apply the average and individual (i.e., Maximum Allowable Variations) package requirements in NIST Handbook 133 (NIST HB 133)³ “Checking the Net Contents of Packaged Goods” to multiunit and variety packages. The handbook’s test procedures and statistical requirements allow reasonable variations in package fill as required under both Federal and State packaging and labeling laws. The average requirement ensures consumers receive properly filled packages and promotes, among other benefits, fair competition in the marketplace. The individual package requirement, or Maximum Allowable Variations (MAVs), are used to limit unreasonable minus package errors in a lot, shipment or delivery of packaged goods (See HB 133, Section 1.2. “Package Requirements”). An unreasonable error is a minus package error that exceeds an MAV specified in the proper table of MAVs in HB 133, Appendix A. “Tables.” The tables consist of MAVs for packages labeled by weight, measure (both liquid and dry volume, as well as products sold by length, width, and thickness) and count.

Many multiunit packages are labeled with a declaration of count (e.g., the number of individual inner packages in the package), the net quantity of the individual inner packages, and a total net quantity of contents (i.e., the sum of the declared net quantities of the individual inner packages). Other multiunit packages are labeled with a net quantity of contents declaration that are sold in open or transparent packaging are not required to bear count or total quantity declarations. The labeling requirements and exemptions for multiunit and variety packages are found in NIST Handbook 130 (NIST HB 130) “Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality”⁴, Section 10.4. “Multiunit Packages” and Section 10.6. “Variety Packages”.

There are no separate test procedures for multiunit and variety packages in NIST HB 133 just test procedures for determining the net quantity of contents of packaged goods sold by weight, measure or count. As a result, weights and measures inspectors apply several different procedures when testing these packages. A state weights and measures official requested guidance from the OWM on applying the MAVs to multiunit packages. An official questioned how the MAVs was to be applied to total quantity declaration. The official presented information illustrating that applying an MAV to the total quantity declaration can indirectly reduce the MAV for the individual inner packages. It is important to note the reduction of the MAV occurs when the fixed values for the NIST HB 133 MAVs tables are used. No reduction of the MAV occurs when the MAV’s are used with the total quantity declarations on multiunit and variety packages are based on a percentage of the labeled quantity (e.g., packages sold by net weight with a quantity less than 36 g (1.26 oz); packages sold by weight with a quantity less than 85 g (3 oz) that are subject to U.S. Department of Agriculture regulation; packages labeled by length, width, and area; polyethylene sheeting and film; mulch; and animal bedding.)

We are proposing test procedures for the use with multiunit and variety packages and providing an alternative approach for applying an MAV to total quantity declarations. The solution for applying an MAV to the total quantity declaration recommended below will result in a large allowable variation but it provides a reasonable and practical solution to the problem that results using the current test method. While the individual package requirement is important, packers cannot take advantage of the MAV values without increasing the risk that a lot, shipment or delivery of packages will fail the average requirement which provides the most important protection for consumers and fair competition.

Variations in the Labeling Requirements for Multiunit Packages Call for Different Test Procedures

Most packers fill multiunit packages by producing individual inner packages with a specific net quantity of contents and assemble them into a master package, applying a total quantity declaration to most packages. The individual inner packages are filled on packaging machines programmed to control fill quantities to ensure lots, shipments, and deliveries meet the package requirements in NIST HB 133. Multiunit packaging allows packers to produce the individual inner packages in large numbers and assembles them in packages with a wide range of unit counts and configurations to fill marketplace demands. Many individual inner packages filled on the same production line are labeled for individual retail sale, so they can be removed from the multiunit package for display and individual sale. Packers use a variety of means to check total quantity declarations in multiunit packages, some packers calculate total

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package quantities and rely on the individual inner package fill to ensure compliance with the average and individual package requirements in NIST HB 133.

Some multiunit packages are labeled with a declaration of count, the net quantity of the individual inner packages, and a total net quantity of contents (i.e., the sum of the labeled net quantity of the individual inner packages). Multiunit packages of food sold in open (transparent) packaging are not required to have declarations of count and total net quantity of content declarations. Because of these labeling variations, different test procedures must be used to verify the net quantity of contents of multiunit packages. The following examples reflect the most common test procedures in use. The examples provide for a sample size of 12 multiunit packages from an inspection lot of 230 multiunit packages. Each multiunit package has ten – 100 gram individual inner packages (the total quantity in each multiunit package is 1, 000 g or 1 kg) and the sample includes a total of 120 individual inner packages.

One procedure is used to test multiunit packages that do not bear a count or a total net quantity declaration on the label (see Note 7 in Section 10.4. “Multiunit Packages” of the UPLR in Appendix A in this document) the same way they would be tested if they were simply individual packages offered for sale on a store shelf. In the multiunit package in Figure 1. “Multiunit Package with Individual Quantity Declarations” each individual inner package is labeled with a net quantity of contents statement of 100 g and that statement is visible to consumers. This type of multiunit package could also include for example an open six-pack carton of bottles of soda.

Figure 1. Multiunit Package with Individual Quantity Declarations (contains two rows of packages)

Cereal	Cereal	Cereal	Cereal	Cereal
Net Wt 100 g	Net Wt 100 g	Net Wt 100 g	Net Wt 100 g	Net Wt 100 g

The procedure to test these multiunit packages is to select a random sample of 12 (See NIST HB 133, Appendix A. Table 2-1.) from the inspection lot of 120 multiunit packages. The individual inner packages are taken as a tare sample (i.e., two are typically required by the sampling plan). The average tare weight is added to the declared net quantity on the individual inner package to obtain a nominal gross weight. The nominal gross weight is subtracted from the gross weight of each of the sample individual inner packages to find errors in the quantity declarations. If there are negative errors, the MAV for the quantity shown on the individual inner packages is applied to decide if there are any unreasonable errors (See NIST HB 133, Appendix A “Table 2-5. “MAVs for Packages Labeled by Net Weight”, the MAV for a 100 g is 7.2 g). If the count of unreasonable errors exceeds the number allowed by the sampling plan, the sample fails. If there are no unreasonable errors in the sample, the average requirement is applied, and the sample passes or fails based on the evaluation criteria detailed in NIST HB 133, Section 2.3.7. “Evaluate for Compliance”

A similar approach is used to test multiunit packages that are required to have count, individual inner package net quantity and total net quantity declarations on their labels, except the MAV is applied to the multiunit packages rather than the individual inner package. A multiunit package that is closed or is wrapped in opaque packaging is required by NIST HB 130, Section 10.4. “Multiunit Packages” (see Appendix A in this document) to have the information on the Principal Display Panel (PDP) as shown in the example in Figure 2. Multiunit Package with Count, Individual and Total Quantity Declarations. This procedure is also often used to test multiunit packages that are open or in transparent wrapping which include count, individual inner package net quantity, and total net quantity declarations on their labels.

Figure 2. Multiunit Package with Count, Individual and Total Quantity Declarations

<p style="text-align: center;">Soap Bars 10 – 100 g BARS – TOTAL NET WEIGHT 1 kg</p>
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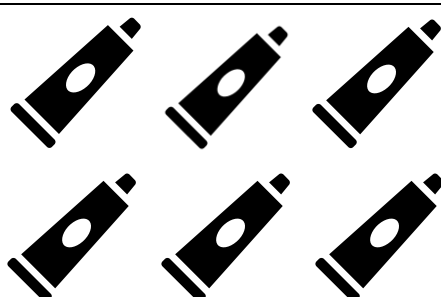
This test is typically used to only verify the total net quantity declaration. The count on all the multiunit packages and declared quantity of individual inner packages is not verified, because only two multiunit packages are opened for

determination of an average tare weight to reduce destructive testing. The two multiunit packages are opened, and tare is taken to determine the average tare weight. The average tare weight is added to the total declared net quantity to obtain a nominal gross weight (NGW). The NGW is subtracted from the measured gross weight of the sample multiunit packages to obtain the errors in total net quantity declarations of each multiunit package in the sample. To determine if the sample passes or fails, the errors in the total net quantity declarations are averaged. If there are minus package errors, the MAV for the total net quantity declaration on the multiunit package is applied to determine if there is an unreasonable package error (In NIST HB 133, Appendix A. Table 2-5. “Maximum Allowable Variations (MAVs) for Packages Labeled by Weight” an MAV of 35.3 g is applied to a 1 kg package). If there are no unreasonable errors in the sample, the average requirement is checked, and the sample passes or fails based on the procedures in NIST HB133, Section 2.3.7. “Evaluate for Compliance”.

There are no specific test procedures for multiunit and variety packages in NIST HB 133. Inspectors may also use a variety of other test procedures for these packages. If a customer complains about a shortage in count an inspector will open all the multiunit packages in a sample to verify count. OWM is aware of other examples of test procedures such as; an inspector will open all the multiunit packages in a sample; verify the net quantity of the individual inner packages, and then use the sum of the errors found with the individual inner packages to calculate the error for each multiunit package. This latter approach is used if they are investigating a complaint about the weight of an individual inner packages labeled for retail sale and the inspector finds the packages were in a multiunit package in a store where they were removed and placed on a store shelf for individual sale. Another test procedure in occasional use is an inspector treats the total number of individual inner packages in the multiunit packages as an inspection lot. The inspector randomly selects a sample of multiunit packages and then opens them and takes another sample of the individual inner packages to use to find if the sample multiunit packages pass or fail the package requirements. When this procedure is used, the total quantity declaration on the multiunit packages are usually not verified.

How Different Test Procedures and Packaging Indirectly Reduce the MAV

In the first test procedure, where the net weights of the individual inner packages were tested separately an MAV of 7.2 g was applied. In the second test procedure, an MAV of 35.3 g was applied where the total net weights of the multiunit packages were measured. The approach using this test procedure effectively requires the packer to distribute the 35.3 g MAV over the individual inner packages so each package would be allowed an MAV of only 3.53 g instead of 7.2 g. Packers use the adjustments on their production lines to control the fill accuracy of the individual inner packages so the total quantity declaration on multiunit packages follow the average and individual package requirements in NIST HB 133. As the MAV for an individual inner package decreases the packer, may either reduce that variability or increase package fill to ensure compliance. This can increase packaging costs and could result in product price increases. In this example, there is the potential for a more than 50 % reduction in the MAV for the same amount of a product solely due to the packaging used to place the product on the shelf in a retail store. In addition, the MAV changes depending on how the individual packages are assembled into multiunit packages. As the count of individual inner packages in the multiunit package increases, the MAV that the packer can use or distribute over the individual inner packages is reduced as shown in table below.

Multiunit Package Count and MAVs for Net Weight				
	Net Weight	MAV for Net Weight ^(a)		This value shows the proportion the Distributed MAV is of the MAV for the Individual Inner Package $Distributed\ MAV/7.2 \times 100\%$
The Individual Inner Package	100 g	7.2 g		
Number of Units in a Multiunit Package	Total Net Weight	MAV for Total Net Weight ^(a)	Distributed MAV <i>Distributed MAV = MAV for Total Net Weight/Number of Packages</i>	
6	600 g	23.5 g	3.91 g	54.30 %
10	1 000 g	35.3 g	3.53 g	49.02 %
12	1 200 g	39.0 g	3.25 g	45.13 %
24	2 400 g	63 g	2.62 g	36.45 %
48	4 800 g	99 g	2.06 g	28.61 %
The illustration below reflects how the 7.2 g MAV allowed for a single 100 g item is reduced by packaging several items in a multiunit package.				
MAV for a Single Individual Inner Package 100 g = 7.2 g^(a)			Total Net Weight MAV Distributed over the Individual Inner Packages in a Multiunit Package of Six Items Total Net Wt: 600 g = MAV of 23.5 g^(a)/6 = 3.91 g per Item	
				
(a) See Table 2-5. “MAVs for Packages Labeled by Weight” in Appendix A. “Tables” in NIST HB 133.				

While the application of the MAVs described in both examples are in full compliance with existing NIST HB 133 test procedures, the indirect reduction of the MAV that results when the MAV is applied to the total quantity declaration on a multiunit package is problematic. When the testing procedures in NIST HB 133 were developed in the 1970s there was no intent to have the value of an MAV indirectly affected by different packaging methods. Any reduction of an MAV for individual inner packages in a multiunit package should be based on data on the package variations taken in production plants and from official weights and measures inspections conducted in the field. This allows for the recognition of the measurement accuracy and variability of packaging machines and other factors that occur in current good manufacturing practice. NIST HB 133 enables inspectors to recognize reasonable variations in package fill allowed under both federal and state laws and regulations and, to meet the requirements in NIST HB 130, Uniform Packaging and Labeling Regulations, Section 12.1.1. “Variations from Declared Net Quantity,” which states “variations from the declared net weight, measure or count shall be permitted when caused by unavoidable deviations

in weighing, measuring or counting the contents of individual packages that occur in current good manufacturing practice....”

As explained above, the OWM found no documentation in the history of the MAVs and NIST HB 133 of any intent to indirectly reduce the MAV value on individual inner packages assembled in multiunit packages. The data used to establish the MAVs focused on the errors and variations found in individual packages where packagers control quantities using filling machines. While the data included errors found in some individual inner packages from multiunit packages (e.g., a 6-pack of soda), errors for the total quantity declarations found on multiunit packages were not considered. Packaging products in multiunit packages for retail sale may be an option, that could be discontinued at a manufacturer’s discretion, but the reduction of the MAV described above also occurs in the current inspection procedures for non-consumer packages that are relied on in wholesale transactions where multiunit packaging is required by definition. Based on the information presented the OWM finds that (1) it is unreasonable to apply a reduced MAV (i.e., no consideration of the MAV for the individual inner packages) to the total quantity declaration on multiunit and variety packages; and (2) there is a need for guidance on testing multiunit and variety packages and for the use of a “Total Quantity MAV” for use with total quantity declarations, on packages containing individual inner packages. OWM is recommending test methods for use with multiunit and variety packages as well as a procedure for calculating a “Total Quantity MAV.”

“Total Quantity MAV”

To ensure reasonable variations are allowed in package filling operations, OWM is recommending that the total quantity declaration on multiunit are verified the use of a “Total Quantity MAV” be applied. The “Total Quantity MAV” is based on the value of the MAVs for the individual inner package quantity and is applied to negative package errors found in the total declared quantity of multiunit packages. A “Total Quantity MAV” can only be applied when the quantities of the individual inner packages are declared. For “Variety Packages,” in which the quantities of the individual inner packages vary such that the MAVs differ, added calculations are necessary and are described in Section 5.4. “Exceptions.” If the quantity of the individual inner package quantity is not declared, which is allowed under an exception in the UPLR, inspectors must apply the MAV for the total declared quantity found in NIST HB 133, Appendix A “Tables.” A “Total Quantity MAV” is defined as the value of the MAV to be applied to each minus Total Quantity Package Error (the sum of the errors found in the individual inner packages) found when verifying the total quantity declarations on multiunit packages. This is determined by obtaining the MAV for the individual inner package quantity and then calculating the “Total Quantity MAV” as follows:

$$\text{Total Quantity MAV} = \text{Number of Individual Inner Packages} \times \text{MAV for Individual Inner Package Quantity}$$

Examples of a “Total Quantity MAV” Used to Verify Total Quantity of Contents Declarations

The examples are based on the test procedures recommended in Section 5.3. “Total Quantity Test Procedure.” In these examples it is the total net contents declaration that is being verified using a gravimetric test procedure. The MAVs for count and individual package quantities are provided because action can be taken on these if unreasonable errors are found in the packages opened for use in tare determination.

Example 1: Multiunit Package of Cereal Packed in 100 g Boxes: This example is based on the Total Quantity Test Procedure shown above in Section 5.3. Only two multiunit packages are opened for a tare determination, so only the total net weight declaration is verified. Package count and the net weights of individual inner packages are not verified to minimize destructive testing and verifying these values would require the opening of all of the packages.

MAV values for the count and individual package quantities are shown in Table “Example 1, Assorted Cereals” to explain how a “Total Quantity MAV” is calculated. A sample of twelve- 24 count multiunit package of 100 g cereal packages is used to show a test for multiunit packages and to explain how a “Total Quantity MAV” is calculated.

In Step 5, the Total Net Weight of the multiunit package is 2.4 kg which is allowed an MAV of 63 g. If a 63 g MAV is applied, a packer would probably need to apply a 2.62 g MAV (i.e., $63 \div 24 = 2.62$) to the individual inner packages not, the 7.2 g allowed in Row 4. To avoid this a “Total Quantity MAV” is used and an MAV of 172.8 g, not 63 g, is compared to each Total Quantity Package Error.

Table: Example 1			
ASSORTED CEREALS			
24 – 100 g (3.5 OZ) PACKAGES - TOTAL NET WT 2.4 kg (5.25 LB)			
	Test Step	Instruction or NIST HB 133 Reference	
1.	a. Define the Inspection Lot (it is the number of multiunit packages available for inspection).	Section 2.3.1. “Define the Inspection Lot”	
	b. Use this number with the proper sampling plan to find the proper sample size.	See Section 2.3.2. “Select Sampling Plans” and also Table 2-1. “Sampling Plans for Category A” or Table 2-2. “Sampling Plans for Category B.”	
	c. Select a random sample.	See Section 2.3.4. “Random Sample Selection.”	
2.	a. Obtain and record the gross weight of the sample packages.	See Section 2.3.3. “Record Inspection Data.”	
	b. Open 2 packages (i.e., the outer and individual inner packages) to obtain the “Average Tare Weight” and calculate a “Nominal Gross Weight.”	See also Sections 2.3.5. “Procedures of Determining Tare.” and	
	c. Use the NGW to determine the errors in the sample packages.	2.3.6. “Determine Nominal Gross Weight and Package Error.”	
3.	The count the of individual inner packages in the sample packages is not determined. If this quantity were verified, each minus package count would be compared to an MAV of:	The MAV for a 24 Count Package is: 1	Table 2-7 “MAVs for Packages Labeled by Count”
4.	The average net weight of the individual inner packages is not determined. If this quantity were verified minus each package errors would be compared to an MAV of:	For a 100 g Individual Inner Package the MAV of 7.2 g is applied.	Table 2-5 “MAVs for Packages Labeled by Weight”
5.	The Total Net Weight of 2.4 kg* is verified. A “Total Quantity MAV” is applied:	A “Total Quantity MAV” is calculated and applied: $24 \times 7.2 \text{ g} = 172.8 \text{ g}$	
6.	The “Total Quantity MAV” is compared to the each minus Total Quantity Package Error to find if any are unreasonable. If the number of unreasonable errors exceed the number allowed for the sample size the sample fails.	Section 2.3.7.1. “MAV Requirement” and Column 4 of Tables 2-1 or 2-2 as appropriate.	
	If the sample does not fail on MAVs the Average Requirement is checked and the sample passes or fails based on the evaluation conducted per Section 2.3.7.	Section 2.3.7.2. “Average Requirement” and Section 2.3.7. “Evaluation for Compliance.”	

Example 2: Multiunit Package of Lemonade in 355 mL Cans:

A test of multiunit packages of twelve cans of lemonade is shown below in Table: “Example 2. Lemonade.” This example, is based on Section 5.3. “Total Quantity.” Only the total net contents declaration is verified. In addition, if the count is verified the MAV for the labeled count in HB133, Appendix A. Table 2-7 “MAVs for Packages Labeled by Count”⁵ is compared to negative package errors (See Row 1). If the net contents of the individual inner packages of 355 mL is verified each is allowed an MAV of 14.7 mL from HB 133, Appendix A. Table 2-6 “MAV’s for Packages Labeled by Liquid or Dry Volume”³ (See Row 2).

The MAV is included to illustrate how a “Total Quantity MAV” is calculated for liquid commodities. In Row 5 the Total Net Contents of 4.26 L is allowed an MAV of 73 mL in HB133, Appendix A, Table 2-6 “MAV’s for Packages Labeled by Liquid or Dry Volume.”³ If a 73 mL MAV is applied to the total net contents declaration a packer would possibly need to apply a 6.08 mL MAV (i.e., $73 \div 12 = 6.08$) to the individual inner packages in the filling process not a 14.7 mL.

In Row 6 a Total Quantity MAV is calculated for use in verifying the total net contents declaration. For this 4.2 L package the Total Quantity MAV is calculated by multiplying the package count of 12×14.7 mL (MAV for the individual inner packages) = 176.4 mL (see Row 6). The Total Quantity MAV of 176.4 mL (not 73 mL) would be compared to minus package errors to determine if they are unreasonable.

Table: Example 2.		
LEMONADE		
12 – 355 mL CANS – TOTAL NET CONTENTS 4.26 L		
	Test Step	Instruction or NIST HB 133 Reference
1.	a. Define the Inspection Lot (it is the number of multiunit packages available for inspection).	Section 2.3.1. “Define the Inspection Lot”
	b. Use this number with the proper sampling plan to find the proper sample size.	See Section 2.3.2. “Select Sampling Plans” and also Table 2-1. “Sampling Plans for Category A” or Table 2-2. “Sampling Plans for Category B.”
	c. Select a random sample.	See Section 2.3.4. “Random Sample Selection.”
2.	a. Verify that the temperature of the product in the sample packages is stabilized at the “Reference Temperature” and then determine the average product density.	See Section 3.1.1.1. “Test Method” and Section 3.2.2. “Test Procedure.”
3.	a. Obtain and record the gross weight of the sample packages.	See Section 2.3.3. “Record Inspection Data.”
	b. Open 2 packages (i.e., the outer and individual inner packages) to obtain the “Average Tare Weight” and calculate a “Nominal Gross Weight.”	See also Sections 2.3.5. “Procedures of Determining Tare” and Section 3.2.2. “Test Procedure.” 2.3.6. “Determine Nominal Gross Weight and Package Error.”
	c. Use the NGW to determine the errors in the sample packages.	

⁵ See Appendix A. “Tables” in NIST HB 133

4.	The count the of individual inner packages in the sample packages is not determined. If this quantity were verified, the minus count would be compared to an MAV of:	The MAV for a 12 Count Package is: 0	Table 2-7 “MAVs for Packages Labeled by Count”
5.	When the average net contents of the individual inner packages are not determined. If this quantity were verified, the minus package errors would be compared to an MAV of:	For a 355 mL Individual Inner Package the MAV of 14.7 mL is applied.	Table 2-6 “MAVs for Packages Labeled by Liquid and Dry Volume”
6.	The Total Net Contents of 4.26 L* is verified. A “Total Quantity MAV” is applied:	For these packages a “Total Quantity MAV” was calculated as follows: $12 \times 14.7 \text{ mL} = 176.4 \text{ mL}$	
7.	The “Total Quantity MAV” is compared to each minus Total Quantity Package Error to find if any are unreasonable. If the unreasonable errors exceed the number amount allowed for the sample size the sample fails.	Section 2.3.7.1. “MAV Requirement” and Column 4 of Tables 2-1 or 2-2 as proper.	
	If the sample does not fail on MAVs the Average Requirement is applied and the sample passes or fails based on the evaluation conducted per Section 2.3.7.	Section 2.3.7.2. “Average Requirement” and Section 2.3.7. “Evaluation for Compliance.”	

Interim Recommendation

Since the NCWM will not consider these proposals until 2019 or later the NIST Office of Weights and Measures recommends that the individual and total quantity package inspection procedures, including the “Total Quantity MAV” described above for use by federal, state and local officials who use NIST HB 133 to verify the net quantity of contents of multiunit and variety packages. While the “Variety Package” requirements in the UPLR do not apply to foods or other commodities subject to the Federal Food, Drug, and Cosmetic Act (21 USC) (and meat and poultry products subject to regulation by the U.S. Department of Agriculture’s Food Safety and Inspection Service), the NIST HB 133 test procedures do apply to these packages, so the Total Quantity MAV should be applied to these packages as well. Utilizing the procedures will help weights and measures officials avoid the possibility that unreasonable Maximum Allowable Variations will be applied to packaged foods and other commodities.

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