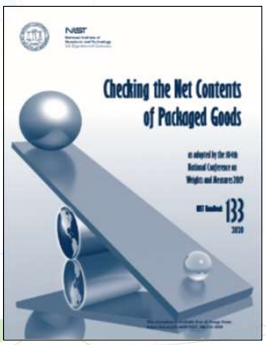
Overview
NIST Handbook 133
"Checking the Net Contents of Packaged Goods"



*** Certain commercial equipment, instruments, or materials are identified in this paper in order to specify the experimental procedure adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the materials or equipment identified are necessarily the best available for the purpose."

Final HB133 Webinar Overview 5/26/2020

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Physical Measurement Laboratory
Office of Weights and Measures
Laws and Metric Program

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Learning Objectives

- The student will:
- Obtain a basic understanding of the Handbook 133 requirements for checking the net content of packaged goods.
- Be able to use the various gravimetric and volumetric test procedures to verify the net quantity of packages labeled by weight, measure, and count.

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Annual Updates

Chapter	Section	Action	Page
Introduction	A. Source	Updated URL and E-mail	1
	C. Amendments	Updated URL's	1
	H. The International System of Units	Updated acronym for General Conference on Weights and Measures (~~GIPM~~ **CGPM**)	2
Chapter 1. General Information	1.3. Sampling Plans	Clarified the instruction to read acceptable lots a ~~9~~**795** % probability of passing.	9
Chapter 2. Test Procedures – Packages Labeled by Weight	2.2.5. Other Test Equipment Requirements	1. Mass Standards – Use NIST Handbook 105-1, "Specifications and Tolerances for ~~Reference Standards and~~ Field Standard Weights ~~and Measures – Field Standard Weights (NIST Class F)" (1990)~~ **(2019)**	17
Chapter 3. Test Procedures – For Packages Labeled by Volume	Table 3-1	Added acronym to title. Code of Federal Regulation **(CFR)** Reference*	46
	Table 3-8. Test Measures for Animal Bedding	Corrected title: Rectangular and Square Test Measures	101

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Basics

- Consumers and business cannot protect themselves from fraud.
- When weights and measures is not active in any sector of the marketplace fraud (intentional, accidental, ignorance or apathy) proliferates and competition suffers (every time!!).
- One goal of weights and measures inspections is to provide a law enforcement **PRESENCE** in the marketplace to protect consumers and reputable businesses.
- Conduct every inspection and investigation as if you were going to defend it before the highest court in your state.
- **The standard of proof is always: "beyond a reasonable doubt."**

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Chapter 1. General Information

This presentation generally follows the chapters of NIST Handbook 133.

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Chapter 1. General Information - Scope

The purpose of net quantity verification is to ensure the accuracy of the net quantity **information** that is required to appear on packages.

The requirements are **based on law** and the test procedures are **based on science** and are reproducible and repeatable.

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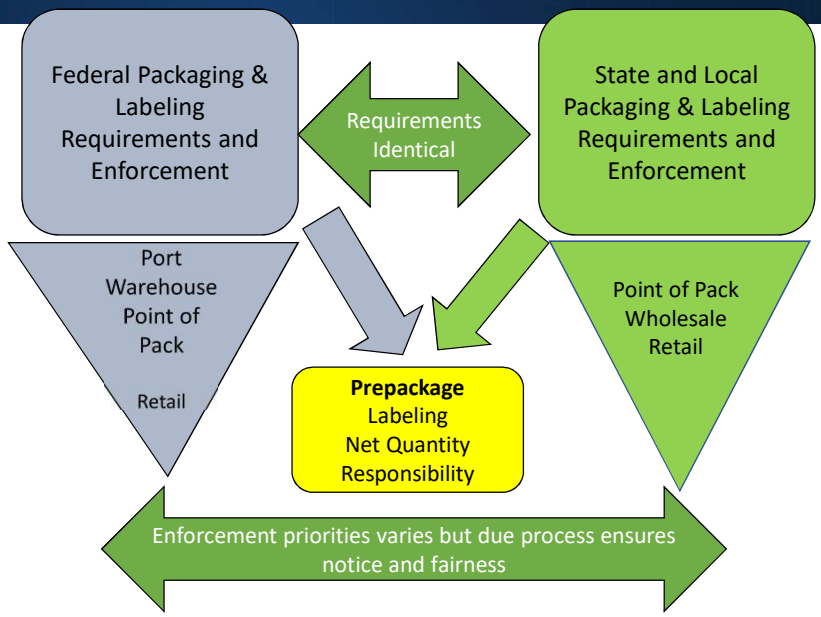
Concurrent Jurisdiction



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Chapter 1. General Information

1.1.a. Use Package Checking Procedures

- Point-of-Pack
  - Greatest Impact
- Distribution & Wholesale
  - Strong Impact
- Retail
  - Mixed Impact

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What products can be tested?

Anything in packaged form.

Learn about the product BEFORE you test it (e.g, how is it made, safety requirements and how it is intended to be used).

- In-state packagers.
- Big consumer impact products (milk, bread, other staple goods).
- Packages delivered to state agencies.
- Marketplace Surveys & Audit Testing.
- Seasonal products.
- Consumer & business complaints.

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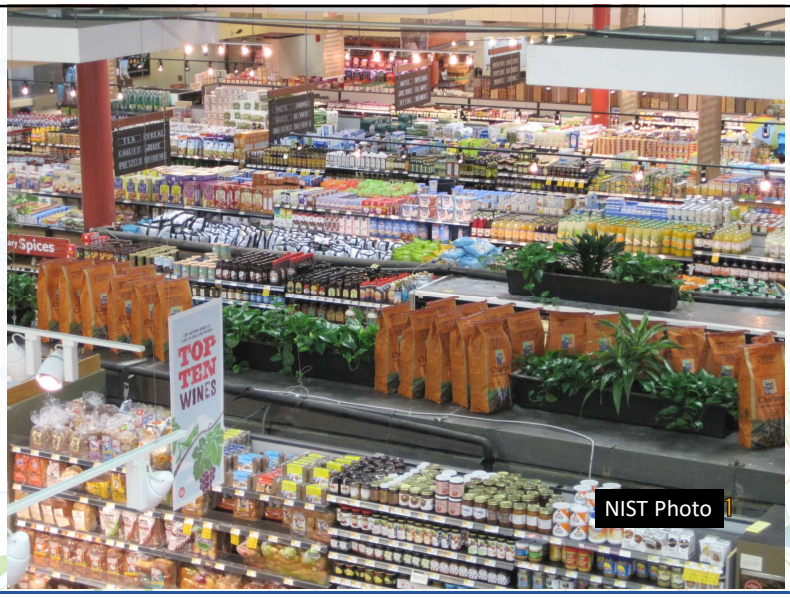

NIST Photo 1

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Example of a Balanced Work Plan

- 40 % on Retail Store.
- 25 % Distribution or Point-of-Pack.
- 10 % Specialty (e.g., polyethyelene sheeting, oil, aerosols, mulch, paint, cement, industrial and construction materials).
- 10 % Liquids (milk and other dairy products, soft drinks and cleaning supplies).
- 10 % Follow-up inspections on products found short measure in past testing.
- 5 % State or Local Institutions.

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What is the purpose of a HB 133 inspections?

INFORMATION

We look at complex information systems

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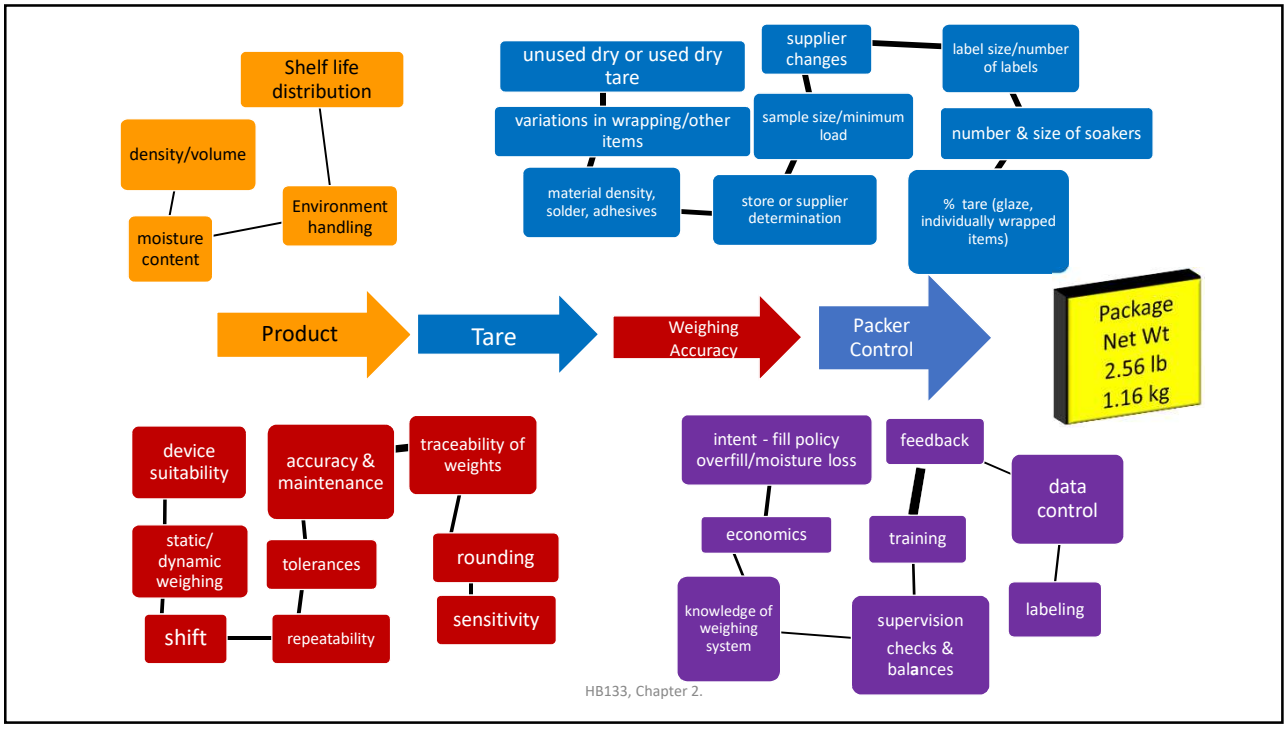

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1.2.1. Inspection Lot

- The collection of identically labeled packages available for inspection at one time.
- This collection will pass or fail as a whole based on the results of tests on a sample drawn.

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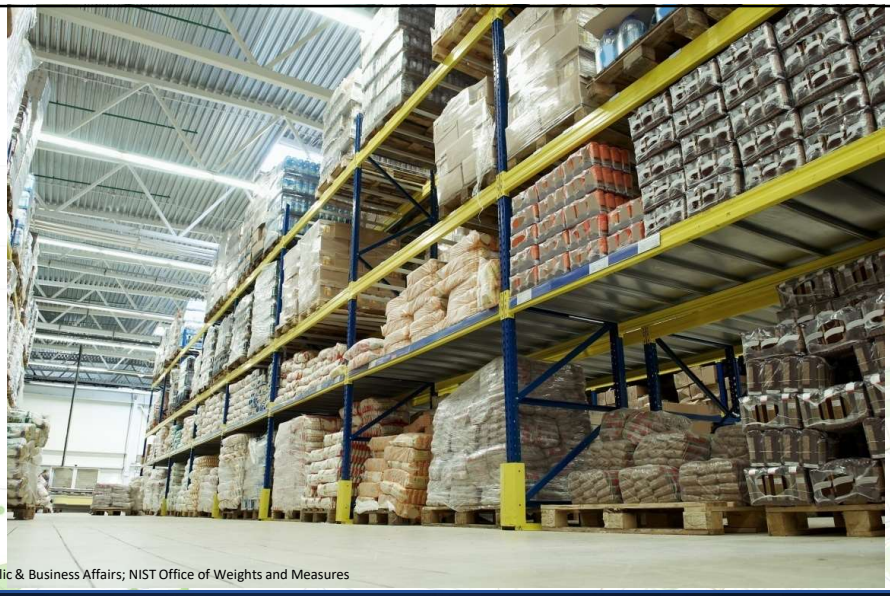

Picture from NIST Public & Business Affairs; NIST Office of Weights and Measures

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A sample must “pass” two requirements

- Average Requirement
- Individual Package Requirement

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A sample "fails" if either requirement is not met.

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How many packages to inspect

Sampling Plans from HB 133

- **Use the sampling plan Category A, Table 2-1**.
- **Use the sampling plan Category B, Table 2-2**. when packages are inspected inside a USDA - regulated establishment.

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Table 2-1. Sampling Plans for Category A

1. Inspection Lot Size	2. Sample Size	3. Sample Correction Factor	4. Number of Minus Package Errors Allowed to Exceed the MAV*
1	1	Apply MAV	
2	2	8.985	
3	3	2.484	
4			
5			
6			
7			
8			
9	9	0.769	
10	10	0.715	
11	11	0.672	
12 to 250	12	0.635	
251 to 3 200	24	0.422	
More than 3 200	48	0.290	1*

*For mulch and soils packaged by volume, see Table 2-10. Exceptions to the MAV – 1 pkg. may exceed the MAV for every

Table 2-2. Sampling Plans for Category B
For Use in USDA-Inspected Meat and Poultry Plants Only

1	2	4
Inspection Lot Size	Sample Size	Number of Packages Allowed to Exceed the MAVs in Table 2-9
250 or Less	10	0
251 or More	30	

The number of packages in the Inspection Lot sets the Sample Size

If the sample size is 24 or less NONE of the packages may exceed the MAV

If you have 220 packages in the Inspection Lot the Sample Size is 12

Category B is used **ONLY** for tests when you are in a USDA inspected packing plant or other establishment

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Reliability of the sampling plans

The **Category A** sampling plan has a 95 % confidence level.

The **Category B** sampling plan has a 50 % confidence level.

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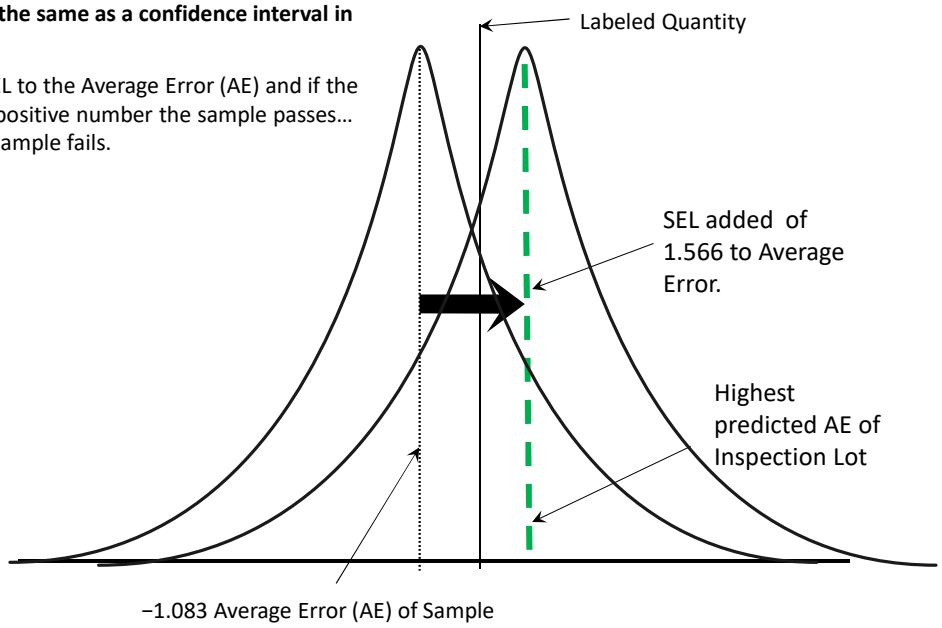
The SEL is the same as a confidence interval in statistics.

Add the SEL to the Average Error (AE) and if the result is a positive number the sample passes… if not the sample fails.



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1.2.6. Moisture Allowances

- A **REASONABLE** allowance for moisture loss must be based on a scientific study.
- HB133 "***Moisture Allowances***" are based on a percentage of the labeled quantity.

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Table 2-3.
Moisture Allowances

Verifying the labeled net weight of packages of:	Moisture Allowance is:	Notes
Flour	3 %	
Dry pet food	3 %	Dry pet food means all extruded dog and cat foods and baked treats packaged in kraft paper bags and/or cardboard boxes with a moisture content of 13 % or less at time of pack.
Pasta products	3 %	Pasta products means all macaroni, noodle, and like products packaged in kraft paper bags, paperboard cartons, and/or flexible plastic bags with a moisture content of 13 % or less at the time of pack.
Borax	See Section 2.4.	
Wet Tare Only[1]		
Fresh poultry	3 %	Fresh poultry is defined as poultry above a temperature of − 3 °C (26 °F) that yields or gives when pushed with the thumb.
Franks or hot dogs	2.5 %	
Bacon, fresh sausage, and luncheon meats	0 %	For packages of bacon, fresh sausage, and luncheon meats, there is no moisture allowance if there is no free-flowing liquid or absorbent material in contact with the product and the package is cleaned of clinging material. Luncheon meats are any cooked sausage product, loaves, jellied products, cured products, and any sliced sandwich-style meat. This does not include whole hams, briskets, roasts, turkeys, or chickens requiring further preparation to be made into ready-to-eat sliced product. When there is no free-flowing liquid inside the package and there are no absorbent materials in contact with the product, Wet Tare and Used Dried Tare are equivalent.

[1]Wet tare procedures must not be used to verify the labeled net weight of packages of meat and poultry packed at an official United States Department of Agriculture (USDA) facility and bearing a USDA seal of inspection. The Food Safety and Inspection Service (FSIS) adopted specific sections of the 2005 4th edition of NIST HB 133 by reference in 2008 but not the "Wet Tare" method for determining net weight compliance. FSIS considers the free-flowing liquids in packages of meat and poultry products, including single-ingredient, raw poultry products, to be integral components of these products (see Federal Register, September 9, 2008 [Volume 73, Number 175] [Final Rule – pages 52189-52193]).

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Section 1.2.6.1. Applying a Moisture Allowance

- To apply an allowance **before** determining package errors, adjust the Nominal Gross Weight. Do NOT adjust the MAV when using nominal gross weight.
- To apply an allowance **after** determining package errors, adjust both the Average Error and the MAV.

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Section 1.6. Health and Safety

The inspector must:

- ✓ Identify the appropriate safety and health practices and procedures to be followed before the inspection begins.
- ✓ Comply with all handling, health, and safety warnings on package labels and those contained in any Safety Data Sheet (SDS)

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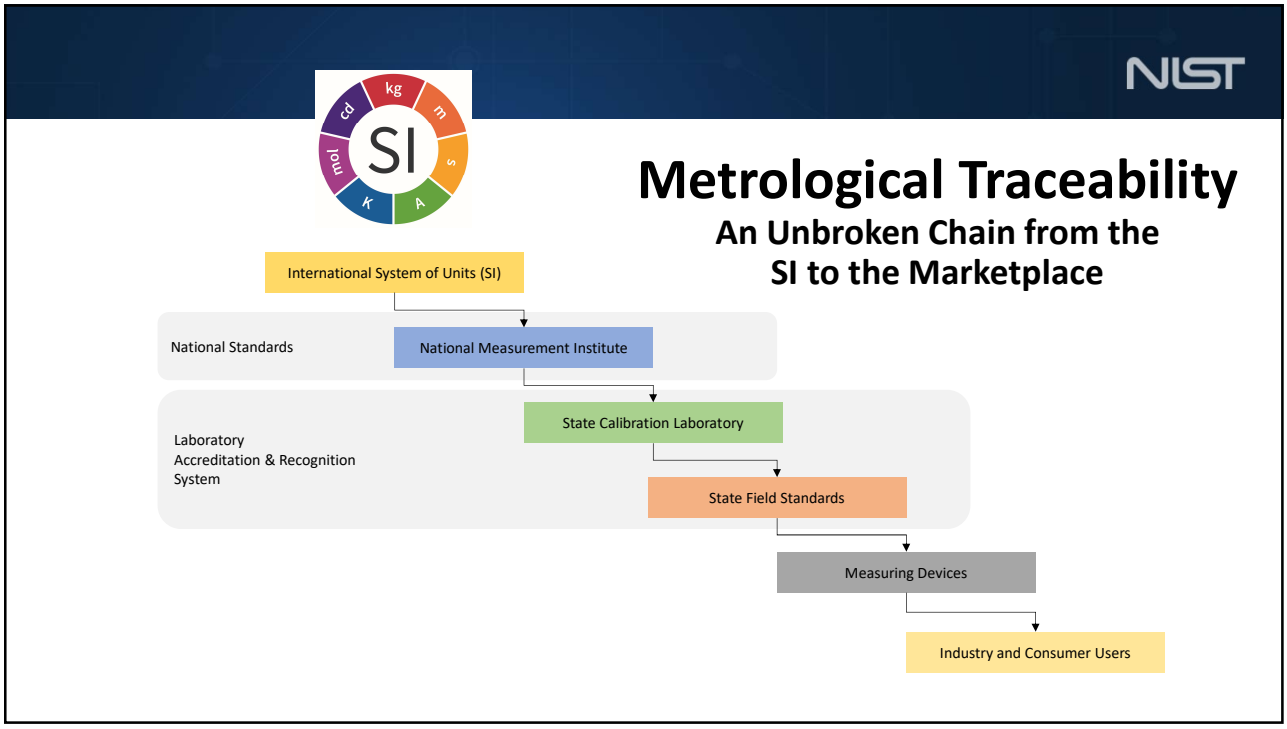

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Basic Test Procedure - Gravimetric Testing
Chapter 2

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Section 2.2. Inspectors Scale or Balance

- ✓ Follow Good Measuring Practice.
  - place on solid - level surface - away from air movement and vibration.
- ✓ Test device before each inspection, after it is moved or if you see erratic results, and if the sample fails.
- ✓ Apply Acceptance Tolerance.

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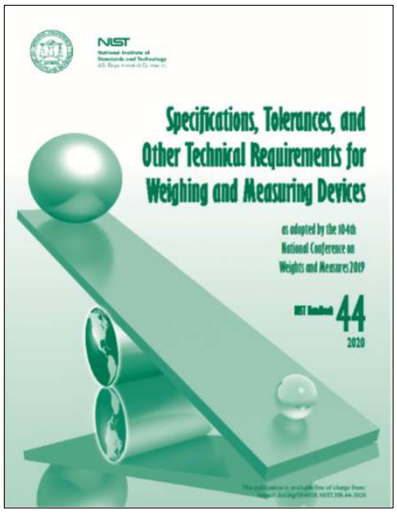
2.2. Inspectors Scale or Balance



Weighing and Measuring Devices

1.10. General Code

2.20. Scales

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Suitability of Package Inspection Balances

d ≤ **MAV ÷ 6**

The MAV for 1 lb is 0.044 lb

0.044 ÷ 6 = .007

Is d (.001) ≤ .007 ?

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Scale Tolerances

Table 2-2. Acceptance Tolerances for Class of Scale Based on Test Load in Divisions		
Test Load in Divisions		Tolerance
Class II Scale	Class III Scale	
0 to 5 000	0 to 500	± 0.5 Division
5 001 to 20 000	501 to 2 000	± 1.0 Division
20 001 or more	2 001 to 4 000	± 1.5 Divisions
Not Applicable	4 001 or more	± 2.5 Divisions

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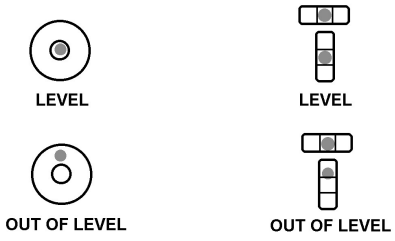
Level Condition



Scales equipped with a level indicator must be maintained in level.

H44 - Code Reference: UR.4.2.

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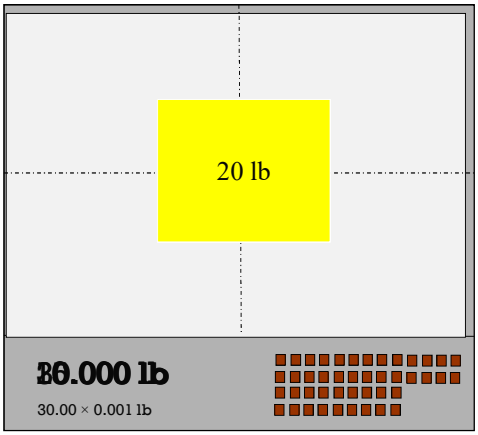
Increasing – Decreasing Load Test

Class II Acceptance Tolerance changes based on test load



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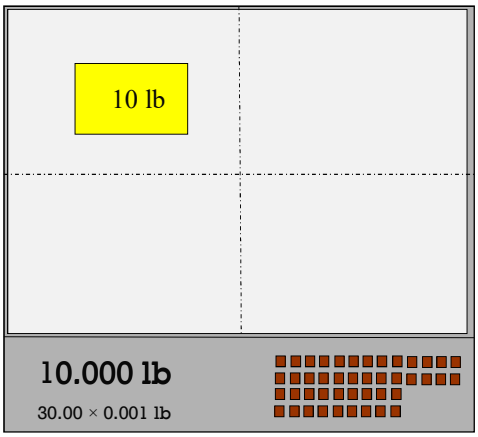
Shift Test Pattern

1st quadrant

2nd quadrant

4th quadrant

3rd quadrant



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2.2.5. Which standards apply to other test equipment

105-1: Specifications & Tolerances for **Field Standard Weights** (NIST Class F) - 2019

105-2: Specifications & Tolerances for **Field Standard Measuring Flasks** - 1996

105-5: Specifications & Tolerances for **Field Standard Stopwatches** - 1997

105-6: Specifications & Tolerances for **Thermometers** - 1997

If you use another measurement instrument find a standard and have it calibrated. ASTM International is another source of standards - www.astm.org

www.nist.gov/pml/weights-and-measures/nist-handbook

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Section 2.3. Basic Test Procedure

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Date: *January 20, 2010*	**Standard Package Report – Example**	Sampling Plan: ☑ A ☐ B	Report Number: *16*
Location (name, address) *Volunteer Market* *18765 Alcoa Highway* *Knoxville, TN 37920*	Product/Brand Identity *Community Group Cookies (Thin Mints)* Lot Codes *April 2009 A & B*	Manufacturer *ABC Cookies Inc.* *1069 Capitol Avenue* *Nashville, TN 37204*	Container Description *Cardboard Box/ Plastic Liner*

1. Labeled Quantity:	2. Unit of Measure:	3. MAV:	4. MAV (dimensionless units) (Box 3 ÷ Box 2 =)	5. Inspection Lot Size:	6. Sample Size (n):
453 g (1 lb)	*0.001 lb*	*0.044 lb*	*44*	*172*	*12*
7. Initial Tare Sample Size:	8. Number of MAVs Allowed:	9. Range of Package Errors (R_e):	10. Range of Tare Weights (R_t):	11. R_e/R_t: (Box 9 ÷ 10 =)	12. Total Number of Tare Samples:
2	*0*	*24*	*2*	*12*	*2*

13. Average Tare Wt:	13a. Tare Correction	14. Nominal Gross Wt: (Box 1 + Box13 − Box 13a =)
0.014 lb ☑ Used Dry Tare ☐ Wet Tare ☐ Unused Dry Tare	☐ Moisture Allowance ☐ Vacuum Pack ☑ Not Applicable	*1.014 lb*

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt	*1.052 lb*	*1.026 lb*								
b. Tare Wt	*0.015 lb*	*0.013 lb*								
c. Net Wt	*1.037 lb*	*1.013 lb*								
d. Package Error	*37*	*13*								

−	+	−	+	−	+	−	+
1.	*38*	13.		25.		37.	
2.	*12*	14.		26.		38.	
3.	*8*	15.		27.		39.	
4.	*4*	16.		28.		40.	
5. *3*		17.		29.		41.	
6. *2*		18.		30.		42.	
7.	*12*	19.		31.		43.	
8. *3*		20.		32.		44.	
9.	*4*	21.		33.		45.	
10. *1*		22.		34.		46.	
11. *0*		23.		35.		47.	
12.	*6*	24.		36.		48.	
Total: *9*	Total: *84*	Total:	Total:	Total:	Total:	Total:	Total:

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Date *January 20, 2010*	**Standard Package Report - Example**	Sampling Plan: ■ A □ B	Report Number *16*
Location (name, address) *Volunteer Market* *18765 Alcoa Highway* *Knoxville, Tennessee 37929*	Product/Brand Identity *Community Group Cookies (Thin Mints)* Codes *April 1998 A&B*	Manufacturer: *ABC Cookies Inc* *1069 Capital Avenue* *Nashville, Tennessee 37204*	Container Description *Cardboard Box / Plastic Liner*

1. Labeled Quantity	2. Unit of Measure:	3. MAV	4. MAV (dimensionless units) (Box 3 ÷ Box 2 =)	5. Inspection Size	6. Sample Size (n)
453 g (1 lb)	*0.001 lb*	*0 .044 lb*	*44*	*172*	*12*
7. Initial Tare Sample Size	8. No. of MAVs Allowed	9. Errors (R_e)	10. Weights (R_t)	11. R_e/R_t (Box 9 ÷ Box 10 =)	12. Total Number of Tare Samples:
2	*0*	*24*	*2*	*12*	*2*

13. Avg. Tare Wt:	13a. ☐ Tare Correction ☐ Moisture Allowance ☐ Vacuum Pack ■ Not Applicable	14. Nominal Gross Wt (Box 1 + Box 13 – Box 13a =)
0 .014 lb ■ Used Dry Tare ☐ Wet Tare ☐ Unused Dry Tare		*1.014 lb*

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt	*1.052 lb*	*1.026 lb*								
b. Tare Wt	*0.015 lb*	*0.013 lb*								
c. Net Wt	*1.037 lb*	*1.013 lb*								
d. Package Error	37	13								

-	+	-	+		+
1.	*38*	13.			
2.	*12*	14.			
3.	*8*	15.			
4.	*4*	16.			
5. *3*		17.			
6. *2*		18.			
7.	*12*	19.		31.	43.
8. *3*		20.		32.	44.
9.	*4*	21.		33.	45.
10. *1*		22.		34.	46.
11. *0*		23.		35.	47.
12.	*6*	24.		36.	48.
Total: *9*	Total *84*	Total	Total	Total	Total	Total	Total

After you compute the Average Tare Weight recalculate the "package errors" for the tare sample and enter the correct values below. This ensures that you are using consistent tare values for the entire sample.

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–	+	–	+	–	+	–	+
1. 38		13.		25.		37.	
2. 12		14.		26.		38.	
3. 8		15.		27.		39.	
4. 4		16.		28.		40.	
5.	3	17.		29.		41.	
6.	2	18.		30.		42.	
7. 12		19.		31.		43.	
8.	2	20.		32.		44.	
9. 4		21.		33.		45.	
10.	1	22.		34.		46.	
11. 0		23.		35.		47.	
12. 6		24.		36.		48.	
Total 84	Total 9	Total	Total	Total	Total	Total	Total

15. Total Error	16. No. of unreasonable minus errors (compare each package error with Column 4)	17. Is Box 16 greater than Box 8?	18. Avg. error in dimensionless units. (Box 15 ÷ Box 6 =)	19. Avg. error in labeled units (Box 18 × Box 2 =)
−75	0	☐ Yes, lot fails √ No, go to 18	− 6.25	− 0.006 lb

20. Is 18 = Zero or Plus?	21. Compute Sample Standard Deviation:	22. Sample Correction Factor:	23. Compute Sample Error Limit (21 × 22 =)
☐ Yes, lot passes, go to 25 √ No, go to 21	11.284	0.635	7.165

24. Disregarding the signs, is Box 18 larger than Box 23?	25. Disposition of Inspection
☐ Yes, lot fails, go to 25 √ No, lot passes	√ Approved ☐ Rejected
Comments: *Lot Passes*	Official's Signature Acknowledgement of Report

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Table 2-5. Maximum Allowable Variations (MAVs) for Packages Labeled by Weight
Do Not Use This Table for Meat and Poultry Products subject to USDA Regulations – Use Table 2-9
For Polyethylene Sheeting and Film, see Table 2-10. Exceptions to the MAVs.

Labeled Quantity	Maximum Allowable Variations
Less than 36 g, 0.08 lb, or 1.28 oz	10 % of labeled quantity
36 g or more to 54 g **0.08 lb or more to 0.12 lb** 1.28 oz or more to 1.92 oz	3.6 g **0.008 lb** $^{1}/_{8}$ oz
More than 54 g to 81 g **More than 0.12 lb to 0.18 lb** More than 1.92 oz to 2.88 oz	5.4 g **0.012 lb** $^{3}/_{16}$ oz
More than 81 g to 117 g **More than 0.18 lb to 0.26 lb** More than 2.88 oz to 4.16 oz	7.2 g **0.016 lb** ¼ oz
More than 117 g to 154 g **More than 0.26 lb to 0.34 lb** More than 4.16 oz to 5.44 oz	9.0 g **0.020 lb** $^{5}/_{16}$ oz
More than 154 g to 208 g **More than 0.34 lb to 0.46 lb** More than 5.44 oz to 7.36 oz	10.8 g **0.024 lb** $^{3}/_{8}$ oz
More than 208 g to 263 g **More than 0.46 lb to 0.58 lb** More than 7.36 oz to 9.28 oz	12.7 g **0.028 lb** $^{7}/_{16}$ oz
More than 263 g to 317 g **More than 0.58 lb to 0.70 lb** More than 9.28 oz to 11.20 oz	14.5 g **0.032 lb** ½ oz
More than 317 g to 381 g **More than 0.70 lb to 0.84 lb** More than 11.20 oz to 13.44 oz	16.3 g **0.036 lb** $^{9}/_{16}$ oz
More than 381 g to 426 g **More than 0.84 lb to 0.94 lb** More than 13.44 oz to 15.04 oz	18.1 g **0.040 lb** $^{5}/_{8}$ oz
More than 426 g to 489 g **More than 0.94 lb to 1.08 lb** More than 15.04 oz to 17.28 oz	19.9 g **0.044 lb** $^{11}/_{16}$ oz

MAV's –

WHERE ARE MAXIMUM ALLOWABLE VARIATIONS FOUND?

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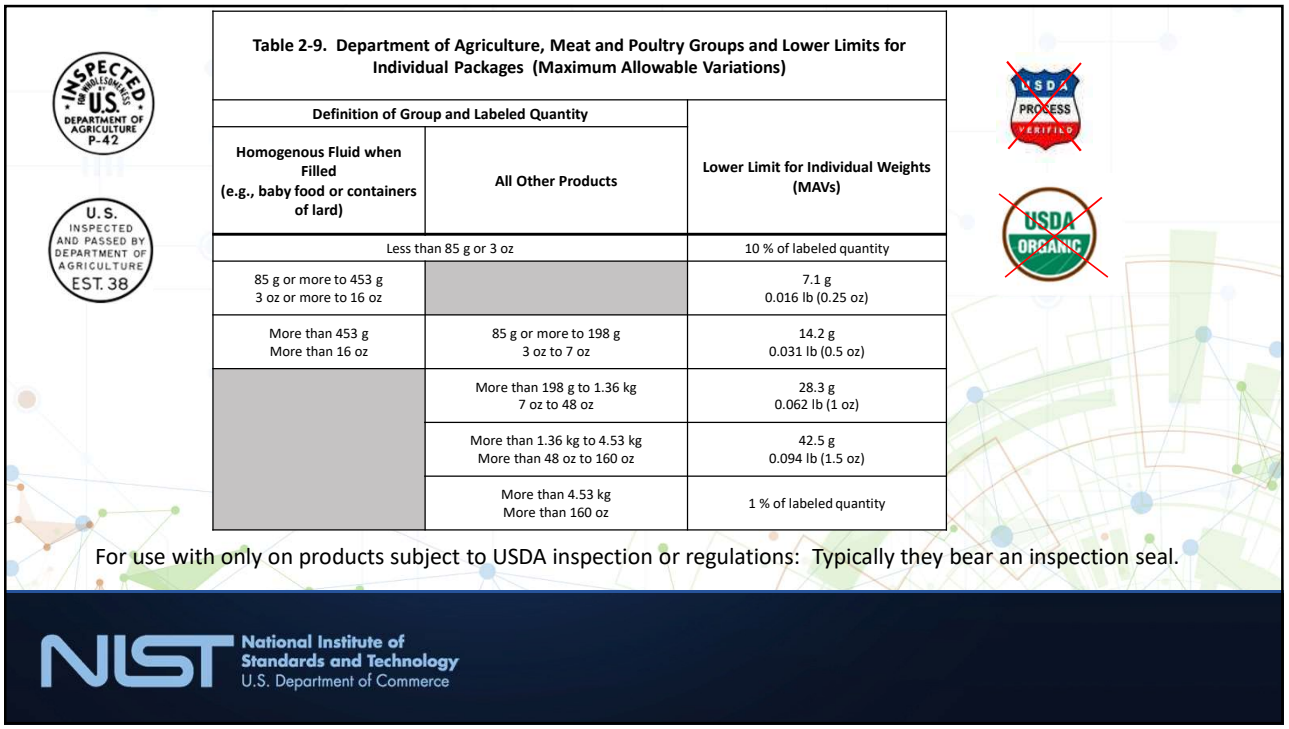

Table 2-9. Department of Agriculture, Meat and Poultry Groups and Lower Limits for Individual Packages (Maximum Allowable Variations)

Definition of Group and Labeled Quantity		Lower Limit for Individual Weights (MAVs)
Homogenous Fluid when Filled (e.g., baby food or containers of lard)	**All Other Products**	
Less than 85 g or 3 oz		10 % of labeled quantity
85 g or more to 453 g 3 oz or more to 16 oz		7.1 g 0.016 lb (0.25 oz)
More than 453 g More than 16 oz	85 g or more to 198 g 3 oz to 7 oz	14.2 g 0.031 lb (0.5 oz)
	More than 198 g to 1.36 kg 7 oz to 48 oz	28.3 g 0.062 lb (1 oz)
	More than 1.36 kg to 4.53 kg More than 48 oz to 160 oz	42.5 g 0.094 lb (1.5 oz)
	More than 4.53 kg More than 160 oz	1 % of labeled quantity

For use with only on products subject to USDA inspection or regulations: Typically they bear an inspection seal.

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Table 2-6. Maximum Allowable Variations for Packages Labeled by Liquid and Dry Volume
Do Not Use This Table for Meat and Poultry Products Subject to USDA Regulations
For Mulch, see Table 2-10. Exceptions to the Maximum Allowable Variations
Use Table 2-9 for USDA –Regulated Products.

Labeled Quantity	Maximum Allowable Variations (MAVs)
3 mL or less **0.50 fl oz or less** 0.18 in^3 or less	0.5 mL **0.02 fl oz** 0.03 in^3
More than 3 mL to 8 mL More than 0.18 in^3 to 0.49 in^3	1.0 mL 0.06 in^3
More than 8 mL to 14 mL More than 0.49 in^3 to 0.92 in^3	1.5 mL 0.09 in^3
More than 14 mL to 22 mL **More than 0.50 fl oz to 0.75 fl oz** More than 0.92 in^3 to 1.35 in^3	1.7 mL **0.06 fl oz** 0.10 in^3
More than 22 mL to 66 mL **More than 0.75 fl oz to 2.25 fl oz** More than 1.35 in^3 to 4.06 in^3	3.8 mL **0.13 fl oz** 0.23 in^3
More than 66 mL to 125 mL **More than 2.25 fl oz to 4.25 fl oz** More than 4.06 in^3 to 7.66 in^3	5.6 mL **0.19 fl oz** 0.34 in^3
More than 125 mL to 170 mL **More than 4.25 fl oz to 5.75 fl oz** More than 7.66 in^3 to 10.37 in^3	7.3 mL **0.25 fl oz** 0.45 in^3
More than 170 mL to 221 mL **More than 5.75 fl oz to 7.50 fl oz** More than 10.37 in^3 to 13.53 in^3	9.1 mL **0.31 fl oz** 0.55 in^3
More than 221 mL to 347 mL **More than 7.50 fl oz to 11.75 fl oz** More than 13.53 in^3 to 21.20 in^3	11.2 mL **0.38 fl oz** 0.68 in^3
More than 347 mL to 502 mL **More than 11.75 fl oz to 17.00 fl oz** More than 21.20 in^3 to 30.67 in^3	14.7 mL **0.5 fl oz** 0.90 in^3

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Table 2-8. Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area
For Textiles, Polyethylene Sheeting and Film – See Table 2-10. Exceptions to the MAVs

Labeled Quantity	Maximum Allowable Variations (MAVs)
1 m or less 1 yd or less	3 % of labeled quantity
More than 1 m to 43 m More than 1 yd to 48 yd	1.5 % of labeled quantity
More than 43 m to 87 m More than 48 yd to 96 yd	2 % of labeled quantity
More than 87 m to 140 m More than 96 yd to 154 yd	2.5 % of labeled quantity
More than 140 m to 301 m More than 154 yd to 330 yd	3 % of labeled quantity
More than 301 m to 1,005 m More than 330 yd to 1,100 yd	4 % of labeled quantity
More than 1,005 m or 1,100 yd	5 % of labeled quantity
Maximum Allowable Variations for Packages Labeled by Area.	
The MAV for packages labeled by area is 3 % of labeled quantity.	
For Textiles, Polyethylene Sheeting and Film, see Table 2-10. Exceptions to the MAVs (Amended 2004)	

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

	Maximum Allowable Variations (MAVs)
Mulch And Soil Labeled By Volume	The MAVs are: For individual packages: 5 % of the labeled volume. For samples: One package may exceed the MAV for every 12 packages in the sample (e.g., when the sample size is 12 or fewer, 1 package may exceed the MAV and when the sample size is 48 packages, 4 packages may exceed the MAV).
Packaged Firewood and Stove Wood Labeled by Volume	20 % of labeled quantity Note: Use Table 2-5 "Maximum Allowable Variations for Packages Labeled by Weight" for packaged artificial and compressed fireplace logs and stove wood pellets and chips labeled by weight.
Specific Agricultural Seeds Labeled By Count	The MAVS are: For corn seed: 2 % of the labeled count For soybean seed: 4 % of the labeled count For field bean seed: 5 % of the labeled count For wheat seed: 3 % of the labeled count
Animal Bedding	5 % of the labeled volume

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Section 2.3.4. Random Sample Selection

- To ensure that the sample represents the entire inspection lot.
- This means every package has an equal chance of selection.
- Eliminates bias and sloppiness.

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If the sample packages are <u>not</u> randomly selected the test result will <u>not</u> be statistically valid. Since the test results are not valid they must not be used for enforcement purposes.

Use the results as an Audit Test

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Appendix B. Random Number Tables

Illustration for Finding/Using Random Digits: Assume that testing takes place on the 3rd day of the week. Start with **Table 3**. Then assume you drop your pencil on the page, and it has showed a starting place at **Column 22**, **Row 45**. That number is **"1."**

Continue to follow the instructions on the previoius page. (See Appendix B. Random Number Tables, Section "Random Starting Place.")

	Column 1	Column 5	Column 8	Column 15	Column 22	Column 30				Column 50
Row 1	37100	62492	63642	47638	13925	80113	88067	42575	44078	62703
Row 2	53406	13855	38519	29500	62479	01036	87964	44498	07793	21599
Row 3	55172	81556	18856	59043	64315	38270	25677	01965	21310	28115
Row 4	40353	84807	47767	46890	16053	32415	60259	99788	55924	22077
Row 5	18899	09612	77541	57675	70153	41179	97535	82889	27214	03482
Row 41	09522	83855	85973	15888	29554	17995	37443	11461	42909	32634
Row 42	93714	15414	93712	02742	34395	21929	38928	31205	01838	60000
Row 43	15681	53599	58185	73840	88758	10618	98725	23146	13521	47905
Row 44	77712	23914	08907	43768	10304	61405	53986	61116	76164	54958
Row 45	78453	54844	61509	01245	91199	07482	02534	08189	62978	55516

Digit Selected
Column 22; Row 45

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TABLE 1 - RANDOM DIGITS

11164	36318	75061	37674	26320	75100	10431	20418	19228	91792
21215	91791	76831	58678	87054	31687	93205	43685	19732	08468
10438	44482	66558	37649	08882	90870	12462	41810	01806	02977
36792	26236	33266	66583	60881	97395	20461	36742	02852	50564
73944	04773	12032	51414	82384	38370	00249	80709	72605	67497
49563	12872	14063	93104	78483	72717	68714	18048	25005	04151
64208	48237	41701	73117	33242	42314	83049	21933	92813	04763
51486	72875	38605	29341	80749	80151	33835	52602	79147	08868
99756	26360	64516	17971	48478	09610	04638	17141	09227	10606
71325	55217	13015	72907	00431	45117	33827	92873	02953	85474
65285	97198	12138	53910	94601	15838	16805	61004	43516	17020
17264	57327	38224	293	31381	38109	34976	65692	98566	29550
95639	99754	31199	9255	68368	04985	51092	37780	40261	14479
61555	76404	86210	11808	12841	45147	97438	60022	12645	62000
78137	98768	04689	87130	79225	08153	84967	64539		74917
62490	99215	84987	28759	19177	14733	24550		68894	38490
24216	63444	21283	07044	92729	37284	1	37485	10415	36457
16975	95428	33226	55903	31605	43817	22	03918	46999	98501
59138	39542	71168	57609	510	77904	74244	50940	31553	62562
29478	59652	50414	31966	12	87154	12944	49862	96566	48825
96155	95009	27429	72918	7	78134	48407	26061	58754	05325
29621	66583	62966	12468	20	14015	04014	35713	03980	03024
12639	75291	71020	17265	4159	64074	64629	63293	53307	48766
14544	37134	54714	02401	63228	26831	19386	15457	17999	18306
83403	88827	09834	11333	68431	31706	26652	04711	34593	22561
67642	05204	30697	44806	96989	68403	85621	45556	35434	09532
64041	99011	14610	40273	09482	62864	01573	82274	81446	32477
17048	94523	97444	59904	16936	39384	7551	09620	63932	03091
93039	89416	52795	10631	09728	68202	763	02477	55494	39563
82244	34392	96607	17220	51984	10753	2	50985	97593	34320
96990	55244	70693	25255	40029	23289	48	07159	60172	81697
09119	74803	97303	88701	51380	73143	982	78635	27556	20712
57666	41204	47589	78364	38266	94393	70713	53388	79865	92069
46492	61594	26729	58272	81754	14648	77210	12923	53712	87771
08433	19172	08320	20839	13715	10597	17234	39355	74816	03363

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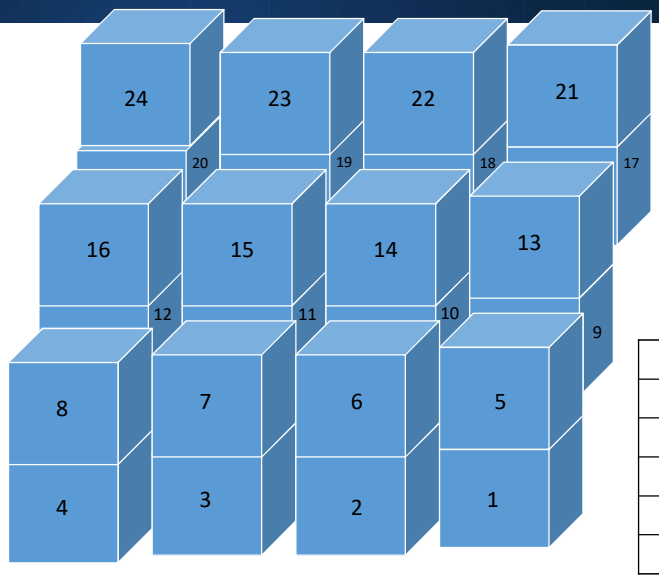
Serial Sampling



8	17
24	5
21	15
3	2
9	11
13	14

2	13
3	14
5	15
8	17
9	21
11	24

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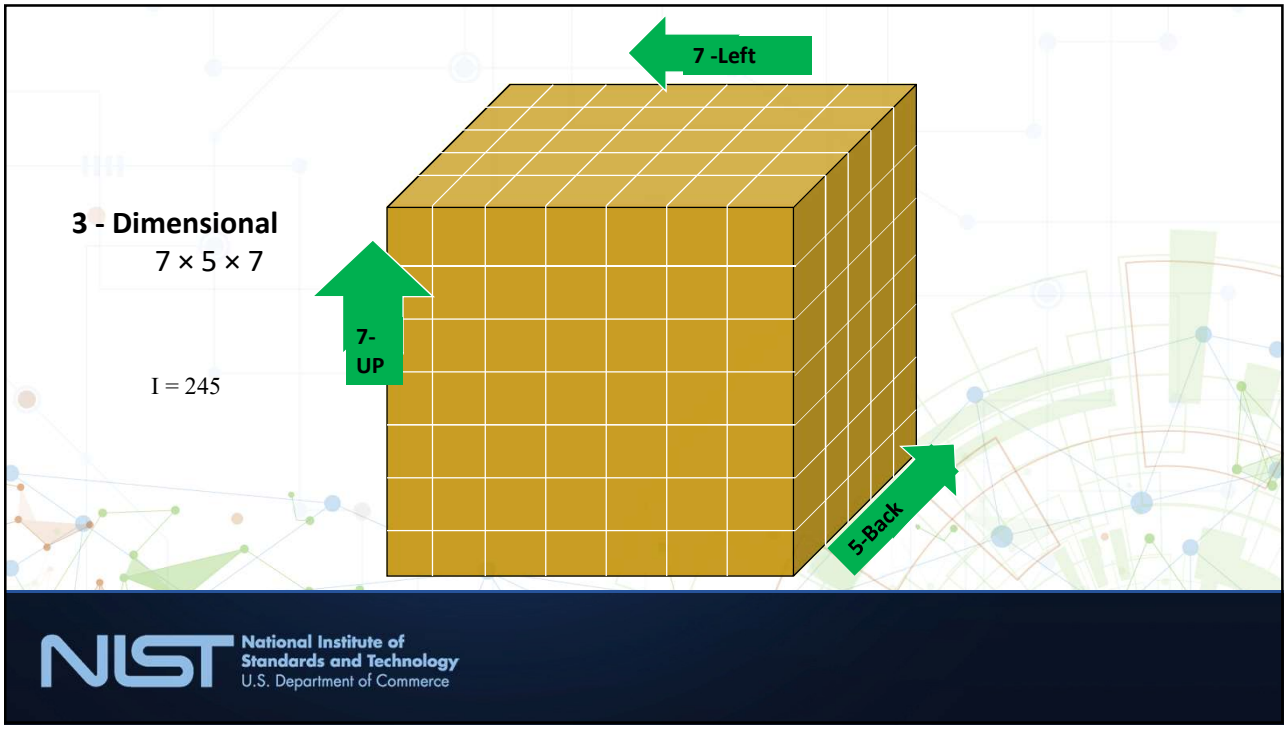

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Random Sampling Production Line (Time)

Use 1 hour's production (3600 seconds).
Use random numbers to select samples from production line based on time.

Divide by 60 to obtain Minutes			
438	7 min	1791	30 min
1164	19 min	2032	34 min
1215	20 min	2872	47 min
1414	23 min	2875	48 min
1486	25 min	3104	51 min
1701	28 min	3266	54 min

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Section 2.3.5. Tare Procedures

- "**Unused** Dry Tare" only available in stores or at Point-of-Pack.
- "**Used**" Dry Tare – closely replicates "Unused "Dry Tare

Defining Tare Accurately

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Section 2.3.5.b. Unused Tare In-Store*

*FDA Note

If there is ANY variation between the first 2 tare samples have 3 more tare samples prepared and determine the Average Tare Weight for all 5 samples.

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	Tare Weight
1	0.036
2	0.037
3	0.037
4	0.037
5	0.036
Avg Tare	**0.037**

8S Foam Tray "unused dry tare"

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	Tare Weight
1	0.83
2	0.85
Avg Tare	0.84

If variations are found you must open additional samples as prescribed.

Plastic Tray with Soaker "used dry tare"

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Table 2-1. Sampling Plans for Category A

1	2	5	6
Inspection Size	**Sample Size**	**Initial Tare Sample Size ****	
		Glass and Aerosol Packages	**All Other Packages**
1	1	2	2
2	2		
3	3		
4	4		
5	5		
6	6		
7	7		
8	8		
9	9		
10	10		
11	11		
12 to 250	12		
251 to 3 200	24	3	
More than 3 200	48		

* For mulch and soils packaged by volume, see Table 2-10. Exceptions to the Maximum Allowable Variations – 1 package may exceed the MAV for every 12 packages in the sample.

**** If sample size is 11 or fewer, the initial tare sample size and the total tare sample size is 2 samples.**

Table 2-2. Sampling Plans for Category B

For Use in USDA-Inspected Meat and Poultry Plants Only

1	2	3
Inspection Size	**Sample Size**	**Initial Tare Sample Size**
250 or Fewer	10	2
251 or More	30	5

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Think of the Numbers

$ Cost of an Error

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Money Value of Weight

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Unit Price	0.001	0.002	0.005	0.01	0.02	0.03	0.05	0.25
50 ¢	0.05¢	0.1¢	0.25¢	0.5¢	1¢	1.5¢	2.5¢	12.5¢
$1.00	0.1¢	0.2¢	0.5¢	1¢	2¢	3¢	5¢	25¢
$2.00	0.2¢	0.4¢	1¢	2¢	4¢	6¢	10¢	50¢
$3.00	0.3¢	0.6¢	1.5¢	3¢	6¢	9¢	15¢	75¢
$4.00	0.4¢	0.8¢	2¢	4¢	8¢	12¢	20¢	$1
$5.00	0.5¢	1¢	2.5¢	5¢	10¢	15¢	25¢	$1.25
$6.00	0.6¢	1.2¢	3¢	6¢	12¢	18¢	30¢	$1.50
$8.00	0.8¢	1.6¢	4¢	8¢	16¢	24¢	40¢	$2
$10.00	1¢	2¢	5¢	10¢	20¢	30¢	50¢	$2.50
$20.00	2¢	4¢	10¢	20¢	40¢	60¢	$1	$5

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Example of the Accumulation of Errors in 1 Year

Assume:

- 260 transactions per day
- $8 lb average unit price
- ± error of 0.01 lb per transaction

Then:

(0.01 lb × $8 lb =) 8 ¢ × 260 (transactions/day) × 7 days per week × 52 weeks per year =

94,640 total weighings/year

$7,571 per year !!!

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Section 2.3.5.2.a. Aerosol Containers & Other Pre-Pressurized Containers

(How is tare determined)

- Cannot be opened for safety reasons.
- Required by the UPLR **to deliver** the declared net contents.
- **Retained product & propellant is "tare."**
- Follow manufacturer instructions (including storage temperature) to empty the packages.

HB133, Chapter 2.

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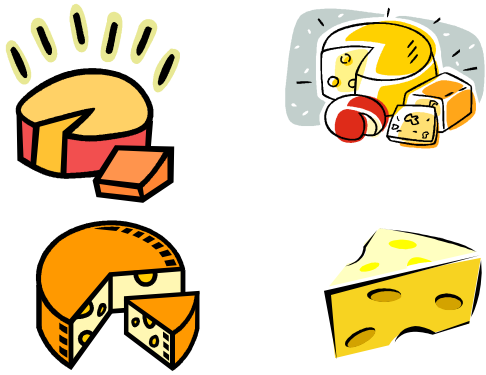
The wax on cheese is tare and it must be deducted.



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RETAILERS MUST ALLOW FOR TARE USING A "PROPORTIONAL" OR "PERCENTAGE" TARE FUNCTION IN SCALES OR POINT-OF-SALE SYSTEMS.

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Tare = weight of bag + label + % glaze

RETAILERS MUST ALLOW FOR "GLAZE" USING A "PROPORTIONAL" OR "PERCENTAGE" TARE FUNCTION IN THEIR SCALES OR POINT-OF-SALE SYSTEM.

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Tare Audit and Test Purchases

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- Verify the tare values used in the store.
  - Select a department.
  - Manually determine tare values.
  - Compare to pre-programmed tares.
- Test Purchases (e.g., Produce)

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Conversions and Rounding Net Quantity Declarations

- The UPLR does not prescribe mandatory rounding rules.
- Quantity declarations in U.S. Customary Units and SI Units on packages do not have to be mathematically equivalent.
- The Uniform Packaging and Labeling Regulation and NIST Handbook 133 requires inspectors to verify the largest declared quantity.

Exercise caution when using any conversion software unless you verify that the factors it uses conform to current values published by NIST

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Ounces to grams

- 1 oz = 28.349 523 125 g[1]
- 10.5 × 28.349 523 125 = 297.669 992 812 g

Which is larger?

- 10.5 oz

What if the can was labeled: 10.5 oz (297.7 g)?

Net Wt 10.5 oz (297 g)

[1] HB 133 - Appendix E. General Table of Units of Measurement

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HB 130 and HB 133 – SI & U.S. Customary Conversion Factors

Appendix A: "Accurate Conversion Factors for Most Packaged Goods (UPLR HB130)"

Appendix B: "Converting U.S. Customary Units to SI Units for Quantity Declarations on Packages (UPLR HB130)"

Appendix E: "General Table of Units of Measure (HB133)"

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Unique Test Procedures Chapter 2.

Aerosol (self-pressurized) Containers
Borax
Drained Weight
Ice Deglazing
Block Ice
Chitterlings (small pig intestines)

70

Audit for Moisture Allowance

If the sample fails a net weight verification.

If the VOLUME OF PRODUCT is greater than volume declared on package the sample passes.

Vol. 2163 mL per NIST Handbook 133

HB 133 - Section 2.4. Borax can lose up to 23 % of weight due to moisture loss.

HB133, Chapter 2.

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Section 2.5. Determination of Drained Weight

All of the samples must be opened. Start the test with the lightest package in the sample - so possible MAV's can be found.

HB 133 follows FDA procedures.

Sieves:

- Quantity of 3 lb or less use a 8 inch sieve with No. 8 mesh.
- Quantities greater than 3 lb use a 12 inch sieve with No. 8 mesh.

HB133, Chapter 2.

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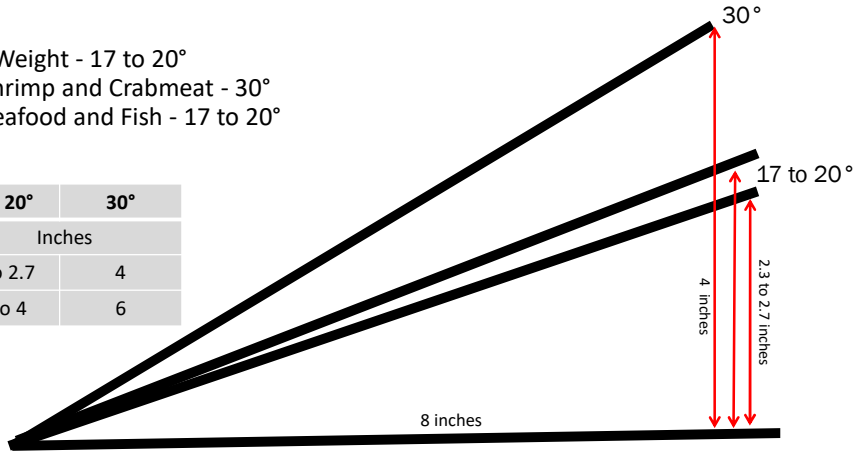
Drain Angles

Critical Measurement

- 2.5 - Drained Weight - 17 to 20°
- 2.6 - Frozen Shrimp and Crabmeat - 30°
- 2.6 - Glazed Seafood and Fish - 17 to 20°

Sieve Diameter	17 to 20°	30°
	Inches	
8	2.3 to 2.7	4
12	3.5 to 4	6



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Drain Time

Critical Measurement

2 Minutes

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Net Weight of Glazed Seafood & Fish (or other food)

- Hold glazed product under a gentle spray of cold water (e.g., in sieve).
- Carefully agitate the product but do not break (or tear) the pieces apart.
- Spray until all glaze is removed.
- Tilt sieve and drain for 2 minutes.
- Immediately transfer product to pan.

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2.6. Drained Weight for Glazed or Frozen Food & Frozen Shrimp & Crabmeat (Blocks)

Equipment

- Thermometer -Water Temp: 23 - 29 °C (75 - 85 °F).
- Continuous Water flow [4-15 L (1-4 gal)/min].
- Wire mesh basket.

No. 8 Sieve:

- 20 cm (8 in) for packages 453 g (1 lb) or less.
- 30 cm (12 in) for packages more than 453 g (1 lb).

2 minute drain time.

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OCTOPUS

Encased in a Block iced, ice glazed, or sold in a frozen state?

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Section 2.7. Chitterlings
(small pig intestines)

Frozen Chitterlings

1. Fully immerse in a **water bath** maintained at a temperature between 23 °C to 29 °C (75 °F to 85 °F).

OR

2. **Place them in a refrigerator for partial thawing over several days**, and then carrying out the final thawing using the water bath technique.

Allowable Purge is 20%

The sample must pass both the net weight and purge tests to comply.

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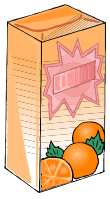
Test Procedures for Packages Labeled By Volume - Chapter 3



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Measuring Liquid Volumes

HB133, Chapter 2.

- Gravimetric Measurement
- Only the packages used for density determinations need be brought to reference temperature.

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Table 3-1. Reference Temperatures for Liquids		
If the liquid commodity is:	**Then the volume is determined at the reference temperature of:**	**Code of Federal Regulation Reference**
Beer	4 °C (39.1 °F)	27 CFR, Part 7.10
Distilled Spirits	15.56 °C (60 °F)	27 CFR, Part 5.11
Frozen food - sold and consumed in the frozen state	At the frozen temperature	21 CFR §101.105(b)(2)(i)
Petroleum	15.6 °C (60 °F)	16 CFR §500.8(b)
Refrigerated food (e.g., milk and other dairy products labeled "KEEP REFRIGERATED")	4 °C (40 °F)	21 CFR §101.105(b)(2)(ii)
Other liquids and wine (e.g., includes liquids sold in a refrigerated state for immediate customer consumption such as soft-drinks, bottled water and others that do not require refrigeration)	20 °C (68 °F)	Food: 21 CFR 101.105(b)(2)(iii) Non-Food: 16 CFR §500.8(b) Wine: 27 CFR, Part 4.10 (b)
Maintain temperatures within ±2 °C (±5 °F) for the sample packages used for density determinations in gravimetric testing and all sample packages used in volumetric testing. (Amended 2010)		

HB133, Chapter 2.

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Selecting the Flask

EXCEPT FOR MILK, you should never mix liquids from two different packages.

For this reason, use the flask sized closest to, but smaller than, the labeled volume.

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Flasks

- Calibrated to Deliver at 20° C (68° F).
  - must be wet down before use
- 30 Second Pour.
- 10 Second Drain (touch off drop).
- @ 10° to 15° from vertical.

HB133, Chapter 2.

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Date: 5/20/14	NIST Handbook 133 **Worksheet for Packages Labeled by Fluid Volume Gravimetric Test Procedure – Decimal Pounds** (ex. for 32 fl oz)				
Label Declaration	Converted to fluid ounce or metric	Largest Declaration		Manufacturer : Milk Packaging Company	
32 fl oz	946.352 mL	32 fl oz		Commodity: Whole Milk	
946 mL	31.988 oz			Lot Code: 19-9872	Plant Number: 20-999
1 quart	32 fl oz				
		Pkg 1	**Pkg 2**	**Pkg 3***	
		*For glass containers the initial tare sample size for sample sizes 24 & 48 is 3			
TARE DETERMINATION					R_t =
1. Gross Weight		2.221	2.222		R_e = 0.001
2. Tare Weight		0.076	0.076		$R_e \div R_t$ =
2a. Net Weight 2b Package Error		2.145 XXX	2.146 XXX		**R_t - Range of Tare Weights** **R_e - Range of Package Errors**
DENSITY					
3. Flask Weight (full)		3.509	3.509		If there is any variation between tare values calculate $R_e \div R_t$ = and use the tare procedures in Section 2.3.5. and Table 2-3 to determine if additional packages must be opened to determine an Average Tare Weight.
4. Flask Weight (empty, wetted)		1.354	1.354		
5. Weight of Liquid (Box 3 − Box 4 =)		2.155	2.155		
6. Volume of Flask (in Fluid Ounces)		32			
What is the Table 3-1. Reference Temperature for this product?		40 °F			
Temperature of Liquid at time of Density Determination?		39.8 °F	41 °F	°F	
7. Liquid Density in Fluid Ounces (Box 5 ÷ Box 6 =)		0.0673437 lb/fl oz	0.0673437 lb/fl oz		
8. Range of Densities		0.000			

HB133, Chapter 2.

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Chapter 3. Additional Test Procedures for Packages Labeled by Volume

Several of the procedures are similar.
Once you have learned how to measure one product you can test many others.

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Why so much work?

The burden of proof:
"Beyond a Reasonable Doubt

The test procedures are complex and time consuming but they are needed to provide accurate determinations of quantity using scientifically valid test methods that are reproducible and that have undergone public review.

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Use Section 4.46. "Berry Baskets and Boxes" in NIST Handbook 44 "Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices."

Berry Baskets

Procedures, material, and dimensional test procedures are taken from NIST Handbook 44 and NBS Handbook 45 "Testing of Measuring Equipment" (for a copy contact NIST).

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Volumetric Test Procedure for Berry Baskets

Dimensional Test Procedure for Berry Baskets

A berry basket or box shall be made of any suitable material that will retain its shape during normal filling, storage, and handling.

Table 1.
Maintenance and Acceptance Tolerances in Excess and in Deficiency

Nominal Capacity	Tolerance	
	In Excess Cubic Inches	In Deficiency Cubic Inches
½ pint	1	0.5
1 pint	2	1.0
1 quart	3	1.5

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Section 3.4. Volumetric Test Procedure for Viscous Fluids – Headspace

*Notice: the mention of trade or brand names does not imply endorsement or recommendation by the U.S. Department of Commerce over similar products available from other manufacturers.

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Ullage or Headspace

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3.4. Volumetric Test Procedure for Viscous Fluids-Headspace

IRREGULAR SURFACE: Use **Section 3.4.2.b.** to determine volume where the commodity does not have a level surface (e.g., mayonnaise and salad dressing).

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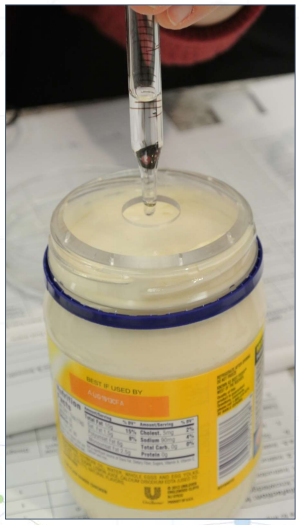

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Section 3.5. Goods Labeled by Capacity - Volumetric Test Procedure

*Notice: the mention of trade or brand names does not imply endorsement or recommendation by the U.S. Department of Commerce over similar products available from other manufacturers.

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Section 3.5. Pressed and Blown Glass Tumblers and Stemware





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Different Package Requirements

- The Average Requirement is NOT applied to these products.
- The Maximum Allowable Variation (MAV) is NOT applied to these products.

98

Table 2-11. Accuracy Requirements for Packages Labeled by Low Count (50 or Fewer) and Packages Given Tolerances (Glass and Stemware)

	1	2	3
Inspection Lot Size	Sample Size	For Packages Labeled by Low Count (50 or Fewer)	For Packages Given Tolerances (Glasses and Stemware)
		Number of Packages Allowed to Contain Less than the Labeled Count	Number of Package Errors that May Exceed the Allowable Difference
1 - 11	1-11	1	0
12 - 250	12		
251 – 3200	24	2	1
More than 3200	48	3	2

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Allowable Differences

Table 3-2.
Allowable Differences for Pressed and Blown Glass Tumblers and Stemware

Unit of Measure	
If the capacity in metric units is:	**Then the allowable difference is:**
200 mL or less	± 10 mL
More than 200 mL	± 5 % of the labeled capacity
If the capacity in inch-pound units is:	**Then the allowable difference is:**
5 fl oz or less	± ¼ fl oz
More than 5 fl. oz.	± 5 % of the labeled capacity

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Section 3.7. Volumetric Test Procedure for Paint, Varnish, and Lacquers – Non-Aerosol.

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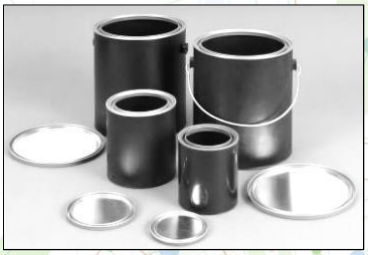
Paint Test Procedure - Revised

Plant Audit and Violation Procedure.



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Section 3.8. Testing Viscous Materials – Such As Caulking Compounds and Pastes

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3.8.1. Test Equipment

Pycnometer or "Density Cup" is a vessel of known Volume used for weighing semifluids.

The density cup can be bought or made.

A slicker plate is available commercially.

The metrology laboratory must calibrate the density cup.

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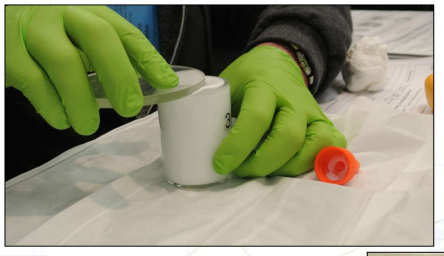

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Section 3.9. Peat Moss

85 L (3 Cubic Feet)

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Dimensional Measuring Frame (drawings are located at www.nist.gov/owm)

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Height Measurement

Width Measurement

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3.9.2. Uncompressed Volume Packages of Peat Moss

3.9.2.1. Test Equipment

- 12.7 mm (or ½ in) SIEVE
- Use test measures as appropriate for the package size.

Refer to Table 3-4. "Specifications for Test Measures for Mulch and Soils" for additional information on test measure size and construction.

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Section 3.10. Mulch and Soils by Volume

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Table 3-4. Specifications for Test Measures for Mulch and Soils

Nominal Capacity of Test Measure[P4]	Actual Volume of the Measure[P4]	Interior Length[P1]	Interior Width[P1]	Interior Height[P2]	Marked Intervals on Interior Wall[P3]	Volume Equivalent of Marked Intervals
30.2 L (1.07 cu ft) for testing packages that contain less than 28.3 L (1 cu ft or 25.7 dry qt)	31.9 L (1.13 cu ft)	213.4 mm (8.4 in)	203.2 mm (8 in)	736.6 mm (29 in)	12.7 mm (1/2 in)	550.6 mL (33.6 in^{3}P)
28.3 L (1 cu ft)	33.04 L (1.16 cu ft)	304.8 mm (12 in)	304.8 mm (12 in)	355.6 mm (14 in)		1179.8 mL (72 cu in)
		406.4 mm (16 in)	228.6 mm (9 in)			
56.6 L (2 cu ft)	63.7 L (2.25 cu ft)	304.8 mm (12 in)	304.8 mm (12 in)	685.8 mm (27 in)		
		406.4 mm (16 in)	228.6 mm (9 in)	685.8 mm (27 in)		
84.9 L (3 cu ft)	92 L (3.25 cu ft)	304.8 mm (12 in)	304.8 mm (12 in)	990.6 mm (39 in)		
		406.4 mm (16 in)	228.6 mm (9 in)	990.6 mm (39 in)		

Measures are typically constructed of 1.27 cm ($^1/_2$ in) marine plywood. The measure must accommodate the entire contents of the package being tested, and a transparent sidewall is useful for determining the level of fill, but must be reinforced if it is not thick enough to resist distortion. If the measure has a clear front, place the level gage at the back (inside) of the measure so that the markings are read over the top of the mulch.

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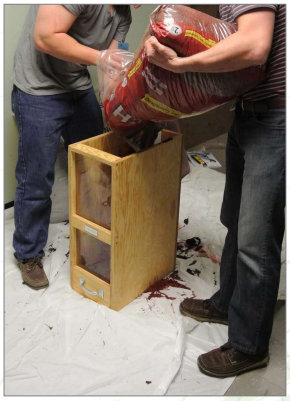

Table 2-10. Exceptions to the Maximum

For individual packages: 5 % of the labeled volume. **For samples:** One package may exceed the MAV for every 12 packages in the sample.

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Section 3.11. Ice Cream Novelties

Displacement vessel with dimensions appropriate for the size of novelties being tested.

- Cold water maintained at 1 °C (33 °F) or below.

113

Ice-pop. Mark on the stick(s) with the indelible marker the point to which the pop will be submerged in the ice water.

Remove the novelty to determine the volume of the stick.

114

3.11. Ice Cream Novelties (Exception)

Pelletized Ice Cream

On April 17, 2009, the FDA issued a letter stating that the appropriate net quantity of content declaration for pelletized ice cream is net weight.

115

3.12. Fresh Oysters Labeled by Volume

Packaged fresh oysters removed from the shell must be labeled by volume.

Tested by Total Volume and % Free Liquid.

The maximum amount of permitted free liquid is limited to 15 % by weight.

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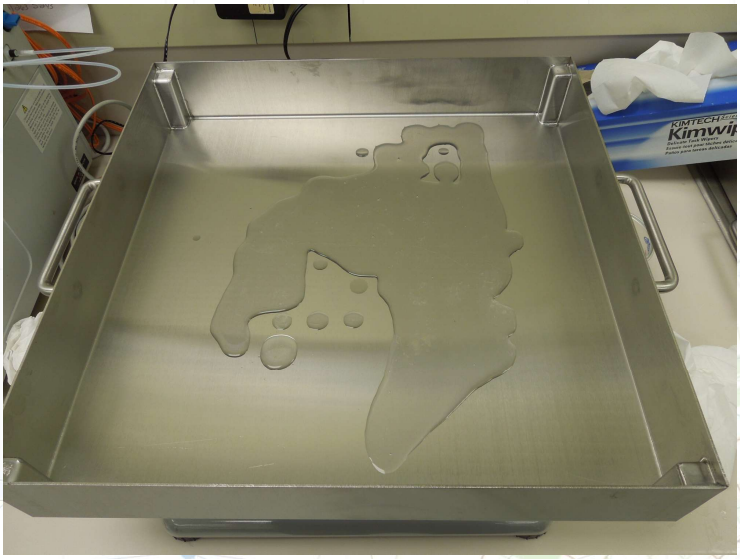

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Section 3.14. Firewood

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Boxed Firewood

When a box contains a bundle of wrapped firewood, the volume of the bundle is verified using the test procedure in "Bundles and Bags."

Measuring the Internal Height of Box

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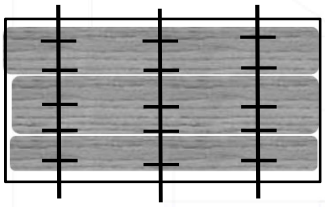
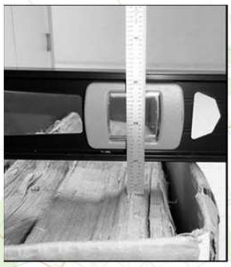
Top View of the Box. Measure at the cross bars.





Examples of the Headspace Measurement.

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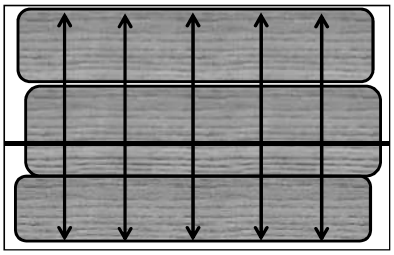
Width of Wood Stack.
Take at least five measurements at intervals spaced along the length of the stack.
Average these values.



Top View of the Box. Measure at crosslines.

Measuring the Width of the Firewood in a Box.

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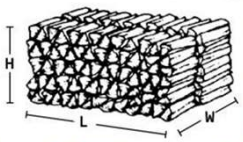
Stacked Firewood

Bulk deliveries of firewood are typically required by law or regulation to be on the basis of cord measurements.

The "cord" is defined as the amount of wood contained in a space of 128 cubic feet when the wood is ranked and well stowed.

The standard dimensions for a cord of wood are 4 ft × 4 ft × 8 ft but wood may be stacked and measured in any configuration.

A Cord of Wood



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Bundles and Bagged - Packaged Firewood and Stove Wood Labeled by Volume

Table 2-10. Exceptions to the Maximum Allowable Variations (MAVs)

20 % of labeled quantity

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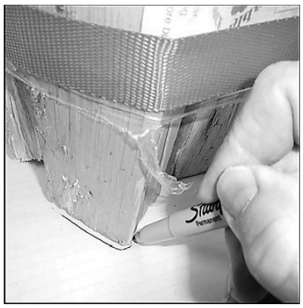
Bundle with Straps Placed at 10 cm (4 in).



Notice: Do not use shrink wrap or packaging to define the perimeter.

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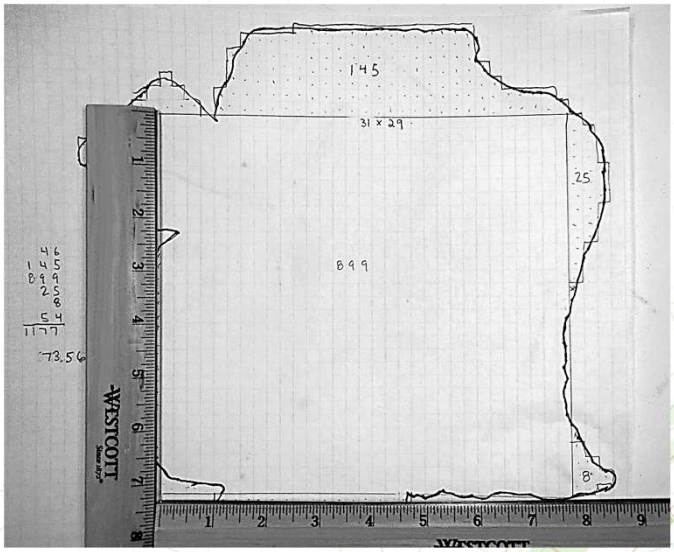

Perimeter of a Bundle as Defined by the Wood.

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Field Audit Procedure – Circumference Method

A circumference estimating method can be used for quickly identifying potentially short measure bundles.

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Section 3.15. Test Procedure for Verifying the Useable Volume Declaration on Packages of Animal bedding

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Method of Sale of Commodities Regulation – Section 2.23. Animal Bedding

The terms "Useable Volume" must appear in the quantity declaration on a package of compressed animal bedding.

If Unit Pricing is provided for use by retail customers to make a value comparison, it shall be in terms of the price per liter.

NOTE: This method of sale for animal bedding shall be enforceable after January 1, 2020.

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Table 3-7.
Recommended Chute Dimensions

Nominal Capacity	Height	Width	Length
70 L (2.5 ft^3)	254 mm (10 in)	228 mm (9 in)	1219 mm (48 in)
100 L (3.5 ft^3)	254 mm (10 in)	279 mm (11 in)	1397 mm (55 in)
170 L (6 ft^3)	279 mm (11 in)	355 mm (14 in)	1727 mm (68 in)
240 L (8.5 ft^3)	304 mm (12 in)	406 mm (16 in)	2006 mm (79 in)
283 L (10 ft^3)	304 mm (12 in)	406 mm (16 in)	2286 mm (90 in)

NOTE: Chutes (see Illustration 1. Testing Chutes) may be constructed using hinges and pins so that they lie flat for transporting. They can be constructed of sheet metal or with other slick surface material which enable the bedding to flow easily. The construction of the chutes used in this study allows the sides to move in or out slightly so that the bedding does not become clogged at the outlet. The heights and lengths may be adjusted slightly to fit into vehicles for transport but the widths should not be reduced because narrowing the opening can restrict material flow and result in "bridging" where the bedding collects and creates a block. Also, the width should be kept smaller than the opening of the test measure so that spillage does not occur during pouring.

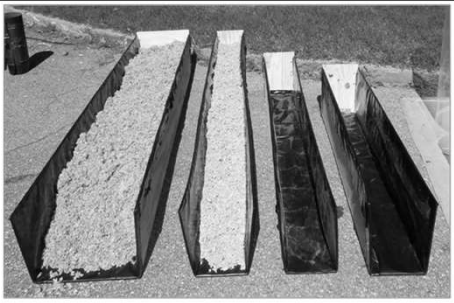

Illustration 1. Testing Chutes

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Table-3.9. Illustrations of Depth Determinations with Cylindrical Test Measures


The ruler is read from the bottom edge of a straight edge or level from a position that reduces parallax.

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Table 2-10. Exceptions to the Maximum Allowable - 5 % of the labeled volume.

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

*** Certain commercial equipment, instruments, or materials are identified in this paper in order to specify the experimental procedure adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the materials or equipment identified are necessarily the best available for the purpose."

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Test Procedures

4.2. Packages Labeled by Count
- 50 Items or Less
- 51 Items or More

4.3. Paper Plates and Sanitary Products
4.4. Packages Labeled by Linear Measurement
4.5. Polyethylene (sheeting and bags)
4.6. Linear (length, width, thickness) and area.
4.7. Baler Twine
4.8. Area of Chamois
4.9. Agricultural Seed

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4.2. Packages Labeled by Count Good Counting Practices

- Select a well-lit area away from disruptions.
- Inspect the container thoroughly to ensure pieces do not remain in the package.
- Segregate the **units** so they can be recounted and for easy visualization.

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Packages Labeled by Count Section 4.2.1. Packages Labeled with 50 Items or Fewer

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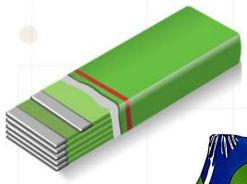
*The "**Average Requirement" does not apply** to packages labeled by count of 50 or fewer items, and an **MAV is not applied to the lot**. It only applies to the packages in the sample.*



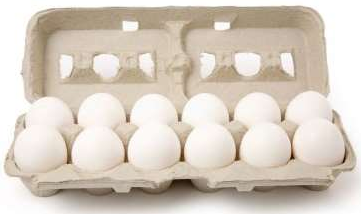


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Table 2-11. Accuracy Requirements for Packages Labeled by Low Count (50 or Fewer)			
	1	2	
Inspection Lot Size	Sample Size	For Packages Labeled by Low Count (50 or Fewer)	
		Number of Packages Allowed to Contain Less than the Labeled Count	
1 - 11	1-11	1	
12 - 250	12	1	
251 – 3200	24	2	
More than 3200	48	3	

Individual packages that are undercount by more than the MAV are considered defective. See Appendix A. "Tables" in HB 133.

Table 2-7. Maximum Allowable Variations (MAVs) for Packages Labeled by Count	
Labeled Quantity	Maximum Allowable Variations (MAVs)
17 or less	0
18 to 50	1

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4.2.2. PACKAGES LABELED BY COUNT OF MORE THAN 50 ITEMS

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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:

1. Audit Procedure
2. Violation Procedure

Both use the weight of a counted number of items in the package.

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Linear Measurement

Good Measuring Practices (GMP)

Examples of practices that cause errors in linear measurement

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Manipulative and Parallax Errors

Bending a Tape or Using Improper Angles on a Ruler or Tape will Result in Measurement Errors

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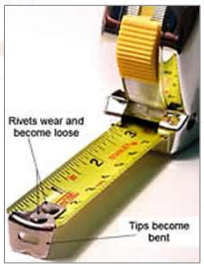
Eliminating Errors with Tape Hooks and Non-Blank End Rulers



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Slippage

Experts have found that when observers moves their heads from the zero reference point to the measurement point they frequently move their hands apart and lose the zero reference.

"Measurement Frame" can be built to aid in keeping the reference point stable to improve the accuracy of the measurements.

Slippage

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Rounding

GMP is to round measurements that fall between two graduations <u>in favor</u> of the packer.

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4.3. Paper Plates and Sanitary Paper Products

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4.3. Paper Plates and Sanitary Paper Products

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

GMP: The material should not be under tension when measured.

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Measuring Base

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

Some 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.

Unless specified in a recognized industry standard, the material should not be under tension.

The item should lay flat and smooth without wrinkles, creases or folds.

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Polyethylene Products

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Polyethylene Products

Most polyethylene products are sold by length, width, thickness, area, and net weight.

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Deadweight Dial Micrometer (or equal)

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2.13.4. Declaration of Weight. – The labeled statement of weight for polyethylene sheeting and film products under Sections 2.13.1.1. Sheeting and film, and 2.13.3.1. Bags, shall be equal to or greater than the weight calculated by using the formula below.
This is a Method of Sale Violation.

For U.S. customary dimensions:

***W* = *T* x *A* x 0.03613 x *D*, where:**

W = net weight in pounds
T = nominal thickness in inches;
A = nominal length in inches times nominal width [NOTE 6, page 126] in inches
D = minimum density in grams per cubic centimeter as defined by the latest version of ASTM Standard D1505, Standard Test Method for Density of Plastics by the Density - Gradient Technique".

0.03613 is a factor for converting g/cm^3 to lb/in^3

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Table 2-10. Exceptions to the Maximum Allowable Variations for … Polyethylene Sheeting and Film

	Maximum Allowable Variations (MAVs)
Polyethylene Sheeting and Film	**Thickness** When the labeled thickness is 25 μm (1 mil or 0.001 in) or less, any individual thickness measurement of polyethylene film may be up to 35 % below the labeled thickness. When the labeled thickness is greater than 25 μm (1 mil or 0.001 in), individual thickness measurements of polyethylene sheeting may be up to 20 % less than the labeled thickness. The average thickness of a single package of polyethylene sheeting may be up to 4 % less than the labeled thickness. **Weight** The MAV for individual packages of polyethylene sheeting and film shall be 4 % of the labeled quantity.

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

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Section 4.7. Baler Twine – Test Procedure for Length

2.25. Baler Twine. – Baler twine shall be sold on the basis of **length** in meters or feet, **and** net mass or **weight** by kilograms or pounds.

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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.

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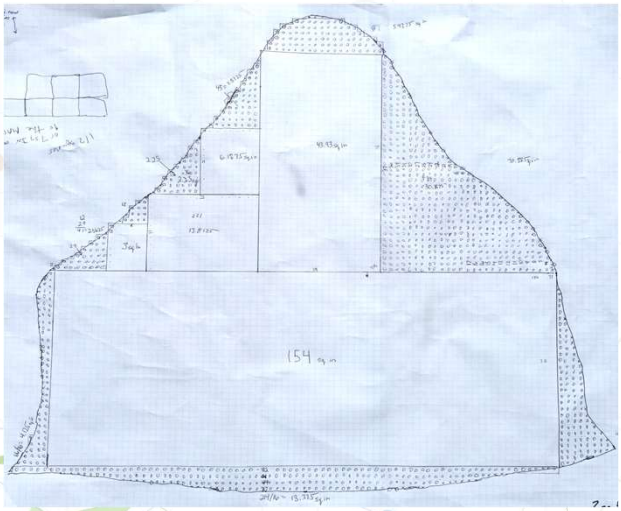

Audit Test For Checking the Area of Chamois

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4.8.2. Gravimetric Procedure for Area Measurement

- Medium weight drawing paper.
- Household iron with low temperature settings.

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Special Measurements

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Recommended Measurement Procedures not included in NIST Handbook 133

Bolts

Knives

TV Screens and Computer Monitors

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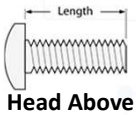
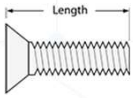
How to Measure a Bolt

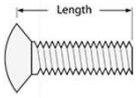
(length and diameter)



Head Above Surface



Countersunk Head



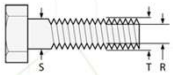
Oval Head

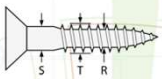
Thread Diameter (T). Also called major diameter.

Shank Diameter (S).

Root Diameter (R). Also called minor diameter.

The fastener diameter is almost always the **Thread Diameter** (or major diameter).





Head Diameter

It common for people to refer to hex bolts by the size of the head measured across the flats (this is also the size wrench the bolt uses).

This is incorrect and should be avoided for two reasons.

- **Miscommunication** can result in getting a much larger bolt than needed.
- **Head size can vary** for the same thread diameter, especially in metric bolts, so even comparing heads to heads you may get an incompatible bolt.

www.boltdepot.com/fastener-information/Measuring/Measure-Length.aspx

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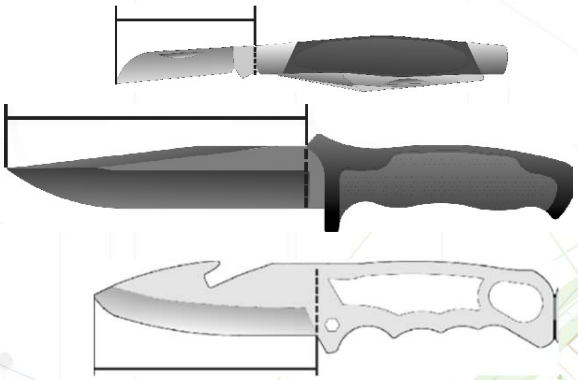
How to Measure a Knife Blade



www.akti.org - how to measure a knife blade

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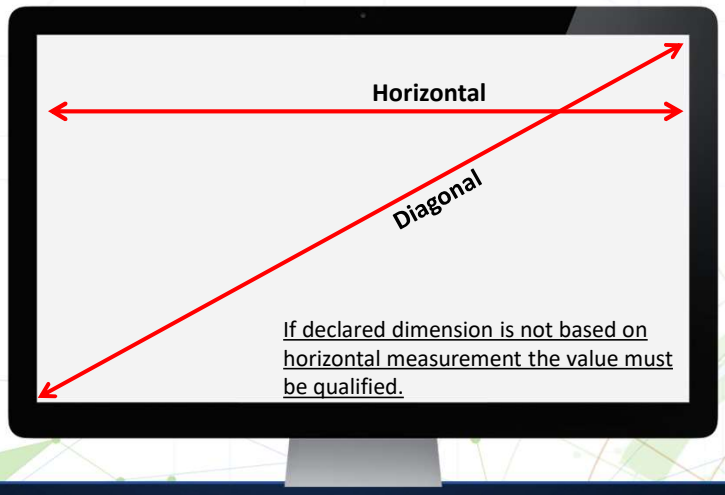
HOW TO MEASURE A TV SCREEN



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Softwood Lumber

"Dimensional Lumber"

Based on NIST Voluntary Product Standard PS 20 "American Softwood Lumber Standard"

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Table 1. Softwood Lumber Sizes

Examples of minimum dressed sizes at the time of manufacture for both unseasoned (green) and dry lumber in the latest version of the U.S. Department of Commerce in Voluntary Product Standard PS 20-15.

Product Classification (Nominal Size)	Minimum Dressed Sizes**			
	Unseasoned		Dry	
Inches	Inches	Millimeters	Inches	Millimeters
Surfaced Lumber*				
2 × 2	$1^{9}/_{16} \times 1^{9}/_{16}$	40 × 40	1½ × 1½	38 × 38
2 × 2½	$1^{9}/_{16} \times 2^{1}/_{16}$	40 × 52	1½ × 2	38 × 51
2 × 3	$1^{9}/_{16} \times 2^{9}/_{16}$	40 × 65	1½ × 2½	38 × 64
2 × 4	$1^{9}/_{16} \times 3^{9}/_{16}$	40 × 90	1½ × 3½	38 × 89
2 × 6	$1^{9}/_{16} \times 5^{5}/_{8}$	40 × 143	1½ × 5½	38 × 140
2 × 8	$1^{9}/_{16} \times 7^{1}/_{2}$	40 × 190	1½ × 7¼	38 × 184
2 × 10	$1^{9}/_{16} \times 9^{1}/_{2}$	40 × 241	1½ × 9¼	38 × 235
2 × 12	$1^{9}/_{16} \times 11^{1}/_{2}$	40 × 292	1½ × 11¼	38 × 286
Board Lumber				
1 × 2	$^{25}/_{32} \times 1^{9}/_{16}$	20 × 40	¾ × 1½	19 × 38
1 × 3	$^{25}/_{32} \times 2^{9}/_{16}$	20 × 65	¾ × 2½	19 × 64
1 × 4	$^{25}/_{32} \times 3^{9}/_{16}$	20 × 90	¾ × 3½	19 × 89
1 × 6	$^{25}/_{32} \times 5^{5}/_{8}$	20 × 143	¾ × 5½	19 × 140
1 × 8	$^{25}/_{32} \times 7^{1}/_{2}$	20 × 190	¾ × 7¼	19 × 184
1 × 10	$^{25}/_{32} \times 9^{1}/_{2}$	20 × 241	¾ × 9¼	19 × 235
1 × 12	$^{25}/_{32} \times 11^{1}/_{2}$	20 × 292	¾ × 11¼	19 × 286

*The dry thicknesses of nominal 3 in and 4 in lumber are 2½ in (64 mm) and 3½ in (89 mm); unseasoned thicknesses are $2^{9}/_{16}$ in (65 mm) and $3^{9}/_{16}$ (90 mm). Widths for these thicknesses are the same as shown above.

**PS 20-15-defines dry lumber as being 19 % or less in moisture content and unseasoned lumber as being over 19 % moisture content. The size of lumber changes approximately 1 % for each 4 % change in moisture content. Lumber stabilizes at approximately 15 % moisture content under normal use conditions.

HB133, Chapter 2.

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Electronic Caliper

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Wood Moisture Meters

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Structural Plywood

Based on NIST Voluntary Product Standard PS 1-19, “Structural Plywood”

Plywood Sheathing

Sanded Plywood

Plywood Siding

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STRUCTURAL PLYWOOD

Measuring and Other Equipment

To measure the thickness of a structural plywood panel and wood-based structural–use panels: use a micrometer.

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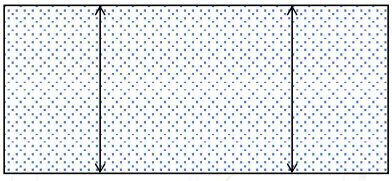
To determine the **Width**:

Take at least two measurements across the sheets width about ¼ of the distance from each end of the sheet (see drawing). Average the results.



Note: Measurements should not be made across the ends of the board or where it has a knot or surface defect.

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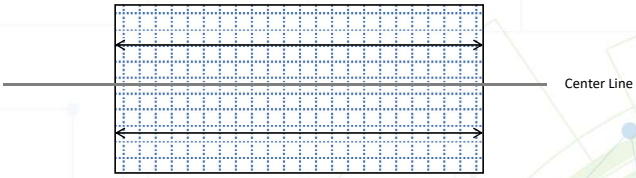
To determine the sheet **Length**:

Take at least 2 measurements along the sheet length about one-quarter of the way from the center line to each edge of the sheet. Average the results.



Note: Measurements should not be made across the ends of the board or where it has a knot or surface defect.

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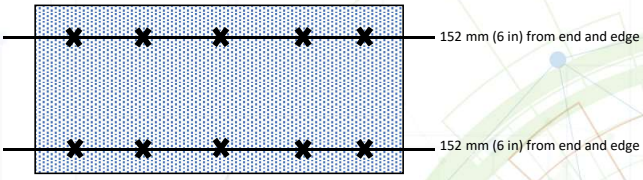
To determine the **THICKNESS**:

The average of at least 10 measurements shall be taken as the thickness of that panel.

Take thickness measurement at least 15 mm (6 in) from each edge of the panel.

Note: Measurements should not be made across the ends of the board or where it has a knot or surface defect.



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Other Packaged Products Test Procedures

Flexible Tubing, Shoelaces, Textiles, Tarps, Bedding, Blankets and Rugs

Based on procedures published by the California Division of Measurement Standards

www.cdfa.ca.gov/dms/programs/qc/QCManual/PriceQualVerProgMan2010.pdf

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TUBING - FLEXIBLE

Procedure

1. Secure one end of tubing with clamp.
2. Apply a constant pull of ten pounds.
3. Maintain constant pull for five minutes and measure the length of the flexible tubing while maintaining constant pull.

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Shoelaces

Procedure

1. Apply steady 85 g (3 oz) pull to shoelace.
2. Measure total length, including the tips.

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Textiles, Tarps, Sleeping Bags, Bedding, Blankets and Rugs

Equipment

1. Linear measure.
2. Four 2-inch "C" clamps, or four weights.
3. Plastic drop cloth - to protect commodity from being soiled.

When inspecting for length, width or area, spread the product and remove all wrinkles without stretching the material.

Ruffles, fringes, etc., are considered part of the product and must be included in the measurement.

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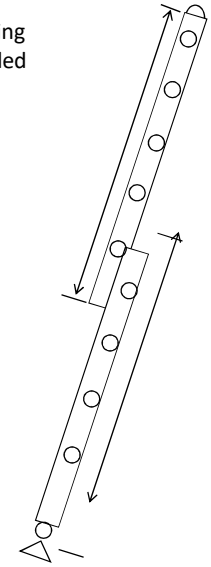
Maximum Working Height or Extended Length



LADDERS

ANSI Standard for Ladders ANSI- ASC A14.5-2007

6.2.4. Extension Ladder Size. - The ladder length is determined by measuring the length of the side rails of each section, excluding the length of any feet and end caps, and totaling the length of the sections.

ANSI – ASC A14.5- 2007 - American National Standard for Ladders – Portable Reinforced Plastic.

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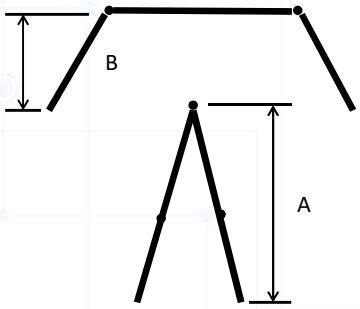
Articulated Ladders



- Stepladder mode (see A). From the bottom of the foot to the center of the pivot pint of the uppermost hinge.
- Platform ladder mode (see B). From the bottom of the foot to the center of the pivot point of the uppermost hinge.
- Straight or Extension ladder mode (see C). From the bottom of the foot to the top of the rail.

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Section 6.6. Step Stools

Includes the height of the top cap (step) and feet.

Any rail or handle that extend above the top cap (step) are <u>not</u> included in the height (see A).

ANSI – ASC A14.2- 2007 - American National Standard for Ladders – Portable Metal.

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Natural Sponges

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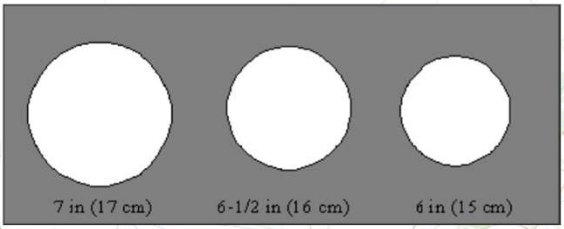
Good Measurement Practice

- **Dimensions are determined with the sponge wet**.

Templates should be constructed of rigid metal or plastic material. - circular openings should graduate in increments of one-half inch (one centimeter).

Measuring templates (see photo below for the currently used type templates):



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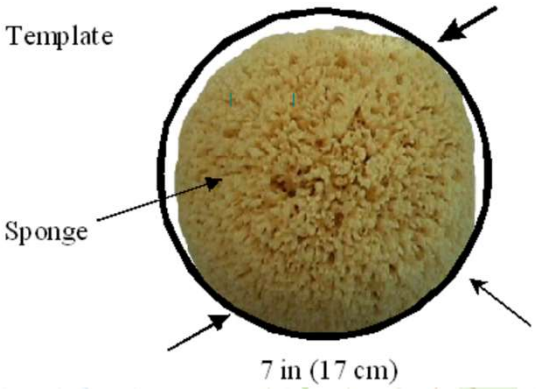
When measured, the sponge is "classified" as a specific size when at least **three (including two opposing) points** of the sponge touch the template.



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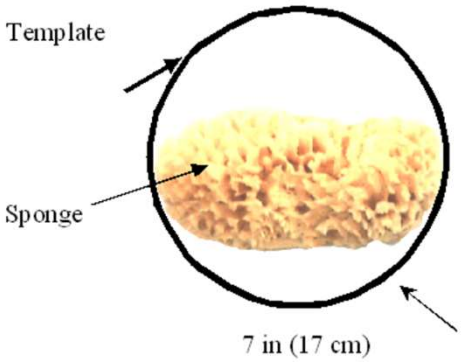
For banana sponges the size will be determined as shown below.



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Summary

We covered:

Chapter 1 –General Information (7 pages)

Chapter 2 – Test Procedures – Packages Labeled by Weight – Gravimetric Testing

Chapter 3 – Test Procedures – For Packages Labeled by Volume

Chapter 4 – Test Procedures – Packages Labeled by Count, Linear Measure, and Thickness

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NIST Handbooks 133 & 130

www.nist.gov\pml\wmd

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SI Resources & Information

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