CALIFORNIA DEPARTMENT OF FOOD AND GRICULTURE
DIVISION OF MEASUREMENT STANDARDS

FIELD REFERENCE MANUAL
2015

California Code of Regulation
Title 4, Division 9

Chapter 1
Tolerances and Specifications for
Commercial Weighing and Measuring Devices

NIST Handbook 44
Sections 4.40. Vehicle Tanks Used as Measures through
4.46. Berry Baskets and Boxes

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This document represents the Division of Measurement Standards' field manual for enforcing regulations pertaining to weights and measures in California. This field manual is not to be considered as the official Code of Regulations, as published by Barclays Law Publishers.

NOTE: Language in Handbook 44 that is not adopted is annotated "**[NOT ADOPTED]**" in this document.

NOTE: Requirements are different than, or in addition to, the requirements of Handbook 44 are included in the appropriate section this document. They are shaded, bordered, and numbered in the 4002 series to differentiate them from the Handbook 44 requirements.

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NIST Handbook 44 (2015 Edition) - Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as adopted by the 98th National Conference on Weights and Measures July 2014 is at:

www.nist.gov/pml/wmd/pubs/hb44.cfm

Section 4.40. Vehicle Tanks Used as Measures

A. Application

A.1. General. – This code applies to vehicle tanks when these are used as commercial measures.

A.2. Exceptions. – This code does not apply to the following devices:

(a) Devices used solely for dispensing a product in connection with operations in which the amount dispensed does not affect customer charges.

(b) Meters mounted on vehicle tanks (for which see Section 3.31. Code for Vehicle-Tank Meters).

A.3. Additional Code Requirements. – In addition to the requirements of this code, Vehicle Tanks Used as Measures shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Compartments.

S.1.1. Compartment Distortion. – The shell and bulkheads of a vehicle tank shall be so constructed that under any condition of liquid lading they will not become distorted sufficiently to cause a change in the capacity of any compartment (as determined by volumetric test) equal to more than 0.25 L per 750 L (0.5 pt per 200 gal), or fraction thereof, of the nominal compartment capacity, or to more than 0.5 L (1 pt), whichever is greater. (This specification prescribes a limit on permissible distortion only, and is not to be construed as setting up a secondary tolerance on compartment capacities to be added to the values given in tolerance paragraph T.2. Tolerance Values.)

S.1.2. Venting. – During filling operations, effective venting of a compartment shall be provided to permit air to escape from all spaces designed to be filled with liquid and to permit the influx of air to the compartment during the discharge of liquid there from. Venting shall prevent any formation of air pockets.

S.1.3. Completeness of Delivery. – A tank shall be so constructed that, when it is standing on a level surface, complete delivery can be made from any compartment through its delivery faucet or valve whether other compartments are full or empty, and whether or not the delivery is through a manifold.

S.1.4. Fill or Inspection Opening. – The fill or inspection opening of a compartment shall be of such size and location that it can readily be determined by visual inspection that the compartment has been properly filled or completely emptied and shall be so positioned with respect to the ends of the compartment that the indicator may be positioned as required. In no case shall the opening, if circular, have a diameter of less than 20 cm ($7\frac{5}{8}$ in), or, if other than circular, have an effective area of less than 290 cm^2 (45 in^2).

S.1.5. Dome Flange and Baffle Plates. – Any dome flange extending into a compartment shall be provided with sufficient perforations or openings flush with the compartment shell to prevent any trapping of air. All baffle plates in a compartment shall be so cut away at top and bottom, and elsewhere as necessary, as to facilitate loading and unloading.

S.1.6. Compartment and Piping Capacities and Emergency Valve. – If a compartment is equipped with an emergency (or safety) valve, this shall be positioned at the lowest point of outlet from the compartment, and the compartment capacity or capacities shall be construed as excluding the capacity of the piping leading therefrom. However, the capacity of the piping leading from such a compartment shall be separately determined and reported, and may be separately marked as specified in S.4. Marking of Compartments.

S.1.6.1. On Vehicle Tanks Equipped for Bottom Loading. – On equipment designed for bottom loading, the compartment capacity shall include the piping of a compartment to the valve located on the upstream side of the manifold and immediately adjacent thereto or, if not manifolded, to the outlet valve, provided that on or immediately adjacent to the marking as specified in S.4. Marking of Compartments the following words or a

statement of similar meaning shall be affixed: "Warning: Emergency valves must be opened before checking measurement."

S.1.7. Expansion Space. – When a compartment is filled to the level of the highest indicator in the compartment, there shall remain an expansion space of at least 0.75 % of the nominal compartment capacity as defined by that indicator.

S.2. Design of Compartment Indicators.

S.2.1. General. – An indicator shall be so designed that it will distinctly and unmistakably define a capacity point of its compartment when liquid is in contact with the lowest portion of the indicator.

S.2.2. Number of Indicators. – In no case shall a compartment be provided with more than five indicators.
(Amended 1972)

S.2.3. Identification of Multiple Indicators. – If a compartment is provided with multiple indicators, each such indicator shall be conspicuously marked with an identifying letter or number.

S.2.4. Location. – An indicator shall be located:

(a) midway between the sides of its compartment;

(b) as nearly as practicable midway between the ends of its compartment, and in no case offset by more than 10 % of the compartment space or 15 cm (6 in), whichever is less;
(Amended 1972)

(c) so that it does not extend into, nor more than 15 cm (6 in) from that section of the compartment defined by a vertical projection of the fill opening;
(Amended 1974)

(d) at a depth, measuring from the top of the dome opening, not lower than 46 cm (18 in) for fill openings of less than 38 cm (15 in) in diameter, or, if other than circular, an effective area of less than 1130 cm^2 (175 in^2), and not lower than 61 cm (24 in) for larger fill openings; and

(e) to provide a clearance of not less than 5 cm (2 in) between indicators.

S.2.5. Permanence. – Any indicator that is not intended to remain adjustable and all brackets or supports shall be securely welded in position.

S.2.6. Adjustable Indicators. – Adequate provision shall be made for conveniently affixing a security seal or seals:

(a) to any indicator intended to remain adjustable, so that no adjustment of the indicator can be made without mutilating or destroying the seal, and

(b) to any removable part to which an indicator may be attached, so that the part cannot be removed without mutilating or destroying the seal.

S.2.7. Sensitiveness. – The position of any indicator in its compartment shall be such that at the level of the indicator a change of 1.0 mm (0.04 in) in the height of the liquid surface will represent a volume change of not more than the value of the tolerance for the nominal compartment capacity as defined by that indicator.

S.3. Design of Compartment Discharge Manifold. – When two or more compartments discharge through a common manifold or other single outlet, effective means shall be provided to ensure:

(a) that liquid can flow through the delivery line leading from only one compartment at one time and that flow of liquid from one compartment to any other is automatically prevented, or

(b) that all compartments will discharge simultaneously.

If the discharge valves from two or more compartments are automatically controlled so that they can only be operated together, thus effectively connecting these compartments to one another, such compartments shall, for purposes of this paragraph, be construed to be one compartment.

S.4. Marking of Compartments.

S.4.1. Compartment Identification. – Each compartment of a multiple-compartment tank shall be conspicuously identified by a letter or number marked on the dome or immediately below the fill opening. Such letters or numbers shall be in regular sequence from front to rear, and the delivery faucets or valves shall be marked to correspond with their respective compartments.

S.4.2. Compartment Capacity, Single Indicator. – A compartment provided with a single indicator shall be clearly, permanently, and conspicuously marked with a statement of its capacity as defined by its indicator.

S.4.3. Compartment Capacity, Multiple Indicators. – A compartment provided with two or more indicators shall be clearly, permanently, and conspicuously marked with a statement identifying:

(a) each indicator by a letter or number; and

(b) immediately adjacent to each letter or number, the capacity of the compartment as defined by the particular indicator.

N. Notes

N.1. Test Liquid. – Water or light fuel oil shall be used as the test liquid for a vehicle-tank compartment.

N.2. Evaporation and Volume Change. – Care shall be exercised to reduce to a minimum, evaporation losses and volume changes resulting from changes in temperature of the test liquid.

N.3. To Deliver. – A vehicle-tank compartment shall be gauged "to deliver." If the compartment is gauged by measuring the test liquid into the tank, the inside tank walls shall first be thoroughly wetted.

N.4. Gauging of Compartments. – When a compartment is gauged to determine the proper position for an indicator or to determine what a capacity marking should be, whether on a new vehicle tank or following repairs or modifications that might affect compartment capacities, tolerances are not applicable, and the indicator shall be set and the compartment capacity shall be marked as accurately as practicable.

N.5. Adjustment and Remarking. – When a compartment is found upon test to have an error in excess of the applicable tolerance, the capacity of the compartment shall be adjusted to agree with its marked capacity, or its marked capacity shall be changed to agree with its capacity as determined by the test.

T. Tolerances

T.1. Application.

T.1.1. To Excess and to Deficiency. – The tolerances hereinafter prescribed shall be applied to errors in excess and in deficiency.

T.2. Tolerance Values. – Maintenance and acceptance tolerances shall be as shown in Table 1. Maintenance and Acceptance Tolerances on Vehicle-Tank Compartments.

Table 1.
Maintenance and Acceptance Tolerances
on Vehicle-Tank Compartments

Nominal Capacity of Compartment	Maintenance and Acceptance Tolerances	
gallons	**Expressed in quarts**	**Expressed in gallons**
200 or less	2	0.5
201 to 400, inclusive	3	0.75
401 to 600, inclusive	4	1.0
601 to 800, inclusive	5	1.25
801 to 1000, inclusive	6	1.50
over 1000	Add 1 quart per 200 gallons or fraction thereof	Add 0.25 gallon per 200 gallons or fraction thereof

UR. User Requirements

UR.1. Conditions of Use.

UR.1.1. Filling. – A vehicle shall stand upon a level surface during the filling of a compartment.

UR.1.2. Delivering. – During a delivery, a vehicle shall be so positioned as to assure complete emptying of a compartment. Each compartment shall be used for an individual delivery only; that is, an individual delivery shall consist of the entire contents of a compartment or compartments.

(Amended 1976)

Section 4.41. Liquid Measures

A. Application

A.1. General. – This code applies to liquid measures; that is, to rigid measures of capacity designed for general and repeated use in the measurement of liquids.

A.2. Exceptions. – The code does not apply to test measures or other volumetric standards.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Liquid Measures shall meet the requirements of Section 1.10. General Code.

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S. Specifications

S.1. Units.

(a) The capacity of a liquid measure shall be 0.1 L, 0.2 L, 0.5 L, 1 L, 2 L, 5 L, or a multiple of 5 L, and the measure shall not be subdivided.

(b) The capacity of a liquid measure shall be 1 gill, ½ liq pt, 1 liq pt, 1 liq qt, ½ gal, 1¼ gal, 1½ gal, or a multiple of 1 gal, and the measure shall not be subdivided. However, 3 pt and 5 pt brick molds and 2½ gal (10-qt) cans shall be permitted when used exclusively for ice cream.

S.2. Material. – Measures shall be made of metal, glass, earthenware, enameled ware, composition, or similar and suitable material. If made of metal, the thickness of the metal shall not be less than the appropriate value given in Table 1. Minimum Thickness of Metal for Liquid Measures.

Table 1.
Minimum Thickness of Metal for Liquid Measures

Nominal Capacity	Minimum Thickness	
	For Iron or Steel, Plated or Unplated (inch)	For Copper or Aluminum (inch)
1 pint or less	0.010	0.020
1 quart, ½ gallon, 1 gallon	0.014	0.028
Over 1 gallon	0.016	0.032

S.3. Capacity Point. – The capacity of a measure shall be determined to a definite edge, or to the lowest portion of a plate, bar, or wire, at or near the top of the measure, and shall not include the capacity of any lip or rim that may be provided.

S.4. Reinforcing Rings. – Reinforcing rings, if used, shall be attached to the outside of the measure and shall show no divisions or lines on the inside surface of the measure.

S.5. Discharge. – A measure equipped with a discharge faucet or valve shall be susceptible to complete discharge through the faucet or valve when the measure is standing on a level surface.

S.6. Marking Requirements. – A measure shall be marked on its side with a statement of its capacity. If the capacity is stated in terms of the pint or quart, the word "Liquid" or the abbreviation "Liq" shall be included.

T. Tolerances

T.1. – Maintenance tolerances in excess and in deficiency shall be as shown in Table 2. Maintenance Tolerances, in Excess and in Deficiency, for Liquid Measures. Acceptance tolerances shall be one-half the maintenance tolerances.

Table 2.
Maintenance Tolerances, in Excess and in Deficiency, for Liquid Measures

Nominal Capacity	Tolerance			
	In Excess		In Deficiency	
	fluid drams	cubic inches	fluid drams	cubic inches
½ pt or less	2.0	0.4	1.0	0.2
1 pt	3.0	0.7	1.5	0.3
1 qt	4.0	0.9	2.0	0.5
½ gal	6.0	1.4	3.0	0.7
	fluid ounces	**cubic inches**	**fluid drams**	**cubic inches**
1 and 1¼ gal	1.0	1.8	4.0	0.9
1½ gal	1.5	2.7	6.0	1.4
	fluid ounces	**cubic inches**	**fluid ounces**	**cubic inches**
2 gal	2.0	3.5	1.0	1.8
3 and 4 gal	4.0	7.0	2.0	3.6
5 gal	6.0	11.0	3.0	5.4
10 gal	10.0	18.0	5.0	9.0

Section 4.42. Farm Milk Tanks

A. Application

A.1. General. – This code applies to farm milk tanks on the premises of producers when these are used, or are to be used, for the commercial measurement of milk.

A.2. Exceptions. – This code does not apply to tanks mounted on highway vehicles.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Farm Milk Tanks shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Components. – A farm milk tank, whether stationary or portable, shall be considered suitable for commercial use only when it comprises:

(a) a vessel, whether or not it is equipped with means for cooling its contents;

(b) means for reading the level of liquid in the tank, such as a removable gauge rod or surface gauge; and

(c) a chart for converting level-of-liquid readings to volume.

Each compartment of a subdivided tank shall, for the purposes of this code, be construed to be a farm milk tank.

S.2. Design of Tank.

S.2.1. Level. – A farm milk tank shall be designed to be in normal operating position when it is in level. The tank shall be so constructed that it will maintain its condition of level under all normal conditions of lading.

S.2.2. Level-Indicating Means. – A tank shall be permanently equipped with sensitive means by which the level of the tank can be determined.

S.2.2.1. On a Stationary Tank. – A stationary tank shall be provided with such level-indicating means as a two-way or circular level, a plumb bob, two-way leveling lugs, or the like; or the top edge or edges of the tank shall be so constructed throughout as to provide an accurate reference for level determinations; provided, that when leveling lugs or the top edge or edges of the tank are used as the reference for level determinations, there shall be supplied with the tank a sensitive spirit level of appropriate dimensions, and the positions where such level is intended to be used shall be permanently marked on the reference surface of the tank; and provided further, that when leveling lugs are used they shall be so designed, constructed, and installed at the factory that any alteration of the original position or condition, such as by hammering or filing, would be difficult and would become obvious. A stationary tank with a nominal capacity of 2000 L or 500 gal, or greater shall be provided with at least two similar level-indicating means, and these shall be located in opposite and distant positions from each other to facilitate an accurate level determination in both directions of the tank's horizontal plane.

(Amended 1980)

S.2.2.2. On a Portable Tank. – A portable tank shall be provided with either a two-way or a circular level.

S.2.3. Portable Tank. – A portable tank shall be of the center-reading type; that is, it shall be so designed that the gauge rod or surface gauge, when properly positioned for use, will be approximately in the vertical axis of the tank, centrally positioned with respect to the tank walls.

S.2.4. Capacity. *– A farm milk tank shall be clearly and permanently marked on a surface visible after installation with its capacity as determined by the manufacturer. The capacity shall not exceed an amount that can be agitated without overflowing and that can be measured accurately with the liquid at rest.*
[Nonretroactive as of January 1, 1979]

S.3. Design of Indicating Means.

S.3.1. General. *– A tank shall include indicating means and shall be calibrated over the entire range of the volume of the tank from 5 % of capacity or 2 m^3 (500 gal) whichever is less, to its maximum capacity.*
[Nonretroactive as of January 1, 1986]

(Added 1985)

S.3.2. Gauge-Rod Bracket or Supports. – If a tank is designed for use with a gauge rod, a substantial and rigid gauge-rod bracket or other suitable supporting elements for positioning the gauge rod shall be provided. A gauge rod and its brackets or other supporting elements shall be so constructed that, whenever the rod is placed in engagement with the bracket or supports and released, the rod will automatically seat itself at a fixed height and in a vertical position. When a gauge rod is properly seated on its brackets or supports, there shall be a clearance of at least 7.5 cm (3 in) between the graduated face of the rod and any tank wall or other surface that it faces.

S.3.3. Gauge Rod. – When properly seated in position, a rod shall not touch the bottom of the tank unless this is required by the design of the supporting elements. The rod shall be graduated throughout an interval corresponding to the volume range within which readings of liquid level are to be made.

S.3.4. Surface-Gauge Bracket or Supports. – If a tank is designed for use with a surface gauge, a substantial and rigid surface-gauge bracket or other suitable supporting elements for positioning the surface gauge shall be provided. A surface gauge and its brackets or other supporting elements shall be so constructed that, whenever the gauge assembly is placed in engagement with the bracket or supports, the indicator, if not permanently mounted on the tank, will automatically seat itself in correct operating position, and the graduated element will be vertically positioned and will be securely held at any height to which it may be manually set.

S.3.5. Surface Gauge. – When properly engaged with its bracket and set to its lowest position, a surface gauge shall not touch the bottom of the tank. The gauge shall be graduated throughout an interval corresponding to the volume range within which readings of liquid level are to be made.

S.3.6. External Gauge Assemblies.

S.3.6.1. Design and Installation. – The gauge assembly shall be designed to meet sanitary requirements and shall be readily accessible for cleaning purposes. The gauge assembly shall be mounted in a vertical position and equipped with a sliding mechanism to assist in determining the liquid level.

S.3.6.2. Gauge Tube. – The gauge tube shall be borosilicate glass or approved rigid plastic or rigidly supported flexible tubing with a uniform internal diameter not less than 2 cm (¾ in). It shall be designed and constructed so that all product in the gauge can be discarded in such a manner that no product in the gauge tube will enter the discharge line or tank.

(Amended 1983)

S.3.6.3. Scale Plate. – The scale plate shall be mounted adjacent to and parallel with the gauge tube and be no more than 7 mm (¼ in) from the tube.

S.3.6.4. Scale Graduations. – The graduation lines shall be clear and easily readable and shall comply with the requirements of paragraphs included under S.3.7. Graduations.

S.3.6.5. Venting. – An external gauge tube shall be adequately vented at the top, open to the atmosphere. Any attachment to the gauge tube shall not adversely affect the operation of this vent.

(Added 1984)

(Added 1977)

S.3.7. Graduations.

S.3.7.1. Spacing and Width of Graduations. – On a gauge rod or surface gauge, the spacing of the graduations, center to center, shall be not more than 1.6 mm (0.0625 in or 1/16 in) and shall not be less than 0.8 mm (0.03125 in or 1/32 in). The graduations shall not be less than 0.12 mm (0.005 in) in width, and the clear interval between adjacent edges of successive graduations shall be not less than 0.4 mm (0.015625 in or 1/64 in).

S.3.7.2. Values of Graduations. – On a gauge rod or surface gauge, the graduations may be designated in inches or in centimeters and fractions thereof, or may be identified in a numerical series without reference to inches or centimeters or fractions thereof. In either case, a volume chart shall be provided for each such rod or gauge and each tank with which it is associated, showing values in terms of the graduation on the rod or gauge. If a rod or gauge is associated with but one tank, in lieu of linear or numerical series graduations and volume chart, values in terms of volume of liquid in the tank may be shown directly on the rod or gauge.

S.3.7.3. Value of Graduated Interval. – The value of a graduated interval on a gauge rod or surface gauge (exclusive on the interval from the bottom of the tank to the lowest graduation) shall not exceed:

(a) 2 L for a tank of a nominal capacity of 1000 L or less; ½ gal for a tank of a nominal capacity of 250 gal or less;

(b) 4 L for a tank of a nominal capacity of 1001 L to 2000 L, inclusive; 1 gal for a tank of a nominal capacity of 251 gal to 500 gal, inclusive;

(c) 6 L for a tank of a nominal capacity of 2001 L to 6000 L, inclusive; 1½ gal for a tank of a nominal capacity of 501 gal to 1500 gal, inclusive:

(d) 8 L for a tank of a nominal capacity of 6001 L to 10 000 L, inclusive; 2 gal for a tank of a nominal capacity of 1501 gal to 2500 gal, inclusive; or

(e) 8 L plus 4 L for each additional 10 000 L or fraction thereof, for tanks of nominal capacity above 10 000 L or 2 gal plus 1 gal for each additional 2500 gal or fraction thereof, for tanks with nominal capacity above 2500 gal.

(Amended 1980)

S.3.8. Design of Indicating Means on Tanks with a Capacity Greater than 8000 Liters or 2000 Gallons. *– Any farm milk tank with a capacity greater than 8000 L, or 2000 gal, shall be equipped with an external gauge assembly. [Nonretroactive and applicable only to tanks manufactured after January 1, 1981]*

(Added 1980)

S.4. Design of Volume Chart.

S.4.1. General. – A volume chart shall show volume values only, *over the entire range of the volume of the tank from 5 % of capacity or 2 m^3 (500 gal) whichever is less, to its maximum capacity.** All letters and figures on the chart shall be distinct and easily readable. The chart shall be substantially constructed, and the face of the chart shall be so protected that its lettering and figures will not tend easily to become obliterated or illegible.
*[*Nonretroactive as of January 1, 1986]*

(Amended 1985)

S.4.2. For a Tank of 1000 Liters, or 250 Gallons, or Less. – The volume chart for a tank of nominal capacity of 1000 L, or 250 gal, or less shall show values at least to the nearest 1 L, or ¼ gal.

S.4.3. For a Tank of 1001 Liters to 2000 Liters, or 251 to 500 Gallons. – The volume chart for a tank of nominal capacity of 1001 L to 2000 L, or 251 gal to 500 gal, inclusive, shall show values at least to the nearest 2 L, or ½ gal.

S.4.4. For a Tank of Greater than 2000 Liters, or 500 Gallons. – The volume chart for a tank of nominal capacity of greater than 2000 L, or 500 gal, shall show values at least to the nearest gallon, or 4 L.

(Amended 1980)

S.5. Gauging.

S.5.1. Level. – A farm milk tank shall be level, as shown by the level-indicating means, during the original gauging operation.

S.5.2. To Deliver. – A farm milk tank shall be originally gauged "to deliver." If the tank is gauged by measuring the test liquid into the tank, the inside tank walls shall first be thoroughly wetted and the tank shall then be drained for 30 seconds after the main drainage flow has ceased.

S.5.3. Preparation of Volume Chart. – When a tank is gauged for the purposes of preparing a volume chart, tolerances are not applicable, and the chart shall be prepared as accurately as practicable.

S.6. Identification. – A tank and any gauge rod, surface gauge, spirit level, and volume chart intended to be used therewith shall be mutually identified, as by a common serial number, in a prominent and permanent manner.

N. Notes

N.1. Test Liquid. – Water shall be used as the test liquid for a farm milk tank.

N.2. Evaporation and Volume Change. – Care shall be exercised to reduce to a minimum, evaporation losses and volume changes resulting from changes in temperature of the test liquid.

N.3. To Deliver. – A farm milk tank shall be tested "to deliver." If the tank is gauged by measuring the test liquid delivered into the tank, the inside tank walls shall first be thoroughly wetted and the tank then shall be drained for 30 seconds after the main drainage flow has ceased.

N.4. Level. – A farm milk tank shall be level, as shown by the level-indicating means, during gauging and testing.

N.5. Test Methods. – Acceptance tests of milk tanks may be of either the prover method or the master meter method provided that the master metering system is capable of operating within 25 % of the applicable tolerance found in T.3. Basic Tolerance Values. Subsequent tests may be of either the prover method or the master meter method provided that the master metering system is capable of operating within 25 % of the applicable tolerance found in T.4. Basic Tolerance Values, Master Meter Method.

N.5.1. Verification of Master Metering Systems. – A master metering system used to gauge a milk tank shall be verified before and after the gauging process. A master metering system used to calibrate a milk tank shall be verified before starting the calibration and re-verified at least every quarter of the tank capacity, or every 2000 L (500 gal), whichever is greater. The above process of re-verifying the master metering system may be waived if the system is verified using a NIST traceable prover with a minimum of two tests immediately before and one test immediately after the gauging process and that each test result is within 25 % of T.3. Basic Tolerance Values.

(Added 2001)(Amended 2012)

N.5.2. Temperature Changes in Water Supply. – When using a master metering system to gauge or calibrate a milk tank, the official shall monitor the temperature of the water before and after changing sources of supply. If the water temperature of the new source changes by more than 2.8 °C (5 °F) from the previous supply, the official shall reverify the accuracy of the master metering system as soon as possible after the system reaches temperature equilibrium with the new supply source.

(Added 2001)

N.6. Reading the Meniscus. – When a reading or setting is to be obtained from a meniscus formed by milk or other opaque liquid, the index or reading line is the position of the highest point of the center of the meniscus. When calibrating a device with water and the device is to be used with an opaque liquid, the reading should be obtained accordingly; that is, the position of the highest point of the center of the meniscus.

(Added 1984)

T. Tolerances

T.1. Application. – The tolerances hereinafter prescribed shall be applied equally to errors in excess and errors in deficiency.

T.2. Minimum Tolerance Values. – On a particular tank, the maintenance and acceptance tolerance applied shall be not smaller than the volume corresponding to the graduated interval at the point of test draft on the indicating means or 2 L (½ gal), whichever is greater.

(Amended 1980)

T.3. Basic Tolerance Values. – The basic maintenance and acceptance tolerance shall be 0.2 % of the volume of test liquid in the tank at each test draft.

(Amended 1975)

T.4. Basic Tolerance Values, Master Meter Method. – The basic maintenance and acceptance tolerance for tanks tested by the master meter method shall be 0.4 % of the volume of test liquid in the tank at each test draft.

(Added 1975)

UR. User Requirements

UR.1. Installation. – A stationary tank shall be rigidly installed in level without the use of removable blocks or shims under the legs. If such tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined.

UR.2. Level Condition.

UR.2.1. Stationary Tank. – A stationary farm milk tank shall be maintained in level.

UR.2.1.1. Leveling Lugs. – If leveling lugs are provided on a stationary tank, such lugs shall not be hammered or filed to establish or change a level condition of the tank.

UR.2.2. Portable Tank. – On a portable tank, measurement readings shall be made only when the tank is approximately level; that is, when it is not out of level by more than 5 % or approximately three degrees in any direction.

UR.3. Weight Chart. – An auxiliary weight chart may be provided, on which shall be prominently displayed the weight per unit volume value used to derive the weight values from the official volume chart.

UR.4. Use. – A farm milk tank shall not be used to measure quantities greater than an amount that can be agitated without overflowing.

4002.7. Farm Milk Tanks. (a) Calibration at Installation. Any farm milk tank exceeding 1,000 gallons capacity installed or relocated after January 1, 1982 shall be calibrated at the farm and a volume chart prepared before the acceptance test is performed.

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Section 4.43. Measure-Containers

A. Application

A.1. General. – This code applies to measure-containers, including lids or closures if such are necessary to provide total enclosure of the measured commodity, as follows:

(a) Retail measure-containers intended to be used only once to determine at the time of retail sale, and from bulk supply, the quantity of commodity on the basis of liquid measure. The retail measure-container serves as the container for the delivery of the commodity.

(b) Prepackaged measure-containers intended to be used only once to determine in advance of sale the quantity of a commodity (such as ice cream, ice milk, or sherbet) on the basis of liquid measure. The prepackaged measure-container serves as the container for the delivery of the commodity, in either a wholesale or a retail marketing unit.

A.2. Exceptions. – This code does not apply to rigid containers used for milk, cream, or other fluid dairy products, which are covered by packaging requirements.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Measure-Containers shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Units. – The capacity of a measure-container shall be a multiple of or a binary submultiple of a quart or a liter, and the measure shall not be subdivided. However, for prepackaged measure-containers, any capacity less than ¼ L or ½ liq pt shall be permitted.
(Amended 1979)

S.2. Capacity Point. – The capacity of a measure-container shall be sharply defined by:

(a) the top edge;

(b) a line near the top edge; or

(c) the horizontal cross-sectional plane established by the bottom surface of the removable lid or cap when seated in the container.

S.3. Shape. – A measure-container shall be designed as some suitable geometrical shape, and its capacity shall be determined without distortion from its normal assembled shape.

S.4. Marking.

S.4.1. Capacity Point. – If the capacity point of a measure-container is defined by a line, the container shall be marked conspicuously on its side with a suitable statement clearly identifying this line as the capacity point.

S.4.2. Capacity Statement. – A measure-container shall be clearly and conspicuously marked with a statement of its capacity in terms of one of the units prescribed in S.1. Units.

N. Notes

N.1. Test Liquid. – Water shall be used as the test liquid for a measure-container.

N.2. Preparation of Container for Test.

N.2.1. General. – Before an actual test is begun, a measure-container shall, if necessary, be so restrained that it will maintain its normal assembled shape and that its sides will not bulge when it is filled with water.

N.2.2. Restraining Form for Test.

N.2.2.1. For Rectangular Containers of One Liter, One Quarter Less. – Bulging of the sides of a rectangular measure-container of 1 L (1 qt) capacity or less may be controlled by holding against each side of the container, with a cord, rubber bands, or tape, a metal plate or a piece of heavy cardboard slightly smaller than the side of the container.

(Amended 1979)

N.2.2.2. For Rectangular Prepackaged Measure-container of Two Quarts or Two Liters or Greater. – A rectangular prepackaged measure-container of 2 L (2 qt) capacity or greater shall be supported during a test by a rigid restraining form. This form shall restrain not less than the entire area of the central two-thirds of each side of the container, measured from bottom to top. The inside width dimension of any side panel of the restraining form shall be 1.6 mm ($^1/16$ in) greater than the corresponding outside dimension of the container. (The outside width dimension of any side panel of the container shall be established by adding to the inner side center-of-score to center-of-score dimension two thicknesses of the board used, and the sum thus obtained shall be rounded off to the nearest 0.4 mm ($^1/64$ in).)

(Amended 1979)

T. Tolerances

T.1. Tolerances on an Individual Measure. – The acceptance tolerances in excess and in deficiency on an individual measure shall be as shown in Table 1. Acceptance Tolerances, in Excess and in Deficiency, for Measure-Containers.

Table 1.
Acceptance Tolerances, in Excess and in Deficiency, for Measure-Containers

Nominal Capacity	Tolerance			
	In Excess		In Deficiency	
	milliliters		milliliters	
¼ liter or less	10		5.0	
½ liter	15		7.5	
1 liter	20		10.0	
Over 1 liter	Add per liter 10 milliliters		Add per liter 5.0 milliliters	
	fluid drams	cubic inches	fluid drams	cubic inches
½ pint or less	3	0.6	1.5	0.3
1 pint	4	1.0	2.0	0.5
1 quart	6	1.4	3.0	0.7
2 quarts	9	2.0	4.5	1.0
3 quarts	10	2.4	5.0	1.2
4 quarts	12	2.8	6.0	1.2
Over 4 quarts	Add per quart 3 fluid drams	Add per quart 0.7 cubic inch	Add per quart 1.5 fluid drams	Add per quart 0.35 cubic inch

T.2. Tolerance on Average Capacity. – The average capacity on a random sample of 10 measures selected from a lot of 25 or more shall be equal to or greater than the nominal capacity.

(Amended 1979)

UR. User Requirements

UR.1. Limitation of Use. – The use of a measure-container with a rectangular cross section of a capacity of 2 L (2 qt) or greater shall be limited to the packaging, in advance of sale, of ice cream, sherbet, or other similar frozen desserts.

(Amended 1979)

Section 4.44. Graduates

A. Application

A.1. General. – This code applies to subdivided glass measures of capacity, either cylindrical or conical in shape.

A.2. Additional Code Requirements. – In addition to the requirements of this code, Graduates shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Units. – Nominal capacities, graduation ranges, values of graduated intervals, and numbered graduations applicable to single-scale graduates and to the appropriate portions of double scale graduates shall be as shown in Table 1. Design Details for Graduates.

Table 1.
Design Details for Graduates

Nominal Capacity	To be Graduated Between	Value of Graduated Intervals	Number at Each Graduation Divisible by
milliliters	**milliliters**	**milliliters**	**milliliters**
5	1 and 5	½	1
10	2 and 10	1	2
25	5 and 25	5	5
50	10 and 50	5	10
100	20 and 100	10	20
500	100 and 500	25	50
1000	200 and 1000	50	100
minims	**minims**	**minims**	**minims**
60	15 and 60	5	10[a]
120	30 and 120	10	20[b]
fluid drams	**fluid drams**	**fluid drams**	**fluid drams**
4	1 and 4	½	1
8	2 and 8	1	2
fluid ounces	**fluid ounces**	**fluid ounces**	**fluid ounces**
2	½ and 2	¼	½
4	1 and 4	½	1
8	2 and 8	½	1
16	4 and 16	1	2
32	8 and 32	2	4

[a] And, in addition, at the first (15-minim) graduation.
[b] And, in addition, at the first (30-minim) graduation.

S.2. Initial Interval. – A graduate shall have an initial interval that is not subdivided, equal to not less than one-fifth and not more than one-fourth of the capacity of the graduate.

S.3. Shape. – A graduate of a capacity of more than 15 mL (4 fl dr) may be of either the cylindrical or circular conical type. A graduate of a capacity of 15 mL (4 fl dr) or less shall be of the single-scale cylindrical type.

S.4. Material. – A graduate shall be made of good-quality, thoroughly annealed, clear, transparent glass, free from bubbles and streaks that might affect the accuracy of measurement. The glass shall be uniform in thickness and shall not be excessively thick.

S.5. Dimensional Proportions.

S.5.1. On a Circular Conical Graduate. – The inside measurement from the bottom of a circular conical graduate to the capacity graduation shall be not less than two times the inside diameter at the capacity graduation. The inside measurement from the bottom of the graduate to the point representing one-fourth of the capacity shall be not less than the inside diameter at that point.

S.5.2. On a Cylindrical Graduate. – The inside measurement from the bottom of a cylindrical graduate to the capacity graduation shall be not less than five times the inside diameter at the capacity graduation.

S.6. Base. – The base of the graduate shall be perpendicular to the vertical axis of the graduate. The diameter of the base shall be of such size that the empty graduate will remain standing on an inclined surface of 25 %, or approximately 15 degrees, from the horizontal.

S.7. Design of Graduations.

S.7.1. General. – Graduations shall be perpendicular to the vertical axis of the graduate and parallel to each other. Graduations shall be continuous, of uniform thickness not greater than 0.4 mm (0.015 in), clearly visible, permanent, and indelible under normal conditions of use.

(Amended 1977)

S.7.2. On a Single-Scale Graduate. – On a single-scale graduate, the main graduations shall completely encircle the graduate and subordinate graduations shall extend at least one-half the distance around the graduate.

S.7.3. On a Double-Scale or a Duplex Graduate. – On a double-scale or duplex graduate, there shall be a clear space between the ends of the main graduations on the two scales, and this space shall be approximately 90 degrees from the lip of the graduate and shall conform to the requirements of Table 2. Clear Space Between Ends of Main Graduations on Double Scale Graduates.

Table 2.
Clear Space Between Ends of Main Graduations on Double Scale Graduates

Inside Diameter of Graduate at the Graduations (inches)	Clear Space Between Ends of Main Graduations (inch)
Less than 1.5	1/8 to 1/4
1.5 to 3, inclusive	1/4 to 1/2
Over 3	3/8 to 5/8

S.8. Basis of Graduation. – A graduate shall be graduated "to deliver" when the temperature of the graduate is 20 °C (68 °F), and shall be marked accordingly in a permanent and conspicuous manner.

S.9. Marking Requirements. – Each main graduation shall be marked to show its value. Intermediate graduations shall not be marked. Value figures shall be uniformly positioned either directly upon or immediately above the graduations to which they refer. Figures placed upon graduations shall be set in from the ends of the graduations a sufficient distance to allow the ends of the graduations to be used in making a setting.

N. Notes

N.1. Test Liquid. – Water shall be used as the test liquid for graduates.

N.2. Temperature Control. – During the test of a graduate, appropriate precautions shall be exercised to reduce any detrimental temperature effects to the practicable minimum.

T. Tolerances

T.1. Maintenance and acceptance tolerances in excess and in deficiency shall be as shown in Table 3. Maintenance and Acceptance Tolerances, in Excess and Deficiency, for Graduates for graduates that are graduated "to contain" or "to deliver." (The tolerance to be applied at any graduation is determined by the inside diameter of the graduate at the graduation in question.)

Table 3.
Maintenance and Acceptance Tolerances, in Excess and in Deficiency, for Graduates

Inside Diameter of Graduate		Tolerance	Inside Diameter of Graduate		Tolerance
From	To But Not Including		From	To But Not Including	
millimeters		milliliters	inches		minims
0	16	0.1	0	9/16	2
16	21	0.2	9/16	13/16	3
21	26	0.4	13/16	1 1/16	6
26	31	0.6	1 1/16	1 5/16	10
31	36	0.8	1 5/16	1 9/16	15
36	41	1.1	1 9/16	1 13/16	20
41	46	1.4	1 13/16	2 1/16	30
46	51	1.8	2 1/16	2 5/16	40
51	56	2.2	2 5/16	2 9/16	50
56	61	2.8	2 9/16	2 13/16	65
61	66	3.4	2 13/16	3 1/16	80
66	71	4.1	3 1/16	3 5/16	95
71	76	4.8	3 5/16	3 9/16	110
76	81	5.6	3 9/16	3 13/16	130
81	86	6.4	3 3/16	4 1/16	150
86	91	7.2			
91	96	8.1			
96	101	9.0			

(Amended 1974)

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Section 4.45. Dry Measures

A. Application

A.1. General. – This code applies to rigid measures of capacity designed for general and repeated use in the measurement of solids, including capacities of ½ bu or more.

A.2. Exceptions.

(a) This code does not apply to "standard containers" used for the measurement of fruits and vegetables and as shipping containers thereof.

(b) This code does not apply to berry baskets and boxes (see Section 4.46. Code for Berry Baskets and Boxes). (Added 1976)

A.3. Additional Code Requirements. – In addition to the requirements of this code, Dry Measures shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Units. – The capacity of a measure shall be 1 bu, a multiple of the bushel, or a binary submultiple of the bushel, and the measure shall not be subdivided or double-ended.

S.2. Material. – A dry measure shall be made of any suitable material that will retain its shape during normal usage.

S.3. Shape. – A measure, other than a basket, of a capacity of ½ bu or less, shall be cylindrical or conical in shape. The top diameter shall in no case be less than the appropriate minimum diameter shown in Table 1. Minimum Top Diameters for Dry Measure other than Baskets. The bottom of a measure, other than a basket, shall be perpendicular to the vertical axis of the measure and shall be flat, except that a metal bottom may be slightly corrugated. The bottom of a measure shall not be adjustable or movable.

Table 1.
Minimum Top Diameters for
Dry Measures other than Baskets

Nominal Capacity	Minimum Top Diameter Inches
1 pint	4
1 quart	5 3/8
2 quarts	6 5/8
½ peck	8 1/2
1 peck	10 7/8
½ bushel	13 3/4

S.3.1. Conical Dry Measure. – If conical, the top diameter shall exceed the bottom diameter by not more than 10 % of the bottom diameter.

S.4. Capacity Point. – The capacity of a measure shall be determined by the top edge of the measure.

S.5. Top Reinforcement. – The top edge of a measure shall be reinforced. On a wooden measure other than a basket, of a capacity of 1 qt or more, this reinforcement shall be in the form of a firmly attached metal band.

S.6. Marking Requirements. – A measure shall be conspicuously marked on its side with a statement of its capacity. If the capacity is stated in terms of the pint or quart, the word "Dry" shall be included. The capacity statement shall be in letters of the following dimensions:

(a) At least ½ in high and ¼ in wide on a measure of any capacity between ½ pt and 1 pk.

(b) At least 1 in high and ½ in wide on a measure of a capacity of ½ bu or more.

(c) On a measure of a capacity of ¼ pt or less, the statement shall be as prominent as practicable, considering the size and design of such measure.

N. Notes

N.1. Testing Medium.

N.1.1. Watertight Dry Measures. – Water shall be used as the testing medium for watertight dry measures.

N.1.2. Nonwatertight Dry Measures. – A dry measure shall be tested either volumetrically using rapeseed as a testing medium or geometrically through inside measurement and calculation.
(Amended 1988)

T. Tolerances

T.1. – Maintenance tolerances in excess and in deficiency shall be as shown in Table 2. Maintenance Tolerances, in Excess and in Deficiency, for Dry Measure. Acceptance tolerances shall be one-half the maintenance tolerances.

Table 2.
Maintenance Tolerances, in Excess and in Deficiency, for Dry Measures

Nominal Capacity	Tolerance	
	In Excess cubic inches	In Deficiency cubic inches
1/32 pint or less	0.1	0.05
1/16 pint	0.15	0.1
1/8 pint	0.25	0.15
¼ pint	0.5	0.3
½ pint	1.0	0.5
1 pint	2.0	1.0
1 quart	3.0	1.5
2 quarts	5.0	2.5
½ peck	10.0	5.0
1 peck	16.0	8.0
½ bushel	30.0	15.0
1 bushel	50.0	25.0

Section 4.46. Berry Baskets and Boxes

A. Application

A.1. General. – This code applies to baskets and boxes for berries and small fruits in capacities of 1 dry quart and less.

A.2. Additional Code Requirements. – In addition to the requirements of this code, Berry Baskets and Boxes shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Units. – The capacity of a berry basket or box shall be ½ dry pint, 1 dry pint, or 1 dry quart.

S.2. Materials. – A berry basket or box shall be made of any suitable materials that will retain its shape during normal filling, storage, and handling.

S.3. Capacity Point. – The capacity of a berry basket or box shall be determined by its top edges.

N. Notes

N.1. Method of Test. – A berry basket or box may be tested either volumetrically, using rape seed as the testing medium, or geometrically through accurate inside dimension measurement and calculation.

T. Tolerances

T.1. Tolerances on Individual Measures. – Maintenance and acceptance tolerances in excess and deficiency on an individual measure shall be as shown in Table 1. Maintenance and Acceptance Tolerances in Excess and in Deficiency.

T.2. Tolerances on Average Capacity. – The average capacity on a random sample of 10 measures selected from a lot of 25 or more shall be equal to or greater than the nominal capacity.

(Amended 1979)

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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