

Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

as adopted by the 104th National Conference on Weights and Measures 2019

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Section 1.10. General Code

G-A. Application

G-A.1. Commercial and Law-Enforcement Equipment. – These specifications, tolerances, and other technical requirements apply as follows:

- (a) To commercial weighing and measuring equipment; that is, to weights and measures and weighing and measuring devices commercially used or employed in establishing the size, quantity, extent, area, composition (limited to meat and poultry), constituent values (limited to grain), or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award, or in computing any basic charge or payment for services rendered on the basis of weight or measure. (Amended 2008)
- (b) To any accessory attached to or used in connection with a commercial weighing or measuring device when such accessory is so designed that its operation affects the accuracy of the device.
- (c) To weighing and measuring equipment in official use for the enforcement of law or for the collection of statistical information by government agencies.

(These requirements should be used as a guide by the weights and measures official when, upon request, courtesy examinations of noncommercial equipment are made.)

G-A.2. Code Application. – This General Code shall apply to all classes of devices as covered in the specific codes. The specific code requirements supersede General Code requirements in all cases of conflict.

(Amended 1972)

G-A.3. Special and Unclassified Equipment. – Insofar as they are clearly appropriate, the requirements and provisions of the General Code and of specific codes apply to equipment failing, by reason of special design or otherwise, to fall clearly within one of the particular equipment classes for which separate codes have been established. With respect to such equipment, code requirements and provisions shall be applied with due regard to the design, intended purpose, and conditions of use of the equipment.

G-A.4. Metric Equipment. – Employment of the weights and measures of the metric system is lawful throughout the United States. These specifications, tolerances, and other requirements shall not be understood or construed as in any way prohibiting the manufacture, sale, or use of equipment designed to give results in terms of metric units. The specific provisions of these requirements and the principles upon which the requirements are based shall be applied to metric equipment insofar as appropriate and practicable. The tolerances on metric equipment, when not specified herein, shall be equivalent to those specified for similar equipment constructed or graduated in the U.S. customary system.

G-A.5. Retroactive Requirements. – “Retroactive” requirements are enforceable with respect to all equipment. Retroactive requirements are printed herein in upright roman type.

G-A.6. Nonretroactive Requirements. – “Nonretroactive” requirements are enforceable on or after the effective date for devices:

- (a) manufactured within a state after the effective date;
- (b) both new and used, brought into a state after the effective date;
- (c) used in noncommercial applications which are placed into commercial use after the effective date; and

- (d) undergoing type evaluation, including devices that have been modified to the extent that a new NTEP Certificate of Conformance (CC) is required.

Nonretroactive requirements are not enforceable with respect to devices that are in commercial service in the state as of the effective date or to new equipment in the stock of a manufacturer or a dealer in the state as of the effective date. *[Nonretroactive requirements are printed in italic type.]*

(Amended 1989 and 2011)

G-A.7. Effective Enforcement Dates of Code Requirements. – Unless otherwise specified, each new or amended code requirement shall not be subject to enforcement prior to January 1 of the year following the adoption by the National Conference on Weights and Measures and publication by the National Institute of Standards and Technology.

G-S. Specifications

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;

- (b) a model identifier that positively identifies the pattern or design of the device;

(1) The model identifier shall be prefaced by the word “Model,” “Type,” or “Pattern.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.). The abbreviation for the word “Model” shall be “Mod” or “Mod.” Prefix lettering may be initial capitals, all capitals, or all lower case.

[Nonretroactive as of January 1, 2003]

(Added 2000) (Amended 2001)

- (c) a nonrepetitive serial number, except for equipment with no moving or electronic component parts and software;

[Nonretroactive as of January 1, 1968]

(Amended 2003 and 2016)

(1) The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.

[Nonretroactive as of January 1, 1986]

(2) Abbreviations for the word “Serial” shall, as a minimum, begin with the letter “S,” and abbreviations for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., S/N, SN, Ser. No., and S. No.).

[Nonretroactive as of January 1, 2001]

- (d) the current software version or revision identifier for not-built-for-purpose, software-based devices manufactured as of January 1, 2004, and all software-based devices (or equipment) manufactured as of January 1, 2022;

(Added 2003) (Amended 2016)

(1) The version or revision identifier shall be:

- i. *prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision.*

[Nonretroactive as of January 1, 2007]

(Added 2006)

Note: *If the equipment is capable of displaying the version or revision identifier, but is unable to meet the formatting requirements, through the NTEP type evaluation process, other options may be deemed acceptable and described in the CC.*

(Added 2016)

- ii. *continuously displayed or be accessible via the display. Instructions for displaying the version or revision identifier shall be described in the CC. As an alternative, permanently marking the version or revision identifier shall be acceptable providing the device does not always have an integral interface to communicate the version or revision identifier.*

[Nonretroactive as of January 1, 2022]

(Added 2016)

- (2) *Abbreviations for the word “Version” shall, as a minimum, begin with the letter “V” and may be followed by the word “Number.” Abbreviations for the word “Revision” shall, as a minimum, begin with the letter “R” and may be followed by the word “Number.” The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.). Prefix lettering may be initial capitals, all capitals, or all lowercase.*

[Nonretroactive as of January 1, 2007]

(Added 2006) (Amended 2016)

- (e) a National Type Evaluation Program (NTEP) Certificate of Conformance (CC) number or a corresponding CC Addendum Number for devices that have a CC.

- (1) *The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms “NTEP CC,” “CC,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).*

[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

(Amended 1985, 1991, 1999, 2000, 2001, 2003, 2006, and 2016)

G-S.1.1. Location of Marking Information for Not-Built-For-Purpose, Software-Based Devices. – *For not-built-for-purpose, software-based devices either:*

- (a) *The required information in G-S.1 Identification. (a), (b), (d), and (e) shall be permanently marked or continuously displayed on the device; or*

- (b) *The Certificate of Conformance (CC) Number shall be:*

- (1) *permanently marked on the device;*

- (2) *continuously displayed; or*

- (3) *accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, “Help,” “System Identification,” “G-S.1. Identification,” or “Weights and Measures Identification.”*

Note: For (b), clear instructions for accessing the information required in G-S.1. (a), (b), and (d) shall be listed on the CC, including information necessary to identify that the software in the device is the same type that was evaluated.
[Nonretroactive as of January 1, 2004]
(Added 2003) (Amended 2006)

G-S.1.2. Devices and Main Elements Remanufactured as of January 1, 2002. – All devices and main elements remanufactured as of January 1, 2002, shall be clearly and permanently marked for the purposes of identification with the following information:

(a) the name, initials, or trademark of the last remanufacturer or distributor; and

(b) the remanufacturer's or distributor's model designation, if different than the original model designation.

(Added 2001) (Amended 2011)

Note: Definitions for "manufactured device," "repaired device," and "repaired element" are included (along with definitions for "remanufactured device" and "remanufactured element") in Appendix D, Definitions.

G-S.2. Facilitation of Fraud. – All equipment and all mechanisms, software, and devices attached to or used in conjunction therewith shall be so designed, constructed, assembled, and installed for use such that they do not facilitate the perpetration of fraud.

(Amended 2007)

G-S.3. Permanence. – All equipment shall be of such materials, design, and construction as to make it probable that, under normal service conditions:

(a) accuracy will be maintained;

(b) operating parts will continue to function as intended; and

(c) adjustments will remain reasonably permanent.

Undue stresses, deflections, or distortions of parts shall not occur to the extent that accuracy or permanence is detrimentally affected.

G-S.4. Interchange or Reversal of Parts. – Parts of a device that may readily be interchanged or reversed in the course of field assembly or of normal usage shall be:

(a) so constructed that their interchange or reversal will not affect the performance of the device; or

(b) so marked as to show their proper positions.

G-S.5. Indicating and Recording Elements.

G-S.5.1. General. – All weighing and measuring devices shall be provided with indicating or recording elements appropriate in design and adequate in amount. Primary indications and recorded representations shall be clear, definite, accurate, and easily read under any conditions of normal operation of the device.

G-S.5.2. Graduations, Indications, and Recorded Representations.

G-S.5.2.1. Analog Indication and Representation. – Graduations and a suitable indicator shall be provided in connection with indications designed to advance continuously.

G-S.5.2.2. Digital Indication and Representation. – Digital elements shall be so designed that:

- (a) All digital values of like value in a system agree with one another.
- (b) A digital value coincides with its associated analog value to the nearest minimum graduation.
- (c) A digital value “rounds off” to the nearest minimum unit that can be indicated or recorded.
- (d) *A digital zero indication includes the display of a zero for all places that are displayed to the right of the decimal point and at least one place to the left. When no decimal values are displayed, a zero shall be displayed for each place of the displayed scale division.*
[Nonretroactive as of January 1, 1986]

(Amended 1973 and 1985)

G-S.5.2.3. Size and Character. – In any series of graduations, indications, or recorded representations, corresponding graduations and units shall be uniform in size and character. Graduations, indications, or recorded representations that are subordinate to, or of a lesser value than others with which they are associated, shall be appropriately portrayed or designated.

[Made retroactive as of January 1, 1975]

G-S.5.2.4. Values. – If graduations, indications, or recorded representations are intended to have specific values, these shall be adequately defined by a sufficient number of figures, words, symbols, or combinations thereof, uniformly placed with reference to the graduations, indications, or recorded representations and as close thereto as practicable, but not so positioned as to interfere with the accuracy of reading.

G-S.5.2.5. Permanence. – Graduations, indications, or recorded representations and their defining figures, words, and symbols shall be of such character that they will not tend easily to become obliterated or illegible.

G-S.5.3. Values of Graduated Intervals or Increments. – In any series of graduations, indications, or recorded representations, the values of the graduated intervals or increments shall be uniform throughout the series.

G-S.5.3.1. On Devices That Indicate or Record in More Than One Unit. – On devices designed to indicate or record in more than one unit of measurement, the values indicated and recorded shall be identified with an appropriate word, symbol, or abbreviation.

(Amended 1978 and 1986)

G-S.5.4. Repeatability of Indications. – A device shall be capable of repeating, within prescribed tolerances, its indications and recorded representations. This requirement shall be met irrespective of repeated manipulation of any element of the device in a manner approximating normal usage (including displacement of the indicating elements to the full extent allowed by the construction of the device and repeated operation of a locking or relieving mechanism) and of the repeated performance of steps or operations that are embraced in the testing procedure.

G-S.5.5. Money Values, Mathematical Agreement. – Any recorded money value and any digital money-value indication on a computing-type weighing or measuring device used in retail trade shall be in mathematical agreement with its associated quantity representation or indication to the nearest 1 cent of money value. This does not apply to auxiliary digital indications intended for the operator’s use only, when these indications are obtained from existing analog customer indications that meet this requirement.

(Amended 1973)

G-S.5.6. Recorded Representations. – Insofar as they are appropriate, the requirements for indicating and recording elements shall also apply to recorded representations. All recorded values shall be printed digitally. In applications where recorded representations are required, the customer may be given the option of not receiving the recorded representation. For systems equipped with the capability of issuing an electronic receipt, ticket, or

other recorded representation, the customer may be given the option to receive any required information electronically (e.g., via cell phone, computer, etc.) in lieu of or in addition to a hard copy.

(Amended 1975 and 2014)

G-S.5.6.1. Indicated and Recorded Representation of Units. – Appropriate abbreviations.

- (a) For equipment manufactured on or after January 1, 2008, the appropriate defining symbols are shown in NIST Special Publication SP 811 “Guide for the Use of International System of Units (SI)” and Handbook 44 Appendix C – General Tables of Units of Measurement.

Note: SP 811 can be viewed or downloaded at <http://physics.nist.gov/cuu/pdf/sp811.pdf> or by going to <http://www.nist.gov/pml/wmd/index.cfm> and selecting Weights and Measures Publications and the link to Special Publications (SP 811), “Guide for the Use of the International System of Units (SI).”

(Added 2007)

- (b) The appropriate defining symbols on equipment manufactured prior to January 1, 2008, with limited character sets are shown in Table 1. Representation of SI Units on Equipment Manufactured Prior to January 1, 2008, with Limited Character Sets.

(Added 1977) (Amended 2007)

Table 1.				
Representation of SI Units on Equipment Manufactured Prior to January 1, 2008, with Limited Character Sets				
Name of Unit	International Symbol (common use symbol)	Representation		
		Form I	Form II	
		(double case)	(single case lower)	(single case upper)
Base SI Units				
meter	m	m	m	M
kilogram	kg	kg	kg	KG
Derived SI Units				
newton	N	N	n	N
pascal	Pa	Pa	pa	PA
watt	W	W	w	W
volt	V	V	v	V
degree Celsius	°C	°C	°c	°C
Other Units				
liter	l or L	L	l	L
gram	g	g	g	G
metric ton	t	t	tne	TNE
bar	bar	bar	bar	BAR

(Table Amended 2007)

G-S.5.7. Magnified Graduations and Indications. – All requirements for graduations and indications apply to a series of graduations and an indicator magnified by an optical system or as magnified and projected on a screen.

G-S.6. Marking Operational Controls, Indications, and Features. – All operational controls, indications, and features, including switches, lights, displays, push buttons, and other means, shall be clearly and definitely identified. The use of approved pictograms or symbols shall be acceptable.

[Nonretroactive as of January 1, 1977]

(Amended 1978 and 1995)

G-S.7. Lettering. – All required markings and instructions shall be distinct and easily readable and shall be of such character that they will not tend to become obliterated or illegible.

G-S.8. Provision for Sealing Electronic Adjustable Components. – *A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.*

[Nonretroactive as of January 1, 1990]

A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

(Added 1985) (Amended 1989 and 1993)

G-S.8.1. Multiple Weighing or Measuring Elements that Share a Common Provision for Sealing. – *A change to any metrological parameter (calibration or configuration) of any weighing or measuring element shall be individually identified.*

[Nonretroactive as of January 1, 2010]

Note: For devices that utilize an electronic form of sealing, in addition to the requirements in G-S.8.1., any appropriate audit trail requirements in an applicable specific device code also apply. Examples of identification of a change to the metrological parameters of a weighing or measuring element include, but are not limited to:

- (1) a broken, missing, or replaced physical seal on an individual weighing, measuring, or indicating element or active junction box;
- (2) a change in a calibration factor or configuration setting for each weighing or measuring element;
- (3) a display of the date of calibration or configuration event for each weighing or measuring element; or
- (4) counters indicating the number of calibration and/or configuration events for each weighing or measuring element.

(Added 2007)

G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Device. - For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device*, such as a secure digital (SD) card, USB flash drive, etc., security shall be provided for those parameters using either:

- (1) an event logger in the device; or
- (2) a physical seal that must be broken in order to remove the digital storage device from the device (or system). If security is provided using an event logger, the event logger shall include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available on demand through the device or through another on-site device. In addition to providing a printed copy of the information, the information may be made available electronically. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)

* Applies only to removable digital storage devices that must remain in the device or system for it to be operational.

(Added 2019)

G-S.9. Metrologically Significant Software Updates. – A software update that changes the metrologically significant software shall be considered a sealable event.

(Added 2016)

G-N. Notes

G-N.1. Conflict of Laws and Regulations. – If any particular provisions of these specifications, tolerances, and other requirements are found to conflict with existing state laws, or with existing regulations or local ordinances relating to health, safety, or fire prevention, the enforcement of such provisions shall be suspended until conflicting requirements can be harmonized. Such suspension shall not affect the validity or enforcement of the remaining provisions of these specifications, tolerances, and other requirements.

G-N.2. Testing With Nonassociated Equipment. – Tests to determine conditions, such as radio frequency interference (RFI) that may adversely affect the performance of a device shall be conducted with equipment and under conditions that are usual and customary with respect to the location and use of the device.

(Added 1976)

G-T. Tolerances

G-T.1. Acceptance Tolerances. – Acceptance tolerances shall apply to equipment:

- (a) to be put into commercial use for the first time;
- (b) that has been placed in commercial service within the preceding 30 days and is being officially tested for the first time;
- (c) that has been returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time within 30 days after corrective service;
- (d) that is being officially tested for the first time within 30 days after major reconditioning or overhaul; and
- (e) undergoing type evaluation.

(Amended 1989)

G-T.2. Maintenance Tolerances. – Maintenance tolerances shall apply to equipment in actual use, except as provided in G-T.1. Acceptance Tolerances.

G-T.3. Application. – Tolerances “in excess” and tolerances “in deficiency” shall apply to errors in excess and to errors in deficiency, respectively. Tolerances “on overregistration” and tolerances “on underregistration” shall apply to errors in the direction of overregistration and of underregistration, respectively. (Also see Appendix D, Definitions.)

G-T.4. For Intermediate Values. – For a capacity, indication, load, value, etc., intermediate between two capacities, indications, loads, values, etc., listed in a table of tolerances, the tolerances prescribed for the lower capacity, indication, load, value, etc., shall be applied.

G-UR. User Requirements

G-UR.1. Selection Requirements.

G-UR.1.1. Suitability of Equipment. – Commercial equipment shall be suitable for the service in which it is used with respect to elements of its design, including but not limited to its weighing capacity (for weighing devices), its computing capability (for computing devices), its rate of flow (for liquid-measuring devices), the character, number, size, and location of its indicating or recording elements, and the value of its smallest unit and unit prices.

(Amended 1974)

G-UR.1.2. Environment. – Equipment shall be suitable for the environment in which it is used including, but not limited to, the effects of wind, weather, and RFI.

(Added 1976)

G-UR.1.3. Liquid-Measuring Devices. – To be suitable for its application, the minimum delivery for liquid-measuring devices shall be no less than 100 divisions, except that the minimum delivery for retail analog devices shall be no less than 10 divisions. Maximum division values and tolerances are stated in the specific codes.

(Added 1995)

G-UR.2. Installation Requirements.

G-UR.2.1. Installation. – A device shall be installed in accordance with the manufacturer’s instructions, including any instructions marked on the device. A device installed in a fixed location shall be installed so that neither its operation nor its performance will be adversely affected by any characteristic of the foundation, supports, or any other detail of the installation.

G-UR.2.1.1. Visibility of Identification. – Equipment shall be installed in such a manner that all required markings are readily observable.

(Added 1978)

G-UR.2.2. Installation of Indicating or Recording Element. – A device shall be so installed that there is no obstruction between a primary indicating or recording element and the weighing or measuring element; otherwise there shall be convenient and permanently installed means for direct communication, oral or visual, between an individual located at a primary indicating or recording element and an individual located at the weighing or measuring element. (Also see G-UR.3.3. Position of Equipment.)

G-UR.2.3. Accessibility for Inspection, Testing, and Sealing Purposes. – A device shall be located, or such facilities for normal access thereto shall be provided, to permit:

- (a) inspecting and testing the device;
- (b) inspecting and applying security seals to the device; and
- (c) readily bringing the testing equipment of the weights and measures official to the device by customary means and in the amount and size deemed necessary by such official for the proper conduct of the test.

Otherwise, it shall be the responsibility of the device owner or operator to supply such special facilities, including such labor as may be needed to inspect, test, and seal the device, and to transport the testing equipment to and from the device, as required by the weights and measures official.

(Amended 1991)

G-UR.3. Use Requirements.

G-UR.3.1. Method of Operation. – Equipment shall be operated only in the manner that is obviously indicated by its construction or that is indicated by instructions on the equipment.

G-UR.3.2. Associated and Nonassociated Equipment. – A device shall meet all performance requirements when associated or nonassociated equipment is operated in its usual and customary manner and location.

(Added 1976)

G-UR.3.3. Position of Equipment. – A device or system equipped with a primary indicating element and used in direct sales, except for prescription scales, shall be positioned so that its indications may be accurately read and the weighing or measuring operation may be observed from some reasonable “customer” and “operator”

position. The permissible distance between the equipment and a reasonable customer and operator position shall be determined in each case upon the basis of the individual circumstances, particularly the size and character of the indicating element.

(Amended 1974 and 1998)

G-UR.3.4. Responsibility, Money-Operated Devices. – Money-operated devices, other than parking meters, shall have clearly and conspicuously displayed thereon, or immediately adjacent thereto, adequate information detailing the method for the return of monies paid when the product or service cannot be obtained. This information shall include the name, address, and phone number of the local responsible party for the device. This requirement does not apply to devices at locations where employees are present and responsible for resolving any monetary discrepancies for the customer.

(Amended 1977 and 1993)

G-UR.4. Maintenance Requirements.

G-UR.4.1. Maintenance of Equipment. – All equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service at a single place of business shall not be considered “maintained in a proper operating condition” if:

- (a) predominantly, equipment of all types or applications are found to be in error in a direction favorable to the device user; or
- (b) predominantly, equipment of the same type or application is found to be in error in a direction favorable to the device user.

(Amended 1973, 1991, and 2015)

G-UR.4.2. Abnormal Performance. – Unstable indications or other abnormal equipment performance observed during operation shall be corrected and, if necessary, brought to the attention of competent service personnel.

(Added 1976)

G-UR.4.3. Use of Adjustments. – Weighing elements and measuring elements that are adjustable shall be adjusted only to correct those conditions that such elements are designed to control, and shall not be adjusted to compensate for defective or abnormal installation or accessories or for badly worn or otherwise defective parts of the assembly. Any faulty installation conditions shall be corrected, and any defective parts shall be renewed or suitably repaired, before adjustments are undertaken. Whenever equipment is adjusted, the adjustments shall be so made as to bring performance errors as close as practicable to zero value.

G-UR.4.4. Assistance in Testing Operations. – If the design, construction, or location of any device is such as to require a testing procedure involving special equipment or accessories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official.

G-UR.4.5. Security Seal. – A security seal shall be appropriately affixed to any adjustment mechanism designed to be sealed.

G-UR.4.6. Testing Devices at a Central Location.

- (a) When devices in commercial service require special test facilities, or must be removed from service for testing, or are routinely transported for the purpose of use (e.g., vehicle-mounted devices and devices used in multiple locations), the official with statutory authority may require that the devices be brought to a central location for testing. The dealer or owner of these devices shall provide transportation of the devices to and from the test location.

- (b) When the request for removal and delivery to a central test location involves devices used in submetering (e.g., electric, hydrocarbon vapor, or water meters), the owner or operator shall not interrupt the utility service to the customer or tenant except for the removal and replacement of the device. Provisions shall be made by the owner or operator to minimize inconvenience to the customer or tenant. All replacement or temporary meters shall be tested and sealed by a weights and measures official or bear a current, valid approval seal prior to use.

(Added 1994)

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Note: In this section of Handbook 44, the reference temperature for the temperature compensation of refined petroleum products is shown as “15 °C (60 °F).” Although these values are not exact equivalents, they reflect industry usage when the SI and U.S. customary units are used in measurements.

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Section 3.30. Liquid-Measuring Devices

A. Application

A.1. General. – This code applies to:

- (a) devices used for the measurement of liquids and
- (b) wholesale devices used for the measurement and delivery of agri-chemical liquids such as fertilizers, feeds, herbicides, pesticides, insecticides, fungicides, and defoliantes.
(Added 1985)

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

- (a) meters mounted on vehicle tanks (Also see Section 3.31. Code for Vehicle-Tank Meters.);
- (b) devices used for dispensing liquefied petroleum gases (Also see Section 3.32. Code for Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices.);
- (c) devices used for dispensing other liquids that do not remain in a liquid state at atmospheric pressures and temperatures;
- (d) water meters;
- (e) devices used solely for dispensing a product in connection with operations in which the amount dispensed does not affect customer charges; or
- (f) mass flow meters. (Also see Section 3.37. Code for Mass Flow Meters.)
(Added 1994)

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

S. Specifications

S.1. Indicating and Recording Elements and Recorded Representations.

S.1.1. General. – A liquid-measuring device:

- (a) shall be equipped with a primary indicating element; and
- (b) may be equipped with a primary recording element.

S.1.2. Units. – A liquid-measuring device shall indicate, and record if the device is equipped to record, its deliveries in liters, gallons, quarts, pints, fluid ounces, or binary-submultiples or decimal subdivisions of the liter or gallon.

(Amended 1987, 1994, and 2006)

S.1.2.1. Retail Motor-Fuel Devices. – Deliveries shall be indicated and recorded, if the device is equipped to record, in liters or gallons and decimal subdivisions or fractional equivalents thereof.

(Added 1979)

S.1.2.2. Agri-Chemical Liquid Devices.

S.1.2.2.1. Liquid Measure. – Deliveries shall be indicated and recorded in liters or gallons and decimal subdivisions or fractional equivalents thereof.

S.1.2.3. Value of Smallest Unit. – The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:

- (a) 0.5 L (0.1 gal) on devices with a maximum rated flow rate of 750 L/min (200 gal/min) or less;
- (b) 5 L (1 gal) on devices with a maximum rated flow of more than 750 L/min (200 gal/min); or
- (c) 5 L (1 gal) on meters with a rated maximum flow rate of 375 L/min (100 gal/min) or more used for jet fuel aviation refueling systems.
(Added 2007)

This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means.
(Amended 1983, 1986, and 2007)

S.1.3. Advancement of Indicating and Recording Elements. – It shall not be possible to advance primary indicating and recording elements except by the mechanical operation of the device. Clearing a device by advancing its elements to zero is permitted, but only if:

- (a) once started, the advancement movement cannot be stopped until zero is reached; and
- (b) in the case of indicating elements only, such elements are automatically obscured until the elements reach the correct zero position.

S.1.4. Graduations.

S.1.4.1. Length. – Graduations shall be varied in length so that they may be conveniently read.

S.1.4.2. Width. – In a series of graduations, the width of:

- (a) every graduation shall be at least 0.2 mm (0.008 in) but not greater than the minimum clear interval between graduations; and
- (b) main graduations shall be not more than 50 % greater than the width of subordinate graduations.

S.1.4.3. Clear Interval Between Graduations. – The clear interval between graduations shall be not less than 1.0 mm (0.04 in). If the graduations are not parallel, the measurement shall be made:

- (a) along the line of movement of the tip of the index of the indicator as it passes over the graduations;
or
- (b) if the indicator extends over the entire length of the graduations, at the point of widest separation of the graduations.

S.1.5. Indicators.

S.1.5.1. Symmetry. – The portion of the index of an indicator associated with the graduations shall be symmetrical with respect to the graduations.

S.1.5.2. Length.

- (a) If the indicator and the graduations are in different planes, the index of the indicator shall extend to each graduation with which it is to be used.
- (b) If the indicator is in the same plane as the graduations, the distance between the index of the indicator and the ends of the graduations, measured along the line of the graduations, shall be not more than 1.0 mm (0.04 in).

S.1.5.3. Width.

- (a) *The index of an indicator shall not be wider than the width of the narrowest graduation.*
[Nonretroactive as of January 1, 2002]
(Amended 2000)
- (b) If the index of an indicator extends over the entire length of a graduation, it shall be of uniform width throughout the portion that coincides with the graduation.

S.1.5.4. Clearance. – If the indicator and the graduations are in different planes, the clearance between the index of an indicator and the plane of the graduations shall be no greater than 1.5 mm (0.06 in).

S.1.5.5. Parallax. – Parallax effects shall be reduced to the practical minimum.

S.1.6. Additional Operating Requirements, Retail Devices (Except Slow-flow Meters).

S.1.6.1. Indication of Delivery. – The device shall automatically show on its face the initial zero condition and the quantity delivered (up to the nominal capacity). However, the following requirements shall apply:

For electronic devices manufactured prior to January 1, 2006, the first 0.03 L (or 0.009 gal) of a delivery and its associated total sales price need not be indicated.

For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero.

[Nonretroactive as of January 1, 2006]

(Added 2005)

(Amended 1982 and 2005)

S.1.6.2. Provisions for Power Loss.

S.1.6.2.1. Transaction Information. – *In the event of a power loss, the information needed to complete any transaction in progress at the time of the power loss (such as the quantity and unit price, or sales price) shall be determinable for at least 15 minutes at the dispenser or at the console if the console is accessible to the customer.*

[Nonretroactive as of January 1, 1983]

S.1.6.2.2. User Information. – *The device memory shall retain information on the quantity of fuel dispensed and the sales price totals during power loss.*

[Nonretroactive as of January 1, 1983]

S.1.6.3. Return to Zero.

- (a) The primary indicating elements, and primary recording elements if the device is equipped to record, shall be readily returnable to a definite zero indication. However, a key-lock operated or other

self-operated device may be equipped with cumulative indicating or recording elements, provided that it is also equipped with a zero-return indicating element.

- (b) It shall not be possible to return primary indicating elements, or primary recording elements beyond the correct zero position.

- (c) Primary indicating elements shall not be resettable to zero during a delivery.

(Amended 1972 and 2016)

S.1.6.4. Display of Unit Price and Product Identity.

S.1.6.4.1. Unit Price.

- (a) A computing or money-operated device shall be able to display on each face the unit price at which the device is set to compute or to dispense.

- (b) *Except for dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), whenever a grade, brand, blend, or mixture is offered for sale from a device at more than one unit price, then all of the unit prices at which that product is offered for sale shall meet the following conditions:*

- (1) *For a system that applies a discount prior to the delivery, all unit prices shall be displayed or shall be capable of being displayed on the dispenser through a deliberate action of the customer prior to the delivery of the product. It is not necessary that all of the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed prior to the delivery of the product.*

[Nonretroactive as of January 1, 1991]

- (2) For a system that offers post-delivery discounts on fuel sales, display of pre-delivery unit price information is exempt from (b)(1), provided the system complies with S.1.6.8. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided.

(Added 2012)

Note: When a product is offered at more than one unit price, display of the unit price information may be through the deliberate action of the customer: 1) using controls on the device; 2) through the customer's use of personal or vehicle-mounted electronic equipment communicating with the system; or 3) verbal instructions by the customer.

(Added 2012)

(Amended 1989, 1997, and 2012)

S.1.6.4.2. Product Identity.

- (a) A device shall be able to conspicuously display on each side the identity of the product being dispensed.

- (b) A device designed to dispense more than one grade, brand, blend, or mixture of product also shall be able to display on each side the identity of the grade, brand, blend, or mixture being dispensed.

S.1.6.5. Money-Value Computations.

- (a) *A computing device shall compute the total sales price at any single-purchase unit price (i.e., excluding fleet sales, other price contract sales, and truck stop dispensers used only to refuel trucks) for which the product being measured is offered for sale at any delivery possible within*

either the measurement range of the device or the range of the computing elements, whichever is less.

[Nonretroactive as of January 1, 1991]

- (b) The analog sales price indicated for any delivered quantity shall not differ from a mathematically computed price (quantity × unit price = total sales price) by an amount greater than the value in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Amended 1984, 1989, and 1993)

S.1.6.5.1. Money-Value Divisions, Analog. – The values of the graduated intervals representing money values on a computing type device shall be no greater than those in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Amended 1991)

Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers				
Unit Price		Money-Value Division	Maximum Allowable Variation	
From	To and Including		Design Test	Field Test
0	\$0.25/liter or \$1.00/gallon	1¢	± 1¢	± 1¢
\$0.25/liter or \$1.00/gallon	\$0.75/liter or \$3.00/gallon	1¢ or 2¢	± 1¢	± 2¢
\$0.75/liter or \$3.00/gallon	\$2.50/liter or \$10.00/gallon	1¢ or 2¢	± 1¢	± 2¢
		5¢	± 2½¢	± 5¢

S.1.6.5.2. Money-Value Divisions, Digital. – A computing type device with digital indications shall comply with the requirements of paragraph G.S.5.5. Money-Values, Mathematical Agreement, and the total price computation shall be based on quantities not exceeding 0.05 L for devices indicating in metric units and 0.01 gal intervals for devices indicating in U.S. customary units.

(Added 1980)

S.1.6.5.3. Auxiliary Elements. – *If a system is equipped with auxiliary indications, all indicated money-value divisions of the auxiliary element shall be identical with those of the primary element.*

[Nonretroactive as of January 1, 1985]

S.1.6.5.4. Selection of Unit Price. – A system shall not permit a change to the unit price during delivery of product. When a product or grade is offered for sale at more than one unit price through a computing device, the following conditions shall be met:

- (a) *Except for a system only capable of applying a post-delivery discount(s), the selection of the unit price shall be made prior to delivery through a deliberate action of the customer to select the unit price for the fuel delivery.*
[Nonretroactive as of January 1, 1991]
- (b) For a system only capable of applying a post-delivery discount(s), the selection of the unit price shall be made through a deliberate action of the customer to select the unit price for the fuel delivery.
(Added 2012)

Note: When a product is offered at more than one unit price, selection of the unit price may be through the deliberate action of the customer: 1) using controls on the device; 2) through the customer's use of personal or vehicle-mounted electronic equipment communicating with the system; or 3) verbal instructions by the customer.

(Added 2012)

The provisions in (a) and (b) do not apply to dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks).

(Added 1989) (Amended 1991, 1992, 1993, 1996, and 2012)

S.1.6.5.5. Display of Quantity and Total Price. – *Except for aviation refueling applications, when a delivery is completed, the total price and quantity for that transaction shall be displayed on the face of the dispenser for at least five minutes or until the next transaction is initiated by using controls on the device or other customer-activated controls.*

[Nonretroactive as of January 1, 1994]

(Added 1992) (Amended 1996 and 2007)

S.1.6.5.6. Display of Quantity and Total Price, Aviation Refueling Applications.

- (a) *The quantity shall be displayed throughout the transaction.*
- (b) *The total price shall also be displayed under one of the following conditions:*
 - (1) The total price can appear on the face of the dispenser or through a controller adjacent to the device.
 - (2) If a device is designed to continuously compute and display the total price, then the total price shall be computed and displayed throughout the transaction for the quantity delivered.
- (c) *The total price and quantity shall be displayed for at least five minutes or until the next transaction is initiated by using controls on the device or other customer-activated controls.*
- (d) *A printed receipt shall be available and shall include, at a minimum, the total price, quantity, and unit price.*

[Nonretroactive as of January 1, 2008]

(Added 2007)

S.1.6.6. Agreement Between Indications.

- (a) When a quantity value indicated or recorded by an auxiliary element is a derived or computed value based on data received from a retail motor fuel dispenser, the value may differ from the quantity value displayed on the dispenser, provided the following conditions are met:
- (1) all total money-values for an individual sale that are indicated or recorded by the system agree; and
 - (2) *within each element, the values indicated or recorded meet the formula (quantity × unit price = total sales price) to the closest cent.*
[Nonretroactive as of January 1, 1988]
- (b) When a system applies a post-delivery discount(s) to a fuel's unit price through an auxiliary element, the following conditions shall apply for computed values:
- (1) the total volume of the delivery shall be in agreement between all elements in the system.

(Added 2012)

(Added 1985) (Amended 1987, 1988, and 2012)

S.1.6.7. Recorded Representations. – *Except for fleet sales and other price contract sales and for transactions where a post-delivery discount is provided, a printed receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:*

- (a) *the total volume of the delivery;*
- (b) *the unit price;*
- (c) *the total computed price; and*
- (d) *the product identity by name, symbol, abbreviation, or code number.*

[Nonretroactive as of January 1, 1986]

(Added 1985) (Amended 1997, 2012, and 2014)

S.1.6.8. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided. – Except for fleet sales and other price contract sales, a printed receipt providing the following information shall be available through a built-in or separate recording element that is part of the system for transactions involving a post-delivery discount:

- (a) the product identity by name, symbol, abbreviation, or code number;
- (b) transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount(s), including the:
 - (1) total volume of the delivery;
 - (2) unit price; and
 - (3) total computed price of the fuel sale.

- (c) an itemization of the post-delivery discounts to the unit price; and
- (d) the final total price of the fuel sale after all post-delivery discounts are applied.

(Added 2012) (Amended 2014)

S.1.6.9. Lubricant Devices, Travel of Indicator. – The indicator shall move at least 2.5 cm (1 in) in relation to the graduations, if provided, for a delivery of 0.5 L (1 pt).

S.1.6.10. Automatic Timeout – Pay-At-Pump for Retail Devices. – *Once a device has been authorized, it must deauthorize within two minutes if not activated. Reauthorization of the device must be performed before any product can be dispensed. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than two minutes.*

[Nonretroactive as of January 1, 2017]

(Added 2016) (Amended 2019)

S.1.7. Additional Operating Requirements, Wholesale Devices Only.

S.1.7.1. Travel of Indicator. – A wholesale device shall be readily operable to deliver accurately any quantity from 200 L (50 gal) to the capacity of the device. If the most sensitive element of the indicating system utilizes an indicator and graduations, the relative movement of these parts corresponding to a delivery of 4 L (1 gal) shall be not less than 5 mm (0.20 in).

(Amended 1987)

S.1.7.2. Money-Values – Mathematical Agreement. – Any digital money-value indication and any recorded money-value on a computing-type device shall be in mathematical agreement with its associated quantity indication or representation to within 1 cent of money-value.

S.2. Measuring Elements.

S.2.1. Air/Vapor Elimination. – A measuring system shall be equipped with an effective air/vapor eliminator or other automatic means to prevent the passage of air/vapor through the meter. Vent lines from the air/vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 1975 and 2017)

S.2.1.1. Air/Vapor Elimination on Loading Rack Measuring Systems.

- (a) A loading rack measuring system shall be equipped with an effective air/vapor eliminator or other automatic means to prevent the passage of air/vapor through the meter unless the system is designed or operationally controlled by a means such that air/vapor cannot enter the system.

- (b) Vent lines from the air/vapor eliminator shall be made of appropriate non-collapsible material.

(Added 1994) (Amended 2017)

S.2.2. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices. For parameters adjusted using other means, the following applies.

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

- (a) any measuring or indicating element;
- (b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and
- (c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

*Audit trails shall use the format set forth in Table S.2.2.**

*[*Nonretroactive as of January 1, 1995]*

(Amended 1991, 1993, 1995, 2006, and 2019)

S.2.3. Directional Flow Valves. – Valves intended to prevent reversal of flow shall be automatic in operation.

Table S.2.2. Categories of Device and Methods of Sealing	
Categories of Device	Methods of Sealing
Category 1: <i>No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
Category 2: <i>Remote configuration capability, but access is controlled by physical hardware.</i> <i>The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i>	<i>[The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information through an on-site device.]*</i> <i>[*Nonretroactive as of January 1, 1996]</i>
Category 3: <i>Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</i> <i>[Nonretroactive as of January 1, 1995]</i> <i>The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i> <i>[Nonretroactive as of January 1, 2001]</i>	<i>An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available on demand through the device or through another on-site device. The information may also be available electronically. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 1993) (Amended 1995, 1998, 1999, 2006, and 2015)

S.2.4. Stop Mechanism.

S.2.4.1. Indication. – The delivery for which the device is set shall be conspicuously indicated.
(Amended 1983)

S.2.4.2. Stroke Limiting Elements. – Stops or other stroke limiting elements subject to direct pressure or impact shall be:

- (a) made secure by positive, nonfrictional engagement of these elements; and
- (b) adjustable to provide for deliveries within tolerances.

(Amended 1983)

S.2.4.3. Setting. – If two or more stops or other elements may be selectively brought into operation to permit predetermined quantities of deliveries:

- (a) the position for the proper setting of each such element shall be accurately defined; and
- (b) any inadvertent displacement from the proper setting shall be obstructed.

(Amended 1983)

S.2.5. Zero-Set-Back Interlock for Retail Devices. – A device shall be constructed so that:

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements, and recording elements if the device is equipped and activated to record, have been returned to their zero positions;
- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

(Amended 1981, 1985, and 2019)

S.2.6. Temperature Determination – Wholesale Devices. – *For test purposes, means shall be provided (e.g., thermometer well) to determine the temperature of the liquid either:*

(a) in the liquid chamber of the meter; or

(b) in the meter inlet or discharge line immediately adjacent to the meter.

[Nonretroactive as of January 1, 1985]

(Added 1984) (Amended 1986)

S.2.7. Wholesale Devices Equipped with Automatic Temperature Compensators.

S.2.7.1. Automatic Temperature Compensation. – A device may be equipped with an automatic means for adjusting the indication and registration of the measured volume of product to the volume at 15 °C (60 °F).

S.2.7.2. Provision for Deactivating. – On a device equipped with an automatic temperature-compensating mechanism that will indicate or record only in terms of gallons compensated to 15 °C (60 °F),

provision shall be made for deactivating the automatic temperature-compensating mechanism so that the meter can indicate and record, if it is equipped to record, in terms of the uncompensated volume.

(Amended 1972)

S.2.7.3. Provision for Sealing Automatic Temperature-Compensating Systems. – Provision shall be made for applying security seals in such a manner that an automatic temperature-compensating system cannot be disconnected and that no adjustment may be made to the system without breaking the seal.

S.2.7.4. Temperature Determination with Automatic Temperature-Compensation. – For test purposes, means shall be provided (e.g., thermometer well) to determine the temperature of the liquid either:

- (a) in the liquid chamber of the meter; or
- (b) immediately adjacent to the meter in the meter inlet or discharge line.

(Amended 1987)

S.2.8. Exhaustion of Supply, Lubricant Devices Other than Meter Types. – When the level of the supply of lubricant becomes so low as to compromise the accuracy of measurement, the device shall:

- (a) automatically become inoperable; or
- (b) give a conspicuous and distinct warning.

S.3. Discharge Lines and Valves.

S.3.1. Diversion of Measured Liquid. – No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or its discharge line. Two or more delivery outlets may be installed only if automatic means are provided to ensure that:

- (a) liquid can flow from only one outlet at a time; and
- (b) the direction of flow for which the mechanism may be set at any time is clearly and conspicuously indicated.

An outlet that may be opened for purging or draining the measuring system or for recirculating, if recirculation is required in order to maintain the product in a deliverable state, shall be permitted only when the system is measuring food products, agri-chemicals, biodiesel, or biodiesel blends. Effective automatic means shall be provided to prevent passage of liquid through any such outlet during normal operation of the measuring system and to inhibit meter indications (or advancement of indications) and recorded representations while the outlet is in operation.

(Amended 1991, 1995, 1996, and 2007)

S.3.2. Exceptions. – The provisions of S.3.1. Diversion of Measured Liquid shall not apply to truck refueling devices when diversion of flow to other than the receiving vehicle cannot readily be accomplished and is readily apparent. Allowable deterrents include, but are not limited to, physical barriers to adjacent driveways, visible valves, or lighting systems that indicate which outlets are in operation, and explanatory signs.

(Amended 1982, 1990, 1991, and 2002)

S.3.3. Pump-Discharge Unit. – A pump-discharge unit equipped with a flexible discharge hose shall be of the wet-hose type.

S.3.4. Gravity-Discharge Unit. – On a gravity-discharge unit:

- (a) the discharge hose or equivalent pipe shall be of the dry-hose type with no shutoff valve at its outlet end unless the hose or pipe drains to the same level under all conditions of use;

- (b) the dry-hose shall be sufficiently stiff and only as long as necessary to facilitate drainage;
- (c) an automatic vacuum breaker, or equivalent mechanism, shall be incorporated to prevent siphoning and to ensure rapid and complete drainage; and
- (d) the inlet end of the hose or outlet pipe shall be high enough to ensure complete drainage.

S.3.5. Discharge Hose, Reinforcement. – A discharge hose shall be reinforced so that the performance of the device is not affected by the expansion or contraction of the hose.

S.3.6. Discharge Valve. – A discharge valve may be installed in the discharge line only if the device is of the wet-hose type. Any other shutoff valve on the discharge side of the meter shall be of the automatic or semiautomatic predetermined-stop type or shall be operable only:

- (a) by means of a tool (but not a pin) entirely separate from the device; or
- (b) by mutilation of a security seal with which the valve is sealed open.

S.3.7. Anti-drain Means. – In a wet-hose pressure-type device, means shall be incorporated to prevent the drainage of the discharge hose.

(Amended 1990)

S.4. Marking Requirements.

S.4.1. Limitation on Use. – The limitations on its use shall be clearly and permanently marked on any device intended to measure accurately only:

- (a) products having particular properties;
- (b) under specific installation or operating conditions; or
- (c) when used in conjunction with specific accessory equipment.

S.4.2. Air Pressure. – If a device is operated by air pressure, the air pressure gauge shall show by special graduations or other means the maximum and minimum working pressures recommended by the manufacturer.

S.4.3. Wholesale Devices.

S.4.3.1. Discharge Rates. – A wholesale device shall be marked to show its designed maximum and minimum discharge rates. However, the minimum discharge rate shall not exceed 20 % of the maximum discharge rate.

S.4.3.2. Temperature Compensation. – If a device is equipped with an automatic temperature compensation, the primary indicating elements, recording elements, and recorded representation shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

S.4.4. Retail Devices.

S.4.4.1. Discharge Rates. – *On a retail device with a designed maximum discharge rate of 115 L (30 gal) per minute or greater, the maximum and minimum discharge rates shall be marked in accordance with*

S.4.4.2. Location of Marking Information; Retail Dispensers. The marked minimum discharge rate shall not exceed 20 % of the marked maximum discharge rate.

[Nonretroactive as of January 1, 1985]

(Added 1984) (Amended 2003 and 2019)

Example: With a marked maximum discharge rate of 230 L/min (60 gpm), the marked minimum discharge rate shall be 45 L/min (12 gpm) or less (e.g., 40 L/min [10 gpm] is acceptable). A marked minimum discharge rate greater than 45 L/min (12 gpm) (e.g., 60 L/min [15 gpm]) is not acceptable.

S.4.4.2. Location of Marking Information for Retail Dispensers. – *The marking information required in the General Code, paragraph G-S.1. Identification shall appear as follows:*

- (a) *within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser (for a system in a dispenser);*
- (b) *either internally and/or externally provided the information is permanent and easily read; and*
- (c) *on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).*

The use of a dispenser key or tool to access internal marking information is permitted for retail liquid-measuring devices.

[Nonretroactive as of January 1, 2003]

(Added 2002) (Amended 2004 and 2019)

S.5. Totalizers for Retail Dispensers. – *Retail dispensers shall be equipped with a non-resettable totalizer for the quantity delivered through the metering device.*

[Nonretroactive as of January 1, 1995]

(Added 1993) (Amended 1994 and 2019)

N. Notes

N.1. Test Liquid.

N.1.1. Type of Liquid. – The liquid used for testing a liquid-measuring device shall be the type the device is used to measure, or another liquid with the same general physical characteristics.

N.1.2. Labeling. – Following the completion of a successful examination of a wholesale device, the weights and measures official should attach a label or tag indicating the type of liquid used during the test.

N.2. Volume Change. – Care shall be taken to minimize changes in volume of the test liquid due to temperature changes and evaporation losses.

N.3. Test Drafts.

N.3.1. Retail Piston-Type and Visible-Type Devices. – Test drafts shall include the full capacity delivery and each intermediate delivery for which the device is designed.

N.3.2. Slow-flow Meters. – Test drafts shall be equal to at least four times the minimum volume that can be measured and indicated through either a visible indication or an audible signal.

N.3.3. Lubricant Devices. – Test drafts shall be 1 L (1 qt). Additional test drafts may include 0.5 L (1 pt), 4 L (4 qt), and 6 L (6 qt).

N.3.4. Other Retail Devices. – On devices with a designed maximum discharge rate of:

- (a) less than 80 L (20 gal) per minute, tests shall include drafts of one or more amounts, including a draft of at least 19 L (5 gal).
- (b) 80 L (20 gal) per minute or greater, tests shall include drafts of one or more amounts, including a draft of at least the amount delivered by the device in one minute at the maximum flow rate of the installation.

(Amended 1984)

N.3.5. Wholesale Devices. – The delivered quantity should be equal to at least the amount delivered by the device in one minute at its maximum discharge rate and shall in no case be less than 200 L (50 gal).

(Amended 1987 and 1996)

N.4. Testing Procedures.

N.4.1. Normal Tests. – The “normal” test of a device shall be made at the maximum discharge flow rate developed under the conditions of installation. Any additional tests conducted at flow rates down to and including one-half of the sum of the maximum discharge flow rate and the rated minimum discharge flow rate shall be considered normal tests.

(Amended 1991)

N.4.1.1. Wholesale Devices Equipped with Automatic Temperature-Compensating Systems. – On wholesale devices equipped with automatic temperature-compensating systems, normal tests shall be conducted:

- (a) by comparing the compensated volume indicated or recorded to the actual delivered volume corrected to 15 °C (60 °F); and
- (b) with the temperature-compensating system deactivated, comparing the uncompensated volume indicated or recorded to the actual delivered volume.

The first test shall be performed with the automatic temperature-compensating system operating in the “as found” condition.

On devices that indicate or record both the compensated and uncompensated volume for each delivery, the tests in (a) and (b) may be performed as a single test.

(Amended 1987)

N.4.2. Special Tests. – “Special” tests shall be made to develop the operating characteristics of a device and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. Normal Tests shall be considered a special test.

N.4.2.1. Slow-Flow Meters. – A “special” test shall be made at a flow rate:

- (a) not larger than twice the actual minimum flow rate; and
- (b) not smaller than the actual minimum flow rate of the installation.

N.4.2.2. Retail Motor-Fuel Devices and DEF Devices

- (a) Devices without a marked minimum flow-rate shall have a “special” test performed at the slower of the following rates:

- (1) 19 L (5 gal) per minute; or

(2) the minimum discharge rate at which the device will deliver when equipped with an automatic discharge nozzle set at its slowest setting.

(b) Devices with a marked minimum flow-rate shall have a “special” test performed at or near the marked minimum flow rate.

(Added 1984) (Amended 2005 and 2019)

N.4.2.3. Other Retail Devices. – “Special” tests of other retail devices shall be made at the slower of the following rates:

(a) 50 % of the maximum discharge rate developed under the conditions of installation; or

(b) the minimum discharge rate marked on the device.

N.4.2.4. Wholesale Devices. – “Special” tests shall be made to develop the operating characteristics of a measuring system and any special associated or attached elements and accessories. “Special” tests shall include a test at or slightly above the slower of the following rates:

(a) 20 % of the marked maximum discharge rate; or

(b) the minimum discharge rate marked on the device.

In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

(Amended 2014)

N.4.3. Money-Value Computation Tests.

N.4.3.1. Laboratory Tests. – When testing the device in the laboratory:

(a) compliance with paragraph S.1.6.5. Money-Value Computations, shall be determined by using the cone gear as a reference for the total quantity delivered;

(b) the indicated quantity shall agree with the cone gear representation with the index of the indicator within the width of the graduation; and

(c) the maximum allowable variation of the indicated sales price shall be as shown in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Amended 1984)

N.4.3.2. Field Tests. – In the conduct of field tests to determine compliance with paragraph S.1.6.5. Money-Value Computations, the maximum allowable variation in the indicated sales price shall be as shown in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Added 1982) (Amended 1984)

N.4.4. Pour and Drain Times.

N.4.4.1. Pour and Drain Times for Hand-held Test Measures. – Hand-held test measures require a 30-second (± 5 seconds) pour followed by a 10-second drain with the measure held at a 10-degree to 15-degree angle from vertical.

N.4.4.2. Drain Times for Bottom Drain Test Measures or Provers. – Bottom drain field standard provers require a 30-second drain time after main flow cessation.

(Added 2009)

N.4.5. Verification of Linearization Factors. – All enabled linearization factors shall be verified. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis at the discretion of the official with statutory authority.

(Added 2016)

N.4.6. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained. When conducting the tests, the flow rates shall be within the minimum and maximum discharge rates as marked by the manufacturer. For devices with no marked minimum and maximum flow rates, the minimum discharge rates shall be as specified in N.4.2.1. or N.4.2.2. and the maximum discharge rates shall be the maximum discharge rate developed under the conditions of the installation. For devices equipped with an automatic temperature compensator, the results shall be based on the uncompensated (gross) volume (e.g., with the temperature compensator deactivated).

(Renumbered and Amended 2019)

N.5. Temperature Correction on Wholesale Devices. – Corrections shall be made for any changes in volume resulting from the differences in liquid temperatures between time of passage through the meter and time of volumetric determination in the prover. When adjustments are necessary, appropriate petroleum measurement tables should be used.

(Amended 1974)

T. Tolerances

T.1. Application to Underregistration and to Overregistration. – The tolerances hereinafter prescribed shall be applied to errors of underregistration and errors of overregistration, whether or not a device is equipped with an automatic temperature compensator.

T.2. Tolerance Values. – Maintenance, acceptance, and special test tolerances shall be as shown in Table T.2. Accuracy Classes and Tolerances for Liquid Measuring Devices Covered in NIST Handbook 44, Section 3.30.

Table T.2. Accuracy Classes and Tolerances for Liquid Measuring Devices Covered in NIST Handbook 44, Section 3.30.				
Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance¹
0.3	<ul style="list-style-type: none"> - Petroleum products delivered from large capacity (flow rates greater than 115 L/min or 30 gpm)** devices, including motor-fuel devices - Heated products (other than asphalt) at temperatures greater than 50 °C (122 °F) - Asphalt at temperatures equal to or below 50 °C (122 °F) - All other liquids not shown in the table where the typical delivery is over 200 L (50 gal) 	0.2 %	0.3 %	0.5 %
0.3A	<ul style="list-style-type: none"> - Asphalt at temperatures greater than 50 °C (122 °F) 	0.3 %	0.3 %	0.5 %
0.5*	<ul style="list-style-type: none"> - Petroleum products delivered from small capacity (at 4 L/min (1 gpm) through 115 L/min or 30 gpm)** motor-fuel devices - Agri-chemical liquids - All other applications not shown in the table where the typical delivery is ≤ 200 L (50 gal) 	0.3 %	0.5 %	0.5 %
1.1	<ul style="list-style-type: none"> - Petroleum products and other normal liquids from devices with flow rates** less than 1 gpm. - Devices designed to deliver less than 1 gal 	0.75 %	1.0 %	1.25 %
<p>* For test drafts ≤ 40 L or 10 gal, the tolerances specified for Accuracy Class 0.5 in the table above do not apply. For these test drafts, the following applies:</p> <p style="margin-left: 40px;">(a) Maintenance tolerances on normal and special tests shall be 20 mL plus 4 mL per indicated liter or 1 in³ plus 1 in³ per indicated gallon.</p> <p style="margin-left: 40px;">(b) Acceptance tolerances on normal and special tests shall be one-half the maintenance tolerance values.</p> <p>¹ Special test tolerances are not applicable to retail motor fuel dispensers.</p> <p>** Flow rate refers to designed or marked maximum flow rate.</p>				

(Added 2002) (Amended 2006 and 2013)

T.3. Repeatability. – When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance. This tolerance does not apply to the test of the automatic temperature-compensating system. (Also see N.4.6. Repeatability Tests.)

(Added 1992) (Amended 2001, 2002, and 2019)

T.4. Automatic Temperature-Compensating Systems. – The difference between the meter errors (expressed as a percentage) determined with and without the automatic temperature-compensating system activated shall not exceed:

- (a) 0.2 % for mechanical automatic temperature-compensating systems; and
- (b) 0.1 % for electronic automatic temperature-compensating systems.

The delivered quantities for each test shall be approximately the same size. The results of each test shall be within the applicable acceptance or maintenance tolerance.

[Nonretroactive as of January 1, 1988]

(Added 1987) (Amended 1992, 1996, and 2002)

UR. User Requirements

UR.1. Selection Requirements.

UR.1.1. Discharge Hose.

UR.1.1.1. Length. – The length of the discharge hose on a retail motor-fuel device:

- (a) shall be measured from its housing or outlet of the discharge line to the inlet of the discharge nozzle;
- (b) shall be measured with the hose fully extended if it is coiled or otherwise retained or connected inside a housing; and
- (c) shall not exceed 5.5 m (18 ft) unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels.

An unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.

(Amended 1972 and 1987)

UR.1.1.2. Marinas and Airports.

UR.1.1.2.1. Length. – The length of the discharge hose shall be as short as practicable, and shall not exceed 15 m (50 ft) unless it can be demonstrated that a longer hose is essential.

UR.1.1.2.2. Protection. – Discharge hoses exceeding 8 m (26 ft) in length shall be adequately protected from weather and other environmental factors when not in use.

(Made retroactive 1974 and Amended 1984)

UR.2. Installation Requirements.

UR.2.1. Manufacturer's Instructions. – A device shall be installed in accordance with the manufacturer's instructions, and the installation shall be sufficiently secure and rigid to maintain this condition.

(Added 1987)

UR.2.2. Discharge Rate. – A device shall be installed so that the actual maximum discharge rate will not exceed the rated maximum discharge rate. Automatic means for flow regulation shall be incorporated in the installation if necessary.

UR.2.3. Suction Head. – A piston-type device shall be installed so that the total effective suction head will not be great enough to cause vaporization of the liquid being dispensed under the highest temperature and lowest barometric pressure likely to occur.

UR.2.4. Diversion of Liquid Flow. – A device equipped with two delivery outlets used exclusively in the fueling of trucks shall be so installed that any diversion of flow to other than the receiving vehicle cannot be readily accomplished and is readily apparent. Allowable deterrents include, but are not limited to, physical barriers to adjacent driveways, visible valves, or lighting systems that indicate which outlets are in operation, and explanatory signs.

(Amended 1991 and 2019)

UR.2.5. Product Storage Identification.

- (a) The fill connection for any petroleum product or other product storage tank or vessel supplying petroleum product or other products shall be permanently, plainly, and visibly marked as to product contained.
- (b) When the fill connection device is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.

(Added 1975) (Amended 1976 and 2019)

UR.3. Use of Device.

UR.3.1. Return of Indicating and Recording Elements to Zero. – On any dispenser used in making retail deliveries, the primary indicating element, and recording element if so equipped, shall be returned to zero before each delivery.

Exceptions to this requirement are totalizers on key-lock-operated or other self-operated dispensers and the primary recording element if the device is equipped to record.

UR.3.2. Unit Price and Product Identity.

- (a) The following information shall be conspicuously displayed or posted on the face of a retail dispenser used in direct sale:
 - (1) except for unit prices resulting from any post-delivery discount and dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), all of the unit prices at which the product is offered for sale; and
 - (2) in the case of a computing type or money-operated type, the unit price at which the dispenser is set to compute.

Provided that the dispenser complies with S.1.6.4.1. Display of Unit Price, it is not necessary that all the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed or posted.

- (b) The following information shall be conspicuously displayed or posted on each side of a retail dispenser used in direct sale:
 - (1) the identity of the product in descriptive commercial terms; and
 - (2) the identity of the grade, brand, blend, or mixture that a multi-product dispenser is set to deliver.

(Amended 1972, 1983, 1987, 1989, 1992, 1993, and 2012)

UR.3.3. Computing Device. – Any computing device used in an application where a product or grade is offered for sale at one or more unit prices shall be used only for sales for which the device computes and displays the sales price for the selected transaction.

(Became retroactive 1999)

(Added 1989) (Amended 1992)

The following exceptions apply:

- (a) Fleet sales and other price contract sales are exempt from this requirement.
- (b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement provided that:

- (1) all purchases of fuel are accompanied by a printed receipt of the transaction containing the applicable price per gallon, the total gallons delivered, and the total price of the sale; and
(Added 1993)
 - (2) unless a dispenser complies with S.1.6.4.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.
(Added 1993)
- (c) A dispenser used in an application where a price per unit discount is offered following the delivery is exempt from this requirement, provided the following conditions are satisfied:
- (1) the unit price posted on the dispenser and the unit price at which the dispenser is set to compute prior to the application of any discount shall be the highest unit price for any transaction;
(Amended 2014)
 - (2) all purchases of fuel are accompanied by a receipt recorded by the system. The receipt shall contain:
 - a. the product identity by name, symbol, abbreviation, or code number;
 - b. transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount including the:
 1. total volume of the delivery;
 2. unit price; and
 3. total computed price of the fuel sale prior to post-delivery discounts being applied.
 - c. an itemization of the post-delivery discounts to the unit price; and
 - d. the final total price of the fuel sale.

(Added 2012) (Amended 2014)

(Added 1989) (Amended 1992, 1993, 2012, and 2014)

UR.3.4. Printed Ticket. – The total price; the total volume of the delivery; the price per liter or gallon; *and a corresponding alpha or numeric dispenser designation** shall be shown, either printed by the device or in clear hand script, on any printed ticket issued by a device and containing any one of these values. Establishments where no product grades are repeated are exempt from the dispenser designation requirement.

**[Nonretroactive as of January 1, 2021]*

(Amended 2001, 2018, and 2019)

UR.3.5. Steps after Dispensing. – After delivery to a customer from a retail motor-fuel device:

- (a) the starting lever shall be returned to its shutoff position and the zero-set-back interlock engaged; and
- (b) the discharge nozzle shall be returned to its designed hanging position unless the primary indicating elements, and recording elements, if the device is equipped and activated to record, have been returned to a definite zero indication.

UR.3.6. Temperature Compensation, Wholesale.**UR.3.6.1. Automatic.**

UR.3.6.1.1. When to be Used. – If a device is equipped with a mechanical automatic temperature compensator, it shall be connected, operable, and in use at all times. An electronic or mechanical automatic temperature-compensating system may not be removed, nor may a compensated device be replaced with an uncompensated device, without the written approval of the responsible weights and measures jurisdiction.

Note: This requirement does not specify the method of sale for product measured through a meter.
(Amended 1989)

UR.3.6.1.2. Invoices.

- (a) A written invoice based on a reading of a device that is equipped with an automatic temperature compensator shall show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).
- (b) The invoice issued from an electronic wholesale device equipped with an automatic temperature-compensating system shall also indicate:
 - (1) the API gravity, specific gravity or coefficient of expansion for the product;
 - (2) product temperature; and
 - (3) gross reading.

(Amended 1987)

UR.3.6.2. Nonautomatic.

UR.3.6.2.1. Temperature Determination. – If the volume of the product delivered is adjusted to the volume at 15 °C (60 °F), the product temperature shall be taken during the delivery in:

- (a) the liquid chamber of the meter; or
- (b) the meter inlet or discharge line adjacent to the meter; or
- (c) the compartment of the receiving vehicle at the time it is loaded.

UR.3.6.2.2. Invoices. – The accompanying invoice shall indicate that the volume of the product has been adjusted for temperature variations to a volume at 15 °C (60 °F) and shall also state the product temperature used in making the adjustment.

UR.3.6.3. Period of Use. – When fuel is bought or sold on an automatic or non-automatic temperature-compensated basis, it shall be bought or sold using this method over at least a consecutive 12-month period, unless otherwise agreed to by both the buyer and seller in writing.

(Added 2003)

U.R.4. Maintenance Requirements.

U.R.4.1. Use of Adjustments. – Whenever a device is adjusted, all enabled linearization factors shall be verified to determine that the errors are in tolerance and any adjustments which are made shall be made so as to bring performance errors as close as practicable to zero value. The verification of enabled linearization factors shall be done through physical testing or a combination of testing and empirical analysis.

(Added 2016)

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Appendix D. Definitions

The specific code to which the definition applies is shown in [brackets] at the end of the definition. Definitions for the General Code [1.10] apply to all codes in Handbook 44.

A

absolute value. – The absolute value of a number is the magnitude of that number without considering the positive or negative sign. [2.20]

acceptance test. – The first official test of a farm milk tank, at a particular location, in which the tank is accepted as correct. This test applies to newly constructed tanks, relocated used tanks, and recalibrated tanks. [4.42]

accurate. – A piece of equipment is “accurate” when its performance or value – that is, its indications, its deliveries, its recorded representations, or its capacity or actual value, etc., as determined by tests made with suitable standards - conforms to the standard within the applicable tolerances and other performance requirements. Equipment that fails so to conform is “inaccurate.” (Also see “correct.”) [Appendix A]

all-class. – A description of a multi-class calibration that includes all the classes of a grain type. [5.56(a), 5.57]
(Added 2007)

analog or digital recorder. – An element used with a belt-conveyor scale that continuously records the rate-of-flow of bulk material over the scale (formerly referred to as a chart recorder). [2.21]
(Amended 1989)

analog type. – A system of indication or recording in which values are presented as a series of graduations in combination with an indicator, or in which the most sensitive element of an indicating system moves continuously during the operation of the device. [1.10]

animal scale. – A scale designed for weighing single heads of livestock. [2.20]
(Amended 1987)

apparent mass versus 8.0 g/cm³. – The apparent mass of an object versus 8.0 g/cm³ is the mass of material of density 8.0 g/cm³ that produces exactly the same balance reading as the object when the comparison is made in air with a density of 1.2 mg/cm³ at 20 °C. [3.37]

approval seal. – A label, tag, stamped or etched impression, or the like, indicating official approval of a device. (Also see “security seal.”) [1.10]

assumed atmospheric pressure. – The average atmospheric pressure agreed to exist at the meter at various ranges of elevation, irrespective of variations in atmospheric pressure from time to time. [3.33]

audit trail. – An electronic count and/or information record of the changes to the values of the calibration or configuration parameters of a device. [1.10, 2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.58]
(Added 1993) (Code References Amended 2019)

automatic bulk weighing system. – A weighing system adapted to the automatic weighing of bulk commodities in successive drafts of predetermined amounts, automatically recording the no-load and loaded weight values and accumulating the net weight of each draft. [2.22]

automatic checkweigher. – An automatic weighing system that does not require the intervention of an operator during the weighing process and used to subdivide items of different weights into one or more subgroups, such as identifying packages that have acceptable or unacceptable fill levels according to the value of the difference between their weight and a pre-determined set point. These systems may be used to fill standard packages for compliance with net weight requirements. [2.24]

(Amended 2004)

automatic gravimetric filling machine (instrument). – A filling machine or instrument that fills containers or packages with predetermined and virtually constant mass of product from bulk by automatic weighing, and which comprises essentially an automatic feeding device or devices associated with one or more weighing unit and the appropriate discharge devices. [2.24]

(Added 2004)

automatic-indicating scale. – One on which the weights of applied loads of various magnitudes are automatically indicated throughout all or a portion of the weighing range of the scale. (A scale that automatically weighs out commodity in predetermined drafts, such as an automatic hopper scale, a packaging scale, and the like, is not an “automatic-indicating” scale.) [2.20, 2.22]

automatic temperature or density compensation. – The use of integrated or ancillary equipment to obtain from the output of a volumetric meter an equivalent mass, or an equivalent liquid volume at the assigned reference temperature below and a pressure of 14.696 lb/in² absolute.

Cryogenic liquids	21 °C (70 °F) [3.34]
Hydrocarbon gas vapor	15 °C (60 °F) [3.33]
Hydrogen gas	21 °C (70 °F) [3.39]
Liquid carbon dioxide	21 °C (70 °F) [3.38]
Liquefied petroleum gas (LPG) and Anhydrous ammonia	15 °C (60 °F) [3.32]
Petroleum liquid fuels and lubricants	15 °C (60 °F) [3.30]

(Amended 2019)

automatic weighing system (AWS). – An automatic weighing system is a weighing device that, in combination with other hardware and/or software components, automatically weighs discrete items and that does not require the intervention of an operator during the weighing process. Examples include, but are not limited to, weigh-labelers and checkweighers. [2.24]

(Amended 2004)

automatic zero-setting mechanism (AZSM). – See “automatic zero-setting mechanism” under “zero-setting mechanism.” [2.22]

(Amended 2010)

automatic zero-setting mechanism (belt-conveyor scale). – A zero setting device that operates automatically without intervention of the operator after the belt has been running empty. [2.21]

(Added 2002)

automatic zero-tracking (AZT) mechanism. – Automatic means provided to maintain the zero-balance indication, within specified limits, without the intervention of an operator. [2.20, 2.22, 2.24]

(Amended 2010)

auxiliary indicator. – Any indicator other than the master weight totalizer that indicates the weight of material determined by the scale. [2.21]

axle-load scale. – A scale permanently installed in a fixed location, having a load-receiving element specially adapted to determine the combined load of all wheels (1) on a single axle or (2) on a tandem axle of a highway vehicle. [2.20]

B

badge. – A metal plate affixed to the meter by the manufacturer showing the manufacturer’s name, serial number and model number of the meter, and its rated capacity. [3.33]

balance, zero-load. – See “zero-load balance.” [2.20]

balance indicator. – A combination of elements, one or both of which will oscillate with respect to the other, for indicating the balance condition of a nonautomatic indicating scale. The combination may consist of two indicating edges, lines, or points, or a single edge, line, or point and a graduated scale. [2.20]

balancing mechanism. – A mechanism (including a balance ball) that is designed for adjusting a scale to an accurate zero-load balance condition. [2.20]

base pressure. – The absolute pressure used in defining the gas measurement unit to be used, and is the gauge pressure at the meter plus an agreed atmospheric pressure. [3.33]

basic distance rate. – The charge for distance for all intervals except the initial interval. [5.54]

basic time rate. – The charge for time for all intervals except the initial interval. [5.54]

basic tolerances. – Tolerances on underregistration and on overregistration, or in excess and in deficiency, that are established by a particular code for a particular device under all normal tests, whether maintenance or acceptance. Basic tolerances include minimum tolerance values when these are specified. Special tolerances, identified as such and pertaining to special tests, are not basic tolerances. [2.20, 2.22., 3.34, 3.38, 4.42, 5.54]

batching system. – One in which raw materials are proportioned in pre-determined quantities by weight and/or liquid measure for inclusion in a finished product. [2.22, 3.36]

(Added 2018)

batching meter. – A device used for the purpose of measuring quantities of water to be used in a batching operation. [3.36]

beam. – See “weighbeam.” [2.20]

beam scale. – One on which the weights of loads of various magnitudes are indicated solely by means of one or more weighbeam bars either alone or in combination with counterpoise weights. [2.20]

bell prover. – A calibrated cylindrical metal tank of the annular type with a scale thereon that, in the downward travel in a surrounding tank containing a sealing medium, displaces air through the meter being proved or calibrated. [3.33]

belt-conveyor. – An endless moving belt for transporting material from place to place. [2.21]

belt-conveyor scale. – A device that employs a weighing element in contact with a belt to sense the weight of the material being conveyed and the speed (travel) of the material, and integrates these values to produce total delivered weight. [2.21]

belt-conveyor scale systems area. – The scale system area refers to the scale suspension, weigh idlers attached to the scale suspension, 5 approach (–) idlers, and 5 retreat (+) idlers. [2.21]

(Added 2001)

belt load. – The weight of the material carried by the conveyor belt, expressed in terms of weight units per unit of length (e.g., pounds per foot, kilograms per meter). Also called “belt loading.” [2.21]

(Added 2013)

belt revolution. – The amount of conveyor belt movement or travel that is equivalent to the total length of the conveyor belt. Also referred to as "belt circuit." [2.21]

(Added 2013)

billed weight. – The weight used in the computation of the freight, postal, or storage charge, whether actual weight or dimensional weight. [5.58]

binary submultiples. – Fractional parts obtained by successively dividing by the number two. Thus, one-half, one-fourth, one-eighth, one-sixteenth, and so on, are binary submultiples. [1.10]

built-for-purpose device. – Any main device or element which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system. [1.10]

(Added 2003)

C

calibration parameter. – Any adjustable parameter that can affect measurement or performance accuracy and, due to its nature, needs to be updated on an ongoing basis to maintain device accuracy (e.g., span adjustments, linearization factors, and coarse zero adjustments). [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.58.]

(Added 1993) (Amended 2016) (Code References Amended 2019)

carbon dioxide liquid-measuring device. – A system including a mechanism or machine of (a) the meter or (b) a weighing type of device mounted on a vehicle designed to measure and deliver liquid carbon dioxide. Means may be provided to indicate automatically, for one of a series of unit prices, the total money value of the quantity measured. [3.38]

car-wash timer. – A timer used in conjunction with a coin-operated device to measure the time during which car-wash water, cleaning solutions, or waxing solutions are dispensed. [5.55]

center-reading tank. – One 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. [4.43]

cereal grain and oil seeds. – Agricultural commodities including, but not limited to, corn, wheat, oats, barley, flax, rice, sorghum, soybeans, peanuts, dry beans, safflower, sunflower, fescue seed, etc. [5.56(a), 5.56(b)]

chart recorder. – See analog or digital recorder.

(Amended 1989)

check rate. – A rate of flow usually 20 % of the capacity rate. [3.33]

checkweighing scale. – One used to verify predetermined weight within prescribed limits. [2.24]

class of grain. – Hard Red Winter Wheat as distinguished from Hard Red Spring Wheat as distinguished from Soft Red Winter Wheat, etc. [5.56(a), 5.56(b), 5.57]

clear interval between graduations. – The distance between adjacent edges of successive graduations in a series of graduations. If the graduations are "staggered," the interval shall be measured, if necessary, between a graduation and an extension of the adjacent graduation. (Also see "minimum clear interval.") [1.10]

cleared. – A taximeter is "cleared" when it is inoperative with respect to all fare indication, when no indication of fare or extras is shown and when all parts are in those positions in which they are designed to be when the vehicle on which the taximeter is installed is not engaged by a passenger. [5.54]

cold-tire pressure. – The pressure in a tire at ambient temperature. [5.53, 5.54]

commercial equipment. – See “equipment.”

(Added 2008)

computing scale. – One that indicates the money values of amounts of commodity weighed, at predetermined unit prices, throughout all or part of the weighing range of the scale. [2.20]

computing type or computing type device. – A device designed to indicate, in addition to weight or measure, the total money value of product weighed or measured, for one of a series of unit prices. [1.10]

concave curve. – A change in the angle of inclination of a belt conveyor where the center of the curve is above the conveyor. [2.21]

concentrated load capacity (CLC) (also referred to as Dual Tandem Axle Capacity[DTAC]). – A capacity rating of a vehicle or axle-load scale, specified by the manufacturer, defining the maximum load applied by a group of two axles with a centerline spaced four feet apart and an axle width of eight feet for which the weighbridge is designed. The concentrated load capacity rating is for both test and use. [2.20]

(Added 1988) (Amended 1991, 1994, and 2003)

configuration parameter. – Any adjustable or selectable parameter for a device feature that can affect the accuracy of a transaction or can significantly increase the potential for fraudulent use of the device and, due to its nature, needs to be updated only during device installation or upon replacement of a component (e.g., division value (increment), sensor range, and units of measurement). [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.58]

(Added 1993) (Code References Amended 2019)

consecutive-car test train. – A train consisting of cars weighed on a reference scale, then coupled consecutively and run over the coupled-in-motion railway track scale under test. [2.20]

(Added 1990)

construction materials hopper scale. – A scale adapted to weighing construction materials such as sand, gravel, cement, and hot oil. [2.20]

contract sale. – A sale where a written agreement exists, prior to the point of sale, in which both buyer and seller have accepted pricing conditions of the sale. Examples include, but are not limited to: e-commerce, club sales, or pre-purchase agreements. Any devices used in the determination of quantity must comply with NIST Handbook 44. [3.30, 3.32, 3.37]

(Added 1993) (Amended 2002)

conventional scale. – If the use of conversion tables is necessary to obtain a moisture content value, the moisture meter indicating scale is called “conventional scale.” The values indicated by the scale are dimensionless. [5.56(b)]

conversion table. – Any table, graph, slide rule, or other external device used to determine the moisture content from the value indicated by the moisture meter. [5.56(b)]

convex curve. – A change in the angle of inclination of a belt conveyor where the center of the curve is below the conveyor. [2.21]

conveyor stringers. – Support members for the conveyor on which the scale and idlers are mounted. [2.21]

correct. – A piece of equipment is “correct” when, in addition to being accurate, it meets all applicable specification requirements. Equipment that fails to meet any of the requirements for correct equipment is “incorrect.” (Also see “accurate.”) [Appendix A]

correction table. – Any table, graph, slide rule, or other external device used to determine the moisture content from the value indicated by the moisture meter when the indicated value is altered by a parameter not automatically corrected for in the moisture meter (for example, temperature or test weight). [5.56(b)]

counterbalance weight(s). – One intended for application near the butt of a weighbeam for zero-load balancing purposes. [2.20]

counterpoise weight(s). – A slotted or “hanger” weight intended for application near the tip of the weighbeam of a scale having a multiple greater than one. [2.20]

coupled-in-motion railroad weighing system. – A device and related installation characteristics consisting of (1) the associated approach trackage, (2) the scale (i.e., the weighing element, the load-receiving element, and the indicating element with its software), and (3) the exit trackage, which permit the weighing of railroad cars coupled in motion. [2.20, 2.23]

(Added 1992)

crane scale. – One with a nominal capacity of 5000 pounds or more designed to weigh loads while they are suspended freely from an overhead, track-mounted crane. [2.20]

cryogenic liquid-measuring device. – A system including a liquid-measuring element designed to measure and deliver cryogenic liquids in the liquid state. [3.34]

(Amended 1986 and 2003)

cryogenic liquids. – Fluids whose normal boiling point is below 120 kelvin ($-243\text{ }^{\circ}\text{F}$). [3.34]

cubic foot, gas. – The amount of a cryogenic liquid in the gaseous state at a temperature of $70\text{ }^{\circ}\text{F}$ and under a pressure of 14.696 lb/in^2 absolute that occupies one cubic foot (1 ft^3). (See NTP.) [3.34]

D

“d,” dimension division value. – The smallest increment that the device displays for any axis and length of object in that axis. [5.58]

d, value scale division. – See “scale division, value of (d).” [2.20, 2.22]

D_{max} (maximum load of the measuring range). – Largest value of a quantity (mass) which is applied to a load cell during test or use. This value shall not be greater than E_{max} . [2.20]

(Added 2005)

D_{min} (minimum load of the measuring range). – Smallest value of a quantity (mass) which is applied to a load cell during test or use. This value shall not be less than E_{min} . [2.20]

(Added 2006)

dairy-product-test scale. – A scale used in determining the moisture content of butter and/or cheese or in determining the butterfat content of milk, cream, or butter. [2.20]

decimal submultiples. – Parts obtained by successively dividing by the number 10. Thus 0.1, 0.01, 0.001, and so on are decimal submultiples. [1.10]

decreasing-load test. – A test for automatic-indicating scales only, wherein the performance of the scale is tested as the load is reduced. [2.20, 2.22]

(Amended 1987)

deficiency. – See “excess and deficiency.” [1.10]

diesel gallon equivalent (DGE). – Diesel gallon equivalent (DGE) means 6.384 pounds of compressed natural gas or 6.059 pounds of liquefied natural gas. [3.37]

(Added 2016)

digital type. – A system of indication or recording of the selector type or one that advances intermittently in which all values are presented digitally, or in numbers. In a digital indicating or recording element, or in digital representation, there are no graduations. [1.10]

dimensional weight (or dim, weight). – A value computed by dividing the object’s volume by a conversion factor; it may be used for the calculation of charges when the value is greater than the actual weight. [5.58]

(Added 2004)

direct sale. – A sale in which both parties in the transaction are present when the quantity is being determined. An unattended automated or customer-operated weighing or measuring system is considered to represent the device/business owner in transactions involving an unattended device. [1.10]

(Amended 1993)

discharge hose. – A flexible hose connected to the discharge outlet of a measuring device or its discharge line. [3.30, 3.31, 3.32, 3.34, 3.37, 3.38, 3.39]

(Added 1987) (Code References Amended 2019)

discharge line. – A rigid pipe connected to the outlet of a measuring device. [3.30, 3.31, 3.32, 3.34, 3.37, 3.39]

(Added 1987) (Code References Amended 2019)

discrimination (of an automatic-indicating scale). – The value of the test load on the load-receiving element of the scale that will produce a specified minimum change of the indicated or recorded value on the scale. [2.20, 2.22]

dispenser. – See motor-fuel device. [3.30, 3.37]

distributed-car test train. – A train consisting of cars weighed first on a reference scale, cars coupled consecutively in groups at different locations within the train, then run over the coupled-in-motion railway track scale under test. The groups are typically placed at the front, middle, and rear of the train. [2.20]

(Added 1990)

dry hose. – A discharge hose intended to be completely drained at the end of each delivery of product. (Also see “dry-hose type.”) [3.30, 3.31]

(Amended 2002)

dry-hose type. – A type of device in which it is intended that the discharge hose be completely drained following the mechanical operations involved in each delivery. (Also see “dry hose.”) [3.30, 3.31, 3.34, 3.35]

dynamic monorail weighing system. – A weighing system which employs hardware or software to compensate for dynamic effects from the load or the system that do not exist in static weighing, in order to provide a stable indication. Dynamic factors may include shock or impact loading, system vibrations, oscillations, etc., and can occur even when the load is not moving across the load-receiving element. [2.20]

(Added 1999)

E

e, value of verification scale division. – See “verification scale division, value of (e).” [2.20]

E_{max} (maximum capacity). – Largest value of a quantity (mass) which may be applied to a load cell without exceeding the mpe. [2.20]

(Added 2005)

E_{min} (minimum dead load). – Smallest value of a quantity (mass) which may be applied to a load cell during test or use without exceeding the mpe. [2.20]

(Added 2006)

e_{min} (minimum verification scale division). – The smallest scale division for which a weighing element complies with the applicable requirements. [2.20, 2.21, 2.24]

(Added 1997)

electronic link. – An electronic connection between the weighing/load-receiving or other sensing element and indicating element where one recognizes the other and neither can be replaced without calibration. [2.20]

(Added 2001)

element. – A portion of a weighing or measuring device or system which performs a specific function and can be separated, evaluated separately, and is subject to specified full or partial error limits.

(Added 2002)

equal-arm scale. – A scale having only a single lever with equal arms (that is, with a multiple of one), equipped with two similar or dissimilar load-receiving elements (pan, plate, platter, scoop, or the like), one intended to receive material being weighed and the other intended to receive weights. There may or may not be a weighbeam. [2.20]

equipment, commercial. – Weights, measures, and weighing and measuring devices, instruments, elements, and systems or portion thereof, used or employed in establishing the measurement or in computing any basic charge or payment for services rendered on the basis of weight or measure. As used in this definition, measurement includes the determination of size, quantity, value, extent, area, composition (limited to meat and poultry), constituent value (for grain), or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award. [1.10, 2.20, 2.21, 2.22, 2.24, 3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 4.40, 5.51, 5.56(a), 5.56(b), 5.57, 5.58, 5.59]

(Added 2008) (Code References Amended 2019)

event counter. – A non-resettable counter that increments once each time the mode that permits changes to sealable parameters is entered and one or more changes are made to sealable calibration or configuration parameters of a device. [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.56(b), 5.57, 5.58]

(Added 1993) (Code References Amended 2019)

event logger. – A form of audit trail containing a series of records where each record contains the number from the event counter corresponding to the change to a sealable parameter, the identification of the parameter that was changed, the time and date when the parameter was changed, and the new value of the parameter. [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.56(b), 5.57, 5.58]

(Added 1993) (Code References Amended 2019)

excess and deficiency. – When an instrument or device is of such a character that it has a value of its own that can be determined, its error is said to be “in excess” or “in deficiency,” depending upon whether its actual value is, respectively, greater or less than its nominal value. (Also see “nominal.”) Examples of instruments having errors “in excess” are: a linear measure that is too long; a liquid measure that is too large; and a weight that is “heavy.” Examples of instruments having errors “in deficiency” are: a lubricating-oil bottle that is too small; a vehicle tank compartment that is too small; and a weight that is “light.” [1.10]

extras. – Charges to be paid by a passenger in addition to the fare, including any charge at a flat rate for the transportation of passengers in excess of a stated number and any charge for the transportation of baggage. [5.54]

F

face. – That side of a taximeter on which passenger charges are indicated. [5.54]

face. – That portion of a computing-type pump or dispenser which displays the actual computation of price per unit, delivered quantity, and total sale price. In the case of some electronic displays, this may not be an integral part of the pump or dispenser. [3.30]

(Added 1987)

fare. – That portion of the charge for the hire of a vehicle that is automatically calculated by a taximeter through the operation of the distance and/or time mechanism. [5.54]

farm milk tank. – A unit for measuring milk or other fluid dairy product, comprising a combination of (1) a stationary or portable tank, whether or not equipped with means for cooling its contents, (2) means for reading the level of liquid in the tank, such as a removable gauge rod or a surface gauge, and (3) a chart for converting level-of-liquid readings to volume; or such a unit in which readings are made on a gauge rod or surface gauge directly in terms of volume. Each compartment of a subdivided tank shall, for purposes of this code, be construed to be a “farm milk tank.” [4.43]

feeding mechanism. – The means for depositing material to be weighed on the belt conveyor. [2.21]

ft³/h. – Cubic feet per hour. [3.33]

fifth wheel. – A commercially-available distance-measuring device which, after calibration, is recommended for use as a field transfer standard for testing the accuracy of taximeters and odometers on rented vehicles. [5.53, 5.54]

fifth-wheel test. – A distance test similar to a road test, except that the distance traveled by the vehicle under test is determined by a mechanism known as a “fifth wheel” that is attached to the vehicle and that independently measures and indicates the distance. [5.53, 5.54]

flat rate. – A rate selection that when applied results in the indication of a fixed (non-incrementing) amount for passenger charges. This rate shall be included on the statement of established rates that is required to be posted in the vehicle. [5.54.]

(Added 2016)

fractional bar. – A weighbeam bar of relatively small capacity for obtaining indications intermediate between notches or graduations on a main or tare bar. [2.20]

G

gasoline gallon equivalent (GGE). – Gasoline gallon equivalent (GGE) means 5.660 pounds of compressed natural gas. [3.37]

(Added 1994) (Amended 2016)

gauge pressure. – The difference between the pressure at the meter and the atmospheric pressure (psi). [3.33]

gauge rod. – A graduated, “dip-stick” type of measuring rod designed to be partially immersed in the liquid and to be read at the point where the liquid surface crosses the rod. [4.42]

gauging. – The process of determining and assigning volumetric values to specific graduations on the gauge or gauge rod that serve as the basis for the tank volume chart. [4.42]

graduated interval. – The distance from the center of one graduation to the center of the next graduation in a series of graduations. (Also see “value of minimum graduated interval.”) [1.10]

graduation. – A defining line or one of the lines defining the subdivisions of a graduated series. The term includes such special forms as raised or indented or scored reference “lines” and special characters such as dots. (Also see “main graduation” and “subordinate graduation.”) [1.10]

grain class. – Different grains within the same grain type. For example, there are six classes for the grain type “wheat:” Durum Wheat, Hard Red Spring Wheat, Hard Red Winter Wheat, Soft Red Winter Wheat, Hard White Wheat, and Soft White Wheat. [5.56(a), 5.57]

(Added 2007)

grain hopper scale. – One adapted to the weighing of individual loads of varying amounts of grain. [2.20]

grain moisture meter. – Any device indicating either directly or through conversion tables and/or correction tables the moisture content of cereal grains and oil seeds. Also termed “moisture meter.” [5.56(a), 5.56(b)]

grain sample. – That portion of grain or seed taken from a bulk quantity of grain or seed to be bought or sold and used to determine the moisture content of the bulk. [5.56(a), 5.56(b)]

grain-test scale. – A scale adapted to weighing grain samples used in determining moisture content, dockage, weight per unit volume, etc. [2.20]

grain type. – See “kind of grain.” [5.56(a), 5.57]

(Added 2007)

gravity discharge. – A type of device designed for discharge by gravity. [3.30, 3.31]

H

head pulley. – The pulley at the discharge end of the belt conveyor. The power drive to drive the belt is generally applied to the head pulley. [2.21]

hexahedron. – A geometric solid (i.e., box) with six rectangular or square plane surfaces. [5.58]

(Added 2008)

hired. – A taximeter is “hired” when it is operative with respect to all applicable indications of fare or extras. The indications of fare include time and distance where applicable unless qualified by another indication of “Time Not Recording” or an equivalent expression. [5.54]

hopper scale. – A scale designed for weighing bulk commodities whose load-receiving element is a tank, box, or hopper mounted on a weighing element. (Also see “automatic hopper scale,” “grain hopper scale,” and “construction materials hopper scale.”) [2.20]

I

idlers or idler rollers. – Freely turning cylinders mounted on a frame to support the conveyor belt. For a flat belt, the idlers consist of one or more horizontal cylinders transverse to the direction of belt travel. For a troughed belt, the idlers consist of one or more horizontal cylinders and one or more cylinders at an angle to the horizontal to lift the sides of the belt to form a trough. [2.21]

idler space. – The center-to-center distance between idler rollers measured parallel to the belt. [2.21]

increasing-load test. – The normal basic performance test for a scale in which observations are made as increments of test load are successively added to the load-receiving element of the scale. [2.20, 2.22]

increment. – The value of the smallest change in value that can be indicated or recorded by a digital device in normal operation. [1.10]

index of an indicator. – The particular portion of an indicator that is directly utilized in making a reading. [1.10]

indicating element. – An element incorporated in a weighing or measuring device by means of which its performance relative to quantity or money value is “read” from the device itself as, for example, an index-and-graduated-scale combination, a weighbeam-and-poise combination, a digital indicator, and the like. (Also see “primary indicating or recording element.”) [1.10]

indicator, balance. – See “balance indicator.” [2.20]

initial distance or time interval. – The interval corresponding to the initial money drop. [5.54]

initial zero-setting mechanism. – See “initial zero-setting mechanism” under “zero-setting mechanism.” [2.20]
(Added 1990)

in-service light indicator. – A light used to indicate that a timing device is in operation. [5.55]

integrator. – A device used with a belt-conveyor scale that combines conveyor belt load (e.g., lb/ft) and belt travel (e.g., feet) to produce a total weight of material passing over the belt-conveyor scale. An integrator may be a separate, detached mechanism or may be a component within a totalizing device. (Also see “master weight totalizer.”) [2.21]
(Added 2013)

interval, clear, between graduations. – See “clear interval between graduations.” [1.10]

interval, graduated. – See “graduated interval.” [1.10]

irregularly-shaped object. – Any object that is not a hexahedron shape. [5.58]
(Added 2008)

J

jewelers’ scale. – One adapted to weighing gems and precious metals. [2.20]

K

kind of grain. – Corn as distinguished from soybeans as distinguished from wheat, etc. [5.56(a), 5.56(b)]

L

label. – A printed ticket, to be attached to a package, produced by a printer that is a part of a prepackaging scale or that is an auxiliary device. [2.20]

large-delivery device. – Devices used primarily for single deliveries greater than 200 gallons, 2000 pounds, 20 000 cubic feet, 2000 liters, or 2000 kilograms. [3.34, 3.38]

laundry-drier timer. – A timer used in conjunction with a coin-operated device to measure the period of time that a laundry drier is in operation. [5.55]

liquefied petroleum gas. – A petroleum product composed predominantly of any of the following hydrocarbons or mixtures thereof: propane, propylene, butanes (normal butane or isobutane), and butylenes. [3.31, 3.32, 3.33, 3.34, 3.37]

liquefied petroleum gas liquid-measuring device. – A system including a mechanism or machine of the meter type designed to measure and deliver liquefied petroleum gas in the liquid state by a definite quantity, whether installed in a permanent location or mounted on a vehicle. Means may or may not be provided to indicate automatically, for one of a series of unit prices, the total money value of the liquid measured. [3.33]
(Amended 1987)

liquefied petroleum gas vapor-measuring device. – A system including a mechanism or device of the meter type, equipped with a totalizing index, designed to measure and deliver liquefied petroleum gas in the vapor state by definite volumes, and generally installed in a permanent location. The meters are similar in construction and operation to the conventional natural- and manufactured-gas meters. [3.33]

liquid fuel. – Any liquid used for fuel purposes, that is, as a fuel, including motor-fuel. [3.30, 3.31]

liquid-fuel device. – A device designed for the measurement and delivery of liquid fuels. [3.30]

liquid-measuring device. – A mechanism or machine designed to measure and deliver liquid by definite volume. Means may or may not be provided to indicate automatically, for one of a series of unit prices, the total money value of the liquid measured, or to make deliveries corresponding to specific money values at a definite unit price. [3.30]

liquid volume correction factor. – A correction factor used to adjust the liquid volume of a cryogenic product at the time of measurement to the liquid volume at NBP. [3.34]

livestock scale. – A scale equipped with stock racks and gates and adapted to weighing livestock standing on the scale platform. [2.20]

(Amended 1989)

load cell. – A device, whether electric, hydraulic, or pneumatic, that produces a signal (change in output) proportional to the load applied. [2.20, 2.21, 2.23]

load cell verification interval (v). – The load cell interval, expressed in units of mass, used in the test of the load cell for accuracy classification. [2.20, 2.21]

(Added 1996)

loading point. – A location on a conveyor where the material is received by the belt. The location of the discharge from a hopper, chute, or pre-feed device used to supply material to a conveyor. [2.21]

(Amended 2013)

load-receiving element. – That element of a scale that is designed to receive the load to be weighed; for example, platform, deck, rail, hopper, platter, plate, scoop. [2.20, 2.21, 2.23]

location services. – Any of the various technologies used to determine the geographical location of a receiving unit in or physically attached to a vehicle. These technologies may include but are not limited to: global positioning services; cellular networks; or wi-fi networks. [5.54]

(Added 2017)

low-flame test. – A test simulating extremely low-flow rates such as caused by pilot lights. [3.33]

lubricant device. – A device designed for the measurement and delivery of liquid lubricants, including, but not limited to, heavy gear lubricants and automatic transmission fluids (automotive). [3.30]

M

m³/h. – Cubic meters per hour. [3.33]

main bar. – A principal weighbeam bar, usually of relatively large capacity as compared with other bars of the same weighbeam. (On an automatic-indicating scale equipped with a weighbeam, the main weighbeam bar is frequently called the “capacity bar.”) [2.20]

main graduation. – A graduation defining the primary or principal subdivisions of a graduated series. (Also see “graduation.”) [1.10]

main-weighbeam elements. – The combination of a main bar and its fractional bar, or a main bar alone if no fractional bar is associated with it. [2.20]

manual zero-setting mechanism. – See “manual zero-setting mechanism” under “zero-setting mechanism.” [2.20]

manufactured device. – Any commercial weighing or measuring device shipped as new from the original equipment manufacturer. [1.10]

(Amended 2001)

mass flow meter. – A device that measures the mass of a product flowing through the system. The mass measurement may be determined directly from the effects of mass on the sensing unit or may be inferred by measuring the properties of the product, such as the volume, density, temperature, or pressure, and displaying the quantity in mass units. [3.37]

master meter test method. – A method of testing milk tanks that utilizes an approved master meter system for measuring test liquid removed from or introduced into the tank. [4.42]

master weight totalizer. – A primary indicating element used with a belt-conveyor scale that incorporates the function of an integrator to indicate the totalized weight of material passed over the scale. (Also see “integrator.”) [2.21]

(Amended 2013)

material test. – The test of a belt-conveyor scale using material (preferably that for which the device is normally used) that has been weighed to an accuracy of 0.1 %. [2.21]

(Amended 1989)

maximum capacity. – The largest load that may be accurately weighed. [2.20, 2.24]

(Added 1999)

maximum cargo load. – The maximum cargo load for trucks is the difference between the manufacturer’s rated gross vehicle weight and the actual weight of the vehicle having no cargo load. [5.53]

measurement field. – A region of space or the measurement pattern produced by the measuring instrument in which objects are placed or passed through, either singly or in groups, when being measured by a single device. [5.58]

measuring element. – That portion of a complete multiple dimension measuring device that does not include the indicating element. [5.58]

meter register. – An observation index for the cumulative reading of the gas flow through the meter. In addition there are one or two proving circles in which one revolution of the test hand represents ½, 1, 2, 5, or 10 cubic feet, or 0.025, 0.05, 0.1, 0.2, or 0.25 cubic meter, depending on meter size. If two proving circles are present, the circle representing the smallest volume per revolution is referred to as the “leak-test circle.” [3.33]

metrological integrity (of a device). – The design, features, operation, installation, or use of a device that facilitates (1) the accuracy and validity of a measurement or transaction, (2) compliance of the device with weights and measures requirements, or (3) the suitability of the device for a given application. [1.10, 2.20]

(Added 1993)

minimum capacity. – The smallest load that may be accurately weighed. The weighing results may be subject to excessive error if used below this value. [2.20, 2.24]

(Added 1999)

minimum clear interval. – The shortest distance between adjacent graduations when the graduations are not parallel. (Also see “clear interval.”) [3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.36, 3.38, 5.50, 5.51, 5.56(b)]

minimum delivery. – The least amount of weight that is to be delivered as a single weighing by a belt-conveyor scale system in normal use. [2.21]

minimum load cell verification interval. – *See* v_{\min}

minimum measured quantity (MMQ). – The smallest quantity delivered for which the measurement is to within the applicable tolerances for that system. [3.37, 3.39]

(Added 2019)

minimum tolerance. – Minimum tolerances are the smallest tolerance values that can be applied to a scale. Minimum tolerances are determined on the basis of the value of the minimum graduated interval or the nominal or reading face capacity of the scale. (Also see definition for basic tolerances.) [2.20, 2.22, 2.24]

minimum totalized load. – The least amount of weight for which the scale is considered to be performing accurately. [2.21]

moisture content (wet basis). – The mass of water in a grain or seed sample (determined by the reference method) divided by the mass of the grain or seed sample expressed as a percentage (%). [5.56(a), 5.56(b)]

money drop. – An increment of fare indication. The “initial money drop” is the first increment of fare indication following activation of the taximeter. [5.54]

money-operated type. – A device designed to be released for service by the insertion of money, or to be actuated by the insertion of money to make deliveries of product. [1.10]

motor-fuel. – Liquid used as fuel for internal-combustion engines. [3.30]

motor-fuel device or motor-fuel dispenser or retail motor-fuel device. – A device designed for the measurement and delivery of liquids used as fuel for internal-combustion engines. The term “motor-fuel dispenser” means the same as “motor-fuel device”; the term “retail motor-fuel device” applies to a unique category of device. (Also see definition of “retail device.”) [3.30, 3.32, 3.37]

multi-class. – A description of a grouping of grain classes, from the same grain type, in one calibration. A multi-class grain calibration may include (1) all the classes of a grain type (all-class calibration), or (2) some of the classes of a grain type within the calibration. [5.56(a), 5.57.]

(Added 2007)

multi-interval scale. – A scale having one weighing range which is divided into partial weighing ranges (segments), each with different scale intervals, with each partial weighing range (segment) determined automatically according to the load applied, both on increasing and decreasing loads. [2.20]

(Added 1995)

multi-jet water meter. – A water meter in which the moving element takes the form of a multiblade rotor mounted on a vertical spindle within a cylindrical measuring chamber. The liquid enters the measuring chamber through several tangential orifices around the circumference and leaves the measuring chamber through another set of tangential orifices placed at a different level in the measuring chamber. These meters register by recording the revolutions of a rotor set in motion by the force of flowing water striking the blades. [3.36]

(Added 2003)

multiple. – An integral multiple; that is, a result obtained by multiplying by a whole number. (Also see “multiple of a scale.”) [1.10]

multiple cell application load cell. – A load cell intended for use in a weighing system which incorporates more than one load cell. A multiple cell application load cell is designated with the letter “M” or the term “Multiple.” (Also see “single cell application load cell.”) [2.20]

(Added 1999)

multiple range scale. – A scale having two or more weighing ranges with different maximum capacities and different scale intervals for the same load receptor, each range extending from zero to its maximum capacity. [2.20]

(Added 1995)

multiple of a scale. – In general, the multiplying power of the entire system of levers or other basic weighing elements. (On a beam scale, the multiple of the scale is the number of pounds on the load-receiving element that will be counterpoised by one pound applied to the tip pivot of the weighbeam.) [2.20]

multi-revolution scale. – An automatic-indicating scale having a nominal capacity that is a multiple of the reading-face capacity and that is achieved by more than one complete revolution of the indicator. [2.20]

multiple-tariff taximeter. – One that may be set to calculate fares at any one of two or more rates. [5.54]

N

NBP. – Normal Boiling Point of a cryogenic liquid at 14.696 lb/in² absolute. [3.34]

NTP. – Normal Temperature and Pressure of a cryogen at a temperature of 21 °C (70 °F) and a pressure of 101.325 kPa (14.696 lb/in² absolute). [3.34]

NTP density and volume correction factor. – A correction factor used to adjust the liquid volume of a cryogenic product at the time of measurement to the gas equivalent at NTP. [3.34]

natural gas. – A gaseous fuel, composed primarily of methane, that is suitable for compression and dispensing into a fuel storage container(s) for use as an engine fuel. [3.37]

(Added 1994)

negotiated rate. – A rate selection that, when applied, results in a fixed (non-incrementing) amount for passenger charges and is based on a value that has been agreed upon by the operator and passenger. [5.54]

(Added 2016)

n_{max} (maximum number of scale divisions). – The maximum number of scale divisions for which a main element or load cell complies with the applicable requirements. The maximum number of scale divisions permitted for an installation is limited to the lowest n_{max} marked on the scale indicating element, weighing element, or load cell. [2.20, 2.21, 2.24]

(Added 1997)

no-load reference value. – A positive weight value indication with no load in the load-receiving element (hopper) of the scale. (Used with automatic bulk-weighing systems and certain single-draft, manually-operated receiving hopper scales installed below grade and used to receive grain.) [2.20]

nominal. – Refers to “intended” or “named” or “stated,” as opposed to “actual.” For example, the “nominal” value of something is the value that it is supposed or intended to have, the value that it is claimed or stated to have, or the value by which it is commonly known. Thus, “1-pound weight,” “1-gallon measure,” “1-yard indication,” and “500-pound scale” are statements of nominal values; corresponding actual values may be greater or lesser. (Also see nominal capacity of a scale.) [1.10]

nominal capacity. – The nominal capacity of a scale is (a) the largest weight indication that can be obtained by the use of all of the reading or recording elements in combination, including the amount represented by any removable

weights furnished or ordinarily furnished with the scale, but excluding the amount represented by any extra removable weights not ordinarily furnished with the scale, and excluding also the capacity of any auxiliary weighing attachment not contemplated by the original design of the scale, and excluding any fractional bar with a capacity less than 2½ % of the sum of the capacities of the remaining reading elements, or (b) the capacity marked on the scale by the manufacturer, whichever is less. (Also see “nominal capacity, batching scale”; “nominal capacity, hopper scale.”) [2.20]

nominal capacity, batching scale. – The nominal capacity of a batching scale is the capacity as marked on the scale by the scale manufacturer, or the sum of the products of the volume of each of the individual hoppers, in terms of cubic feet, times the weight per cubic foot of the heaviest material weighed in each hopper, whichever is less. [2.20]

nominal capacity, hopper scale. – The nominal capacity of a hopper scale is the capacity as marked on the scale by the scale manufacturer, or the product of the volume of the hopper in bushels or cubic feet times the maximum weight per bushel or cubic foot, as the case may be, of the commodity normally weighed, whichever is less. [2.20]

non-automatic checkweigher. – A weighing instrument that requires the intervention of an operator during the weighing process, used to subdivide items of different weights into one or more subgroups, such as identifying packages that have acceptable or unacceptable fill levels according to the value of the difference between their weight and a pre-determined set point. [2.24]

Notes: Determining the weighing result includes any intelligent action of the operator that affects the result, such as deciding and taking an action when an indication is stable or adjusting the weight of the weighed load.

Deciding the weighing result is acceptable means making a decision regarding the acceptance of each weighing result on observing the indication or releasing a print-out. The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable.

(Added 2004)

non-automatic weighing instrument. – A weighing instrument or system that requires the intervention of an operator during the weighing process to determine the weighing result or to decide that it is acceptable. [2.20, 2.24]

Notes: Determining the weighing result includes any intelligent action of the operator that affects the result, such as deciding and taking an action when an indication is stable or adjusting the weight of the weighed load.

Deciding the weighing result is acceptable means making a decision regarding the acceptance of each weighing result on observing the indication or releasing a print-out. The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable.

(Added 2004) (Amended 2005)

non-resettable totalizer. – An element interfaced with the measuring or weighing element that indicates the cumulative registration of the measured quantity with no means to return to zero. [3.30, 3.37, 3.39]

(Added 2019)

nonretroactive. – “Nonretroactive” requirements are enforceable after the effective date for:

1. devices manufactured within a state after the effective date;
2. both new and used devices brought into a state after the effective date; and
3. devices used in noncommercial applications which are placed into commercial use after the effective date.

Nonretroactive requirements are not enforceable with respect to devices that are in commercial service in the state as of the effective date or to new equipment in the stock of a manufacturer or a dealer in the state as of the effective date. (*Nonretroactive requirements are printed in italic type.*) [1.10]

(Amended 1989)

nose-iron. – A slide-mounted, manually-adjustable pivot assembly for changing the multiple of a lever. [2.20]

notes. – A section included in each of a number of codes, containing instructions, pertinent directives, and other specific information pertaining to the testing of devices. Notes are primarily directed to weights and measures officials.

O

odometer. – A device that automatically indicates the total distance traveled by a vehicle. For the purpose of this code, this definition includes hub odometers, cable-driven odometers, and the distance-indicating or odometer portions of “speedometer” assemblies for automotive vehicles. [5.53]

official grain samples. – Grain or seed used by the official as the official transfer standard from the reference standard method to test the accuracy and precision of grain moisture meters. [5.56(a), 5.56(b)]

official with statutory authority. – The representative of the jurisdiction(s) responsible for certifying the accuracy of the device. [2.20, 2.21, 2.22]

(Added 1991)

operating tire pressure. – The pressure in a tire immediately after a vehicle has been driven for at least 5 miles or 8 kilometers. [5.53, 5.54]

over-and-under indicator. – An automatic-indicating element incorporated in or attached to a scale and comprising an indicator and a graduated scale with a central or intermediate “zero” graduation and a limited range of weight graduations on either side of the zero graduation, for indicating weights greater than and less than the predetermined values for which other elements of the scale may be set. (A scale having an over-and-under indicator is classed as an automatic-indicating scale.) [2.20]

overregistration and underregistration. – When an instrument or device is of such a character that it indicates or records values as a result of its operation, its error is said to be in the direction of overregistration or underregistration, depending upon whether the indications are, respectively, greater or less than they should be. Examples of devices having errors of “overregistration” are: a fabric-measuring device that indicates more than the true length of material passed through it; and a liquid-measuring device that indicates more than the true amount of the liquid delivered by the device. Examples of devices having errors of “underregistration” are: a meter that indicates less than the true amount of product that it delivers; and a weighing scale that indicates or records less than the true weight of the applied load. [1.10]

P

parallax. – The apparent displacement, or apparent difference in height or width, of a graduation or other object with respect to a fixed reference, as viewed from different points. [1.10]

parking meter. – A coin-operated device for measuring parking time for vehicles. [5.55]

passenger vehicles. – Vehicles such as automobiles, recreational vehicles, limousines, ambulances, and hearses. [5.53]

performance requirements. – Performance requirements include all tolerance requirements and, in the case of nonautomatic-indicating scales, sensitivity requirements (SR). (Also see definitions for “tolerance” and “sensitivity requirement.”) [1.10]

point-of-sale system. – An assembly of elements including a weighing or measuring element, an indicating element, and a recording element (and may also be equipped with a “scanner”) used to complete a direct sales transaction. The system components, when operated together, must be capable of the following:

1. determining the weight or measure of a product or service offered;
2. calculating a charge for the product or service based on the weight or measure and an established price/rate structure;
3. determining a total cost that includes all associated charges involved with the transaction; and
4. providing a sales receipt.

[2.20, 3.30, 3.32, 3.37, 3.39]

(Added 1986) (Amended 1997 and 2015) (Code References Amended 2019)

poise. – A movable weight mounted upon or suspended from a weighbeam bar and used in combination with graduations, and frequently with notches, on the bar to indicate weight values. (A suspended poise is commonly called a “hanging poise.”) [2.20]

postal scale. – A scale (usually a computing scale) designed for use to determine shipping weight or delivery charges for letters or parcels delivered by the U.S. Postal Service or private shipping companies. A weight classifier may be used as a postal scale. [2.20]

(Added 1987)

prepackaging scale. – A computing scale specially designed for putting up packages of random weights in advance of sale. [2.20]

prescription scale. – A scale or balance adapted to weighing the ingredients of medicinal and other formulas prescribed by physicians and others and used or intended to be used in the ordinary trade of pharmacists. [2.20]

pressure type (device). – A type of device designed for operation with the liquid under artificially produced pressure. [3.30, 3.31]

primary indicating or recording elements. – The term “primary” is applied to those principal indicating (visual) elements and recording elements that are designed to, or may, be used by the operator in the normal commercial use of a device. The term “primary” is applied to any element or elements that may be the determining factor in arriving at the sale representation when the device is used commercially. (Examples of primary elements are the visual indicators for meters or scales not equipped with ticket printers or other recording elements and both the visual indicators and the ticket printers or other recording elements for meters or scales so equipped.) The term “primary” is not applied to such auxiliary elements as, for example, the totalizing register or predetermined-stop mechanism on a meter or the means for producing a running record of successive weighing operations, these elements being supplementary to those that are the determining factors in sales representations of individual deliveries or weights. (Also see “indicating element” and “recording element.”) [1.10]

prover method. – A method of testing milk tanks that utilizes approved volumetric prover(s) for measuring the test liquid removed from or introduced into the tank. [4.42]

prover oil. – A light oil of low vapor pressure used as a sealing medium in bell provers, cubic-foot bottles, and portable cubic-foot standards. [3.33]

proving indicator. – The test hand or pointer of the proving or leak-test circle on the meter register or index. [3.33, 3.36.]

R

“r” factor. – A computation for determining the suitability of a vehicle scale for weighing vehicles with varying axle configurations. The factor was derived by dividing the weights in FHWA Federal Highway Bridge Gross Weight Table B by 34 000 lbs. (The resultant factors are contained in Table UR.3.2.1.) [2.20]

radio frequency interference (RFI). – Radio frequency interference is a type of electrical disturbance that, when introduced into electronic and electrical circuits, may cause deviations from the normally expected performance. [1.10]

random error(s). – The sample standard deviation of the error (indicated values) for a number of consecutive automatic weighings of a load, or loads, passed over the load receptor, shall be expressed mathematically as:

$$s = \sqrt{\frac{1}{n-1} \sum (x_i - \bar{x})^2} \quad \text{or} \quad s = \sqrt{\frac{1}{n-1} \left(\sum x_i^2 - \frac{(\sum x_i)^2}{n} \right)}$$

where: x = error of a load indication
 n = the number of loads

[2.24]

ranges, weight. – See “weight ranges.” [2.20]

rated capacity. – The rate of flow in cubic meters per hour of a hydrocarbon gas vapor-measuring device as recommended by the manufacturer. This rate of flow should cause a pressure drop across the meter not exceeding ½-inch water column. [3.33]

rated scale capacity. – That value representing the weight that can be delivered by the device in one hour. [2.21]

ratio test. – A test to determine the accuracy with which the actual multiple of a scale agrees with its designed multiple. This test is used for scales employing counterpoise weights and is made with standard test weights substituted in all cases for the weights commercially used on the scale. (It is appropriate to use this test for some scales not employing counterpoise weights.) [2.20]

reading face. – That portion of an automatic-indicating weighing or measuring device that gives a visible indication of the quantity weighed or measured. A reading face may include an indicator and a series of graduations or may present values digitally, and may also provide money-value indications. [1.10, 2.20]

(Amended 2005)

reading-face capacity. – The largest value that may be indicated on the reading face, exclusive of the application or addition of any supplemental or accessory elements. [1.10]

recorded representation. – The printed, embossed, or other representation that is recorded as a quantity by a weighing or measuring device. [1.10]

recording element. – An element incorporated in a weighing or measuring device by means of which its performance relative to quantity or money value is permanently recorded on a tape, ticket, card, or the like, in the form of a printed, stamped, punched, or perforated representation. [1.10, 2.21]

recording scale. – One on which the weights of applied loads may be permanently recorded on a tape, ticket, card, or the like in the form of a printed, stamped, punched, or perforated representation. [2.20]

reference weight car. – A railcar that has been statically weighed for temporary use as a mass standard over a short period of time, typically the time required to test one scale.

Note: A test weight car that is representative of the types of cars typically weighed on the scale under test may be used wherever reference weight cars are specified. [2.20]

(Added 1991) (Amended 2012)

remanufactured device. – A device that is disassembled, checked for wear, parts replaced or fixed, reassembled and made to operate like a new device of the same type. [1.10]

(Added 2001)

remanufactured element. – An element that is disassembled, checked for wear, parts replaced or fixed, reassembled and made to operate like a new element of the same type. [1.10]

(Added 2001)

remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device. [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 5.54, 5.56(a), 5.58]

(Added 1993) (Code References Amended 2019)

repaired device. – A device to which work is performed that brings the device back into proper operating condition. [1.10]

(Added 2001)

repaired element. – An element to which work is performed that brings the element back into proper operating condition. [1.10]

(Added 2001)

retail device. – A measuring device primarily used to measure product for the purpose of sale to the end user. [3.30, 3.32, 3.37, 3.39]

(Amended 1987 and 2004) (Code References Amended 2019)

retroactive. – “Retroactive” requirements are enforceable with respect to all equipment. Retroactive requirements are printed herein in upright roman type. (Also see “nonretroactive.”) [1.10]

road test. – A distance test, over a measured course, of a complete taximeter assembly when installed on a vehicle, the mechanism being actuated as a result of vehicle travel. [5.53, 5.54]

rolling circumference. – The rolling circumference is the straight-line distance traveled per revolution of the wheel (or wheels) that actuates the taximeter or odometer. If more than one wheel actuates the taximeter or odometer, the rolling circumference is the average distance traveled per revolution of the actuating wheels. [5.53, 5.54]

S

scale. – See specific type of scale. [2.20]

scale area, belt-conveyor. – See belt-conveyor scale systems area. [2.21]

(Added 2001)

scale division, number of (n). – Quotient of the capacity divided by the value of the verification scale division. [2.20]

$$n = \frac{\text{Capacity}}{e}$$

scale division, value of (d). – The value of the scale division, expressed in units of mass, is the smallest subdivision of the scale for analog indication or the difference between two consecutively indicated or printed values for digital indication or printing. (Also see “verification scale division.”) [2.20, 2.22]

scale section. – A part of a vehicle, axle-load, livestock, or railway track scale consisting of two main load supports, usually transverse to the direction in which the load is applied. [2.20]

seal. – See “approval seal,” “security seal.” [1.10]

section capacity. – The section capacity of a scale is the maximum live load that may be divided equally on the load pivots or load cells of a section. [2.20]

(Added 2001)

section test. – A shift test in which the test load is applied over individual sections of the scale. This test is conducted to disclose the weighing performance of individual sections, since scale capacity test loads are not always available and loads weighed are not always distributed evenly over all main load supports. [2.20]

security means. – A method used to prevent access by other than qualified personnel, or to indicate that access has been made to certain parts of a scale that affect the performance of the device. [2.21]

security seal. – A uniquely identifiable physical seal, such as a lead-and-wire seal or other type of locking seal, a pressure-sensitive seal sufficiently permanent to reveal its removal, or similar apparatus attached to a weighing or measuring device for protection against or indication of access to adjustment. (Also see “approval seal.”) [1.10]

(Amended 1994)

selector-type. – A system of indication or recording in which the mechanism selects, by means of a ratchet-and-pawl combination or by other means, one or the other of any two successive values that can be indicated or recorded. [1.10]

semi-automatic zero-setting mechanism. – See “semi-automatic zero-setting mechanism” under “zero-setting mechanism.” [2.20]

sensitivity (of a nonautomatic-indicating scale). – The value of the test load on the load-receiving element of the scale that will produce a specified minimum change in the position of rest of the indicating element or elements of the scale. [2.20]

sensitivity requirement (SR). – A performance requirement for a non automatic-indicating scale; specifically, the minimum change in the position of rest of the indicating element or elements of the scale in response to the increase or decrease, by a specified amount, of the test load on the load-receiving element of the scale. [2.20]

shift test. – A test intended to disclose the weighing performance of a scale under off-center loading. [2.20]

side. – That portion of a pump or dispenser which faces the consumer during the normal delivery of product. [3.30]

(Added 1987)

simulated-road test. – A distance test during which the taximeter or odometer may be actuated by some means other than road travel. The distance traveled is either measured by a properly calibrated roller device or computed from rolling circumference and wheel-turn data. [5.53, 5.54]

simulated test. – A test using artificial means of loading the scale to determine the performance of a belt-conveyor scale. [2.21]

single cell application load cell. – A load cell intended for use in a weighing system which incorporates one or more load cells. A single cell application load cell is designated with the letter “S” or the term “Single.” (Also see “multiple cell application load cell.”) [2.20]

(Added 1999)

single-tariff taximeter. – One that calculates fares at a single rate only. [5.54]

skirting. – Stationary side boards or sections of belt conveyor attached to the conveyor support frame or other stationary support to prevent the bulk material from falling off the side of the belt. [2.21]

slow-flow meter. – A retail device designed for the measurement, at very slow rates (less than 40 L (10 gal) per hour), of liquid fuels at individual domestic installations. [3.30]

small-delivery device. – Any device other than a large-delivery device. [3.34, 3.38]

span (structural). – The distance between adjoining sections of a scale. [2.20]

(Added 1988)

specification. – A requirement usually dealing with the design, construction, or marking of a weighing or measuring device. Specifications are directed primarily to the manufacturers of devices. [1.10]

static monorail weighing system. – A weighing system in which the load being applied is stationary during the weighing operation. [2.20]

(Added 1999)

strain-load test. – The test of a scale beginning with the scale under load and applying known test weights to determine accuracy over a portion of the weighing range. The scale errors for a strain-load test are the errors observed for the known test loads only. The tolerances to be applied are based on the known test load used for each error that is determined. [2.20, 2.22]

subordinate graduation. – Any graduation other than a main graduation. (Also see “graduation.”) [1.10]

subsequent distance or time intervals. – The intervals corresponding to money drops following the initial money drop. [5.54]

substitution test. – A scale testing process used to quantify the weight of material or objects for use as a known test load. [2.20]

(Added 2003)

substitution test load. – The sum of the combination of field standard test weights and any other applied load used in the conduct of a test using substitution test methods. [2.20]

(Added 2003)

surface gauge. – A combination of (1) a stationary indicator, and (2) a movable, graduated element designed to be brought into contact with the surface of the liquid from above. [4.42]

systematic (average) error (\bar{x}). – The mean value of the error (of indication) for a number of consecutive automatic weighings of a load, or loads, passed over the load-receiving element (e.g., weigh-table), shall be expressed mathematically as:

$$\bar{x} = \frac{\sum x}{n}$$

where: x = error of a load indication
 n = the number of loads

[2.24]

T

tail pulley. – The pulley at the opposite end of the conveyor from the head pulley. [2.21]

take-up. – A device to provide sufficient tension in a conveyor belt so that the belt will be positively driven by the drive pulley. – A counter-weighted take-up consists of a pulley free to move in either the vertical or horizontal direction with dead weights applied to the pulley shaft to provide the tension required. [2.21]

tare mechanism. – A mechanism (including a tare bar) designed for determining or balancing out the weight of packaging material, containers, vehicles, or other materials that are not intended to be included in net weight determinations. [2.20]

tare-weighbeam elements. – The combination of a tare bar and its fractional bar, or a tare bar alone if no fractional bar is associated with it. [2.20]

taximeter. – A device that automatically calculates, at a predetermined rate or rates, and indicates the charge for hire of a vehicle. [5.54]

test chain. – A device used for simulated tests consisting of a series of rollers or wheels linked together in such a manner as to assure uniformity of weight and freedom of motion to reduce wear, with consequent loss of weight, to a minimum. [2.21]

test liquid. – The liquid used during the test of a device. [3.30, 3.31, 3.34, 3.35, 3.36, 3.37, 3.38]

test object. – An object whose dimensions are verified by appropriate reference standards and intended to verify compliance of the device under test with certain metrological requirements. [5.58]

test puck. – A metal, plastic, or other suitable object that remains stable for the duration of the test, used as a test load to simulate a package. Pucks can be made in a variety of dimensions and have different weights to represent a wide range of package sizes. Metal versions may be covered with rubber cushions to eliminate the possibility of damage to weighing and handling equipment. The puck mass is adjusted to an accuracy specified in N.1.2. Accuracy of Test Pucks or Packages. [2.24]

(Amended 2004)

test train. – A train consisting of or including reference weight cars and used to test coupled-in-motion railway track scales. The reference weight cars may be placed consecutively or distributed in different places within a train. [2.20]

(Added 1990) (Amended 1991)

test weight car. – A railroad car designed to be a stable mass standard to test railway track scales. The test weight car may be one of the following types: a self-contained composite car, a self-propelled car, or a standard rail car. [2.20]

(Added 1991)

testing. – An operation consisting of a series of volumetric determinations made to verify the accuracy of the volume chart that was developed by gauging. [4.42]

time recorder. – A clock-operated mechanism designed to record the time of day. Examples of time recorders are those used in parking garages to record the “in” and “out” time of day for parked vehicles. [5.55]

timing device. – A device used to measure the time during which a particular paid-for service is dispensed. Examples of timing devices are laundry driers, car-wash timers, parking meters, and parking-garage clocks and recorders. [5.55]

tolerance. – A value fixing the limit of allowable error or departure from true performance or value. (Also see “basic tolerances.”) [1.10]

training idlers. – Idlers of special design or mounting intended to shift the belt sideways on the conveyor to assure the belt is centered on the conveying idlers. [2.21]

transfer standard. – A measurement system designed for use in proving and testing cryogenic liquid-measuring devices. [3.38]

tripper. – A device for unloading a belt conveyor at a point between the loading point and the head pulley. [2.21]

U

uncoupled-in-motion railroad weighing system. – A device and related installation characteristics consisting of (1) the associated approach trackage, (2) the scale (i.e., the weighing element, the load-receiving element, and the indicating element with its software), and (3) the exit trackage, which permit the weighing of railroad cars uncoupled in motion. [2.20]

(Added 1993)

underregistration. – See “overregistration” and “underregistration.” [1.10]

unit price. – The price at which the product is being sold and expressed in whole units of measurement. [1.10, 2.20, 3.30, 3.31, 3.32, 3.37, 3.39]

(Added 1992) (Code References Amended 2019)

unit train. – A unit train is defined as a number of contiguous cars carrying a single commodity from one consignor to one consignee. The number of cars is determined by agreement among the consignor, consignee, and the operating railroad. [2.20]

unit weight. – One contained within the housing of an automatic-indicating scale and mechanically applied to and removed from the mechanism. The application of a unit weight will increase the range of automatic indication, normally in increments equal to the reading-face capacity. [2.20]

user requirement. – A requirement dealing with the selection, installation, use, or maintenance of a weighing or measuring device. User requirements are directed primarily to the users of devices. (Also see Introduction, Section D.) [1.10]

usual and customary. – Commonly or ordinarily found in practice or in the normal course of events and in accordance with established practices. [1.10]

utility-type water meter. – A device used for the measurement of water, generally applicable to meters installed in residences or business establishments. excluding batching meters. [3.36]

(Added 2011)

V

value of minimum graduated interval. – (1) The value represented by the interval from the center of one graduation to the center of the succeeding graduation. (2) The increment between successive recorded values. (Also see “graduated interval.”) [1.10]

vapor equalization credit. – The quantity deducted from the metered quantity of liquid carbon dioxide when a vapor equalizing line is used to facilitate the transfer of liquid during a metered delivery. [3.38]

vapor equalization line. – A hose or pipe connected from the vapor space of the seller’s tank to the vapor space of the buyer’s tank that is used to equalize the pressure during a delivery. [3.38]

vehicle on-board weighing system. – A weighing system designed as an integral part of or attached to the frame, chassis, lifting mechanism, or bed of a vehicle, trailer, industrial truck, industrial tractor, or forklift truck. [2.20]
(Amended 1993)

vehicle scale. – A scale adapted to weighing highway, farm, or other large industrial vehicles (except railroad freight cars), loaded or unloaded. [2.20]

verification scale division, value of (e). – A value, expressed in units of weight (mass) and specified by the manufacturer of a device, by which the tolerance values and the accuracy class applicable to the device are determined. The verification scale division is applied to all scales, in particular to ungraduated devices since they have no graduations. The verification scale division (e) may be different from the displayed scale division (d) for certain other devices used for weight classifying or weighing in pre-determined amounts, and certain other Class I and II scales. [2.20]

visible type. – A type of device in which the measurement takes place in a see-through glass measuring chamber. [3.30]

v_{\min} (minimum load cell verification interval). – The smallest load cell verification interval, *expressed in units of mass** into which the load cell measuring range can be divided. [2.20, 2.24]
[*Nonretroactive as of January 1, 2001]
(Added 1996) (Amended 1999)

W

weighbeam. – An element comprising one or more bars, equipped with movable poises or means for applying counterpoise weights or both. [2.20]

weigh-belt system. – A type of belt-conveyor scale system designed by the manufacturer as a self-contained conveyor system and that is installed as a unit. A unit is comprised of integral components and, at minimum, includes a: conveyor belt; belt drive; conveyor frame; and weighing system. A weigh-belt system may operate at single or multiple flow rates and may use variable-speed belt drives. [2.21]
(Added 2015)

weighing element. – That portion of a scale that supports the load-receiving element and transmits to the indicating element a signal or force resulting from the load applied to the load-receiving element. [2.20, 2.21, 2.22]
(Added 1988)

weigh-labeler. – An automatic weighing system that determines the weight of a package and prints a label or other document bearing a weight declaration for each discrete item (usually a label also includes unit and total price declarations). Weigh-labelers are sometimes used to weigh and label standard and random packages (also called “Prepackaging Scales”). [2.24]
(Amended 2004)

weigh module – The portion of a load-receiving element supported by two sections. The length of a module is the distance to which load can be applied. [2.20]

(Added 2013)

weighment. – A single complete weighing operation. [2.20, 2.21]

(Added 1986)

weight, unit. – See “unit weight.” [2.20]

weight classifier. – A digital scale that rounds weight values up to the next scale division. These scales usually have a verification scale division (e) that is smaller than the displayed scale division. [2.20]

(Added 1987)

weight ranges. – Electrical or electro-mechanical elements incorporated in an automatic indicating scale through the application of which the range of automatic indication of the scale is increased, normally in increments equal to the reading-face capacity. [2.20]

wet basis. – See “moisture content (wet basis).” [5.56(a), 5.56(b)]

wet hose. – A discharge hose intended to be full of product at all times. (Also see “wet-hose type.”) [3.30, 3.31, 3.38, 3.39]

(Amended 2002) (Code References Amended 2019)

wet-hose type. – A type of device designed to be operated with the discharge hose full of product at all times. (Also see “wet hose.”) [3.30, 3.32, 3.34, 3.37, 3.38, 3.39]

(Amended 2002) (Code References Amended 2019)

wheel-load weighers. – Compact, self-contained, portable weighing elements specially adapted to determining the wheel loads or axle loads of vehicles on highways for the enforcement of highway weight laws only. [2.20]

wholesale device. – Any device other than a retail device. (Also see “retail device.”) [3.30, 3.32]

wing pulley. – A pulley made of widely spaced metal bars in order to set up a vibration to shake loose material off the underside (return side) of the belt. [2.21]

Z

zero-load balance. – A correct weight indication or representation of zero when there is no load on the load-receiving element. (Also see “zero-load balance for an automatic-indicating scale,” “zero-load balance for a nonautomatic-indicating scale,” “zero-load balance for a recording scale.”) [2.20]

zero-load balance, automatic-indicating scale. – A condition in which the indicator is at rest at, or oscillates through approximately equal arcs on either side of, the zero graduation. [2.20]

zero-load balance, nonautomatic-indicating scale. – A condition in which (a) the weighbeam is at rest at, or oscillates through approximately equal arcs above and below, the center of a trig loop; (b) the weighbeam or lever system is at rest at, or oscillates through approximately equal arcs above and below, a horizontal position or a position midway between limiting stops; or (c) the indicator of a balance indicator is at rest at, or oscillates through approximately equal arcs on either side of, the zero graduation. [2.20]

zero-load balance for a recording scale. – A condition in which the scale will record a representation of zero load. [2.20]

zero-load reference (belt-conveyor scales). – A zero-load reference value represents no load on a moving conveyor belt. This value can be either; a number representing the electronic load cell output, a percentage of full scale capacity, or other reference value that accurately represents the no load condition of a moving conveyor belt. The no load reference value can only be updated after the completion of a zero load test.[2.21]

(Added 2002)

zero-setting mechanism. – Means provided to attain a zero balance indication with no load on the load-receiving element. The types of zero-setting mechanisms are: [2.20, 2.22, 2.24]

automatic zero-setting mechanism (AZSM). – Automatic means provided to set the zero-balance indication without the intervention of an operator. [2.22]

(Added 2010)

automatic zero-tracking (AZT) mechanism. – See “automatic zero-tracking (AZT) mechanism.” (NOTE: AZT maintains zero with specified limits. “Zero-setting sets/establishes zero with limits based on scale capacity.) [2.20, 2.22, 2.24]

initial zero-setting mechanism. – Automatic means provided to set the indication to zero at the time the instrument is switched on and before it is ready for use. [2.20]

(Added 1990)

manual zero-setting mechanism. – Nonautomatic means provided to attain a zero balance indication by the direct operation of a control. [2.20]

semiautomatic zero-setting mechanism. – Automatic means provided to attain a direct zero balance indication requiring a single initiation by an operator. [2.20]

(Amended 2010)

zero-setting mechanism (belt-conveyor scale). – A mechanism enabling zero totalization to be obtained over a whole number of belt revolutions. [2.21, 2.23]

(Added 2002)

zero-tracking mechanism. – See “automatic zero-tracking mechanism” under “zero-setting mechanism.” [2.20, 2.22, 2.24]

zone of uncertainty. – The zone between adjacent increments on a digital device in which the value of either of the adjacent increments may be displayed. [2.20]

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