CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Extracts from the

CALIFORNIA CODE OF REGULATIONS

TITLE 4, DIVISION 9

WEIGHTS AND MEASURES FIELD REFERENCE MANUAL (2019)

Chapter 1
Tolerances and Specifications for Commercial Weighing and Measuring Devices

Part 5: NIST Handbook 44

Sections:

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
DIVISION OF MEASUREMENT STANDARDS

DISCLAIMER

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

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

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

To find the latest online version of the California Code of Regulations (CCR) Title 4, Division 9, visit the California Office of Administration Law (OAL) at:

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The CCR may also be accessed at **http://oal.ca.gov/** by selecting the link Titled "California Code of Regulations" under the list of "Sponsored Links" in the left column on the OAL Home page.

For information concerning the contents of this document, please contact the Division of Measurement Standards by e-mail at **dms@cdfa.ca.gov**.

NIST Handbook 44 (2019 Edition) - Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as adopted by the 102nd National Conference on Weights and Measures in July 2018 is available at:

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

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Section 5.50. Fabric-Measuring Devices

A. Application

A.1. General. – This code applies only to mechanisms and machines designed to indicate automatically (with or without value-computing capabilities) the length of fabric passed through the measuring elements.

A.2. Devices Used to Measure Other Similar Material in Sheet, Roll, or Bolt Form. – Insofar as they are clearly appropriate, the requirements and provisions of this code apply also to devices designed for the commercial measurement of other material similar to fabrics, in sheet, roll, or bolt form.

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

S. Specifications

S.1. Units. – A fabric-measuring device shall indicate lengths as follows:

(a) For devices indicating in metric units, lengths shall be indicated in terms of 5 cm; 10 cm; 25 cm; or 50 cm and meters.

In addition, lengths may be indicated in terms of any or all of the following subdivisions: millimeters and centimeters.

(b) For devices indicating in U.S. customary units, lengths shall be indicated in terms of 1/8 yd; ¼ yd; or ½ yd; and yards.

In addition, lengths may be indicated in terms of any or all of the following subdivisions: 1/8 yd; 1/16 yd; inches and feet.

Digital indicators may indicate values in decimal fractions.
(Amended 1977)

S.2. Design of Indicating Elements.

S.2.1. Graduations.

S.2.1.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.2.1.2. Width. – In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, and the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in) in width.

S.2.1.3. Clear Interval between Graduations. – The clear interval between graduations shall be at least 6 mm for cm graduations (¼ in for 1/8 yd graduations), and 3 mm for 20 cm graduations (⅛ in for 1 in graduations).

S.2.2. Indicator.

S.2.2.1. Symmetry. – The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.

S.2.2.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case the distance between the end 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.2.2.3. Width. – The index of an indicator shall not be wider than the narrowest graduations with which it is used, and shall in no case exceed 0.4 mm (0.015 in).

S.2.2.4. Clearance. – The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).

S.2.2.5. Parallax. – Parallax effects shall be reduced to the practicable minimum.

S.2.3. Money-Value Computations.

S.2.3.1. Full-Computing Type. – In this type, the money value at each of a series of unit prices shall be computed automatically for every length within the range of measurement of the fabric-measuring device. Value graduations shall be provided and shall be accurately positioned. The value of each graduated interval shall be 1 cent at all prices per yard of 30 cents and less, and shall not exceed 2 cents at higher prices per yard. Five-cent intervals may be represented in the two-cent range by special graduations, but these shall not be positioned in the clear intervals between graduations of the regular series.

S.2.3.2. Limited-Computing Type. – In this type, the money value at each of a series of unit prices shall be computed automatically only for lengths corresponding to a definite series of length graduations. There shall be no value graduations. At no position that the chart can assume shall two value figures at the same price per yard be completely and clearly exposed to view at one time. Money values shown shall be mathematically accurate, except that a fraction of less than ½ cent shall be dropped and the next higher cent shall be shown in the case of a fraction of ½ cent or more. One of the following requirements shall be met:

(a) There shall be a money-value computation for each length graduation within the range of measurement of the device.

(b) No money-value computation shall be exposed to view except at such times as the device shows a length indication for which a corresponding series of value indications is computed.

(c) Each column or row of money-value computations shall be marked to show the length to which the computations correspond, the device shall be marked to show the character and limitations of the computations, and there shall be computations corresponding to at least 10 cm (⅛ yd) throughout the range of measurement of the device.

S.2.4. Return to Zero. – Primary indicating elements shall be readily returnable to a definite zero indication. Means shall be provided to prevent the return of the indicating elements beyond their correct zero positions.

S.3. Marking Requirements. – If a device will not accurately measure all fabrics, it shall be marked to indicate clearly its limitations.

S.4. Design Accuracy. – Indications of length and money value shall be accurate whether the values of the indications are being increased or decreased.

N. Notes

N.1. Testing Medium. – A fabric-measuring device shall be tested with a suitable testing tape approximately 7.62 cm (3 in) wide and with a graduated length of at least 11 m (12 yd), made from such material and having such surface finish as to provide dimensional stability and reduce slippage to the practicable minimum.

T. Tolerances

T.1. Tolerance Values. – Maintenance and acceptance tolerances shall be as shown in Table 1. Maintenance and Acceptance Tolerances for Fabric-Measuring Devices.

Table 1.
Maintenance and Acceptance Tolerances for Fabric-Measuring Devices

Indication of Device (yards)	Maintenance Tolerance		Acceptance Tolerance	
	On Under-registration (inches)	On Over-registration (inches)	On Under-registration (inches)	On Over-registration (inches)
2 or less	3/8	¼	¼	1/8
3	3/8	5/16	¼	5/32
4	½	5/16	¼	5/32
5	5/8	3/8	5/16	3/16
6	¾	3/8	3/8	3/16
7 and 8	1	½	½	¼
9	1¼	5/8	5/8	5/16
10 and 11	1½	¾	¾	3/8
12 and 13	1¾	7/8	7/8	7/16
14 and 15	2	1	1	½
Over 15	Add 1/8 inch per indicated yard	Add 1/16 inch per indicated yard	Add 1/16 inch per indicated yard	Add 1/32 inch per indicated yard

UR. User Requirements

UR.1. Installation Requirements.

UR.1.1. Installation. – A fabric-measuring device shall be securely supported and firmly fixed in position.

UR.2. Use Requirements.

UR.2.1. Limitation of Use. – A fabric-measuring device shall be used to measure only those fabrics that it was designed to measure, and in no case shall it be used to measure a fabric that a marking on the device indicates should not be measured.

UR.2.2. Return of Indicating Elements to Zero. – The primary indicating elements shall be returned to zero before each measurement.

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Section 5.51. Wire- and Cordage-Measuring Devices

A. Application

A.1. General. – This code applies to mechanisms and machines designed to indicate automatically the length of cordage, rope, wire, cable, or similar flexible material passed through the measuring elements.

A.2. Additional Code Requirements. – In addition to the requirements of this code, Wire- and Cordage-Measuring Devices shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Units. – A wire- or cordage-measuring device shall indicate lengths in terms of feet, yards, or meters, or combinations of units of the same measurement system, and shall have minimum increments with values that do not exceed the equivalent of 0.1 meter or 0.1 yard.

(Amended 1989)

S.2. Design of Indicating Elements.

S.2.1. Graduations.

S.2.1.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.2.1.2. Width. – In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, and the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in), nor more than 1.0 mm (0.04 in), in width.

S.2.1.3. Clear Interval between Graduations. – The clear interval between graduations shall be at least as wide as the widest graduation, and in no case less than 0.8 mm (0.03 in).

S.2.2. Indicator.

S.2.2.1. Symmetry. – The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.

S.2.2.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case the distance between the end 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.2.2.3. Width. – The index of an indicator shall not be wider than the narrowest graduations with which it is used, and shall in no case exceed 0.4 mm (0.015 in).

S.2.2.4. Clearance. – The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).

S.2.2.5. Parallax. – Parallax effects shall be reduced to the practicable minimum.

S.2.3. Zero Indication. – Primary indicating elements shall be readily returnable to a definite zero indication.

S.3. Design of Measuring Elements.

S.3.1. Sensitiveness. – If the most sensitive element of the indicating system utilizes an indicator and graduations, the relative movement of these parts corresponding to a measurement of 30 cm (1 ft) shall be not less than 6 mm (¼ in).

S.3.2. Slippage. – The measuring elements of a wire- or cordage-measuring device shall be so designed and constructed as to reduce to the practicable minimum any slippage of material being measured and any lost motion in the measuring mechanism.

S.3.3. Accessibility. – A wire- or cordage-measuring device shall be so constructed that the measuring elements are readily visible and accessible, without disassembly of any supporting frame or section of the main body, for purposes of cleaning or removing any foreign matter carried into the mechanism by the material being measured.

S.4. Marking Requirements.

S.4.1. Limitation of Use. – If a device will measure accurately only certain configurations, diameters, types, or varieties of materials, or with certain accessory equipment, all limitations shall be clearly and permanently stated on the device.

S.4.2. Operating Instructions. – Any necessary operating instructions shall be clearly stated on the device.

S.4.3. Indications. – Indicating elements shall be identified by suitable words or legends so that the values of the indications will be unmistakable.

S.5. Design Accuracy. – Indications of length shall be accurate whether the values of the indications are being increased or decreased.

N. Notes

N.1. Testing Medium. – Wherever feasible, a wire- or cordage-measuring device shall be tested with a steel tape not less than 10 mm (⅜ in) in width and at least 15 m (50 ft) in length. When a device cannot be tested in this manner because of the design of the device, it shall be tested with a dimensionally stable material appropriately marked and compared at frequent periodic intervals with a steel tape in order to assure that any marked interval is not in error by more than ⅓ of the tolerance of the device at that particular interval.

(Amended 1981)

N.2. Minimum Test. – Tests shall be conducted at a minimum initial increment of 5 m (20 ft) and appropriate increments up to at least 15 m (50 ft).

T. Tolerances

T.1. Tolerance Values. – Maintenance and acceptance tolerances shall be as shown in Table 1. Maintenance and Acceptance Tolerances for Wire- and Cordage-Measuring Devices.

Table 1. Maintenance and Acceptance Tolerances for Wire- and Cordage-Measuring Devices		
Indication of Device (feet)	**Acceptance and Maintenance Tolerances**	
	On Underregistration (inches)	**On Overregistration (inches)**
20	6	3
Over 20 to 30	8	4
Over 30 to 40	10	5
Over 40 to 50	12	6
Over 50	Add 2 inches per indicated 10 feet	Add 1 inch per indicated 10 feet

UR. User Requirements

UR.1. Installation Requirements.

UR.1.1. Installation. – A wire- or cordage-measuring device shall be securely supported and firmly fixed in position.

UR.2. Use Requirements.

UR.2.1. Limitation of Use. – A wire- or cordage-measuring device shall be used to measure only those materials that it was designed to measure, and in no case shall it be used to measure a material that a marking on the device indicates should not be measured.

UR.2.2. Return to Zero. – The primary indicating elements of a wire- or cordage-measuring device shall be returned to zero before each measurement.

UR.2.3. Operation of Device. – A wire- or cordage-measuring device shall not be operated in such a manner as to cause slippage or inaccurate measurement.

UR.2.4. Cleanliness. – The measuring elements of a wire- or cordage-measuring device shall be kept clean to prevent buildup of dirt and foreign material that would adversely affect the measuring capability of the device.

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Section 5.52. Linear Measures

A. Application

A.1. General. – This code applies to any linear measure or measure of length, whether flexible or inflexible, permanently installed or portable.

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

S. Specifications

S.1.M. Units. – A linear measure may be in total length, and the total length may be subdivided in any or all of the following:

(a) centimeters and tenths of the centimeter;

(b) meters; and

(c) multiples of meters.

An one-meter measure may be graduated, in addition, to show 0.1 m and multiples of 0.1 m subdivisions.

S.1. Units. – A linear measure may be in total length, and the total length may be subdivided in any or all of the following:

(a) inches and binary submultiples of the inch;

(b) feet;

(c) yards and multiples of yards.

A 1-yard measure may be graduated, in addition, to show ⅓ yd and ⅔ yd subdivisions. A flexible tape may be graduated in tenths or hundredths of a foot, or both tenths and hundredths of a foot. (Any other subdivisions are allowable only on measures of special purposes and when required for such purposes.)

S.2. Material.

S.2.1. Flexible Tape. – A flexible tape shall be made of metal.

S.2.2. End Measure. – If an end measure is made of material softer than brass, the ends of the measure shall be protected by brass (or other metal at least equally hard) securely attached.

S.3. Finish. – Measures shall be smoothly finished.

S.4. Design.

S.4.1. Rigid Measure. – A rigid measure shall be straight.

S.4.2. Folding Measure. – A folding measure shall open to a definite stop, and when so opened shall be straight.

S.5. Graduations.

S.5.1. General. – Graduations shall be perpendicular to the edge of the measure.

S.5.2. Width. – The width of the graduations on any measure shall not exceed one-half the width of the smallest graduated interval on the measure, and in no case shall be wider than 0.75 mm (0.03 in).

(Amended 1982)

T. Tolerances

T.1. For Measures Except Metal Tapes. – Maintenance tolerances in excess and in deficiency for measures except metal tapes shall be as shown in Table 1. Maintenance Tolerances, in Excess and in Deficiency, for Linear Measures Except Metal Tapes. Acceptance tolerances shall be one-half the maintenance tolerances.

Table 1.
Maintenance Tolerances, in Excess and in Deficiency, for Linear Measures Except Metal Tapes

Nominal Interval from Zero	Tolerance
Feet	**Inch**
½ or less	1/64
1	1/32
2	1/16
3	3/32
4	1/8
5	5/32
6	3/16

T.2. For Metal Tapes. – Maintenance and acceptance tolerances in excess and in deficiency for metal tapes shall be as shown in Table 2. Maintenance and Acceptance Tolerances, in Excess and in Deficiency, for Metal Tapes. Tapes of 10 m (25 ft) or over shall be tested at a tension resulting from a load of 5 kg (10 lb). Tapes less than 10 m (25 ft) shall be tested at a tension resulting from a load of 2.5 kg (5 lb). However, flexible metal tapes of 10 m (25 ft) or less that are not normally used under tension shall be tested with no tension applied. All tapes shall be supported throughout on a horizontal flat surface whenever tested.

(Amended 1972)

Table 2.
Maintenance and Acceptance Tolerances, in Excess and in Deficiency, for Metal Tapes

Nominal Interval from Zero	Tolerance
Feet	**Inch**
6 or less	1/32
7 to 30, inclusive	1/16
31 to 55, inclusive	1/8
56 to 80, inclusive	3/16
81 to 100, inclusive	¼

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Section 5.53. Odometers

A. Application

A.1. General. – This code applies to odometers that are used or are to be used to determine the charges for rent or hire of passenger vehicles and trucks and buses. (When official examinations are undertaken on odometers that form the basis for the payment of fees or taxes to, or the preparation of reports for, governmental agencies, and in similar cases, the requirements of this code shall be applied insofar as they are applicable and appropriate to the conditions of such special uses.)
(Amended 1977)

A.2. Exceptions. – This code does not apply to taximeters (for which see Section 5.54. Code for Taximeters).
(Amended 1977)

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

S. Specifications

S.1. Design of Indicating Elements.

S.1.1. General. – The primary indicating element of an odometer may be:

(a) the distance-traveled portion of the "speedometer" assembly of a motor vehicle;

(b) a special cable-driven distance-indicating device; or

(c) a hub odometer attached to the hub of a wheel on a motor vehicle.

(Amended 1977)

S.1.2. Units. – An odometer shall indicate in terms of miles or kilometers.
(Amended 1977)

S.1.3. Minimum Indicated Value. – The value of the interval of indicated distance shall be:

(a) for odometers indicating in kilometers, 0.1 km; or

(b) for odometers indicating in miles, 0.1 mi.

(Amended 1977)

S.1.4. Advancement of Indicating Elements. – The most sensitive indicating elements of an odometer may advance continuously or intermittently; all other elements shall advance intermittently. Except when the indications are being returned to zero, the indications of an installed odometer shall be susceptible to advancement only by the rotation of the vehicle wheel or wheels.
(Amended 1977)

S.1.5. Readability. – Distance figures and their background shall be of sharply contrasting colors. Figures indicating tenth units shall be differentiated from other figures with different colors, or with a decimal point, or by other equally effective means. Except during the period of advance of any decade to the next higher indication, only one figure in each decade shall be exposed to view. Any protective covering intended to be transparent shall be in such condition that it can be made transparent by ordinary cleaning of its exposed surface.
(Amended 1977)

S.1.6. Digital Indications and Representation. – Digital indicating odometers (discontinuous registration) shall "round off" indications to the nearest minimum division or truncate indications to the lower minimum division.

(Added 1990)

N. Notes

N.1. Testing Procedures.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of an odometer shall be conducted using one or more of the following test methods:

(a) Road Test. – A road test consists of driving the vehicle over a precisely measured road course.

(b) Fifth-Wheel Test. – A fifth-wheel test consists of driving the vehicle over any reasonable road course and determining the distance actually traveled through the use of a mechanism known as a "fifth wheel" that is attached to the vehicle and that independently measures and indicates the distance.

(c) Simulated-Road Test. – A simulated-road test consists of determining the distance traveled by use of a roller device, or by computation from rolling circumference and wheel-turn data.

(Amended 1977)

N.1.2. Test Runs. – Not less than two test runs shall be conducted. Acceleration and deceleration shall be carefully controlled to avoid spinning or skidding the wheels.

(Amended 1977)

N.1.2.1. For Devices Indicating in Miles. – The test runs shall be 2 mi in length, shall start from, and finish at, a dead stop with a minimum of 80 % of the run between 30 mi/h and 45 mi/h.

(Added 1977)

N.1.2.2. For Devices Indicating in Kilometers. – The test runs shall be 3 km in length, shall start from, and finish at, a dead stop with a minimum of 80 % of the run between 50 km/h and 75 km/h.

(Added 1977)

N.1.3. Test Conditions.

N.1.3.1. Tire Stabilization. – Road tests or fifth-wheel tests shall be preceded by a run of at least 8 km or 5 mi, for the purpose of stabilizing tire pressures. Simulated road tests on a roller device shall be made at stable tire pressures.

(Amended 1977)

N.1.3.2. Tire Pressure. – At the completion of the test run or runs, the tires of the vehicle under test shall be checked to determine that the tire pressure is that operating tire pressure posted in the vehicle. If not, the tire pressure should be adjusted to the posted tire pressure and further tests may be conducted to determine the operating characteristics of the odometer.

(Amended 1977)

N.1.3.3. Vehicle Loading.

(a) **Passenger Load.** – During the distance test of an odometer, the vehicle may carry two persons.

(b) **Truck Cargo Load.** – Truck odometers shall be tested by one of the following methods:

(1) the truck is loaded with one-half of the maximum cargo load; or

(2) unloaded if unloaded test tolerances are applied.

(Amended 1977 and 1987)

T. Tolerances

T.1. To Underregistration and to Overregistration. – The tolerances hereinafter prescribed shall be applied to errors of underregistration and errors of overregistration.

T.2. Tolerance Values. – Except for unloaded trucks, maintenance and acceptance tolerances on odometers shall be 4 % of the interval under test.

(Amended 1977and 1987)

T.2.1. Tolerances for Unloaded Trucks. – Maintenance and acceptance tolerances on truck odometers shall be 5 % for underregistration and 3 % for overregistration of the interval under test.

(Added 1987)

UR. User Requirements

UR.1. Inflation of Vehicle Tires. – The operational tire pressure of passenger vehicle and truck tires shall be posted in the vehicle and tires shall be maintained at the posted pressure.

(Amended 1977)

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Section 5.54. Taximeters

A. Application

A.1. General. – This code applies to taximeters; that is, to devices that automatically calculates at a predetermined rate or rates and indicate the charge for hire of a vehicle.

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

(a) Odometers on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Devices that only display a flat rate or negotiated rate.; or

(c) Transportation Network Measurement Systems. (Also see Section 5.60. Transportation Network Measurement Systems.)

(Amended 1977, 2016 and 2017)

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

S. Specifications

S.1. Design of Indicating and Recording Elements.

S.1.1. General. – A taximeter shall be equipped with a primary indicating element.
(Amended 1988 and 2015)

S.1.1.1. Recording Elements. *– A receipt providing information as required in S.1.9. Recorded Representations shall be available from a taximeter or taximeter system through an integral or separate recording element for all transactions conducted.*
[Nonretroactive January 1, 2016]
(Added 2015)

S.1.2. Advancement of Indicating Elements. – Except when a taximeter is being cleared, the primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or by the time mechanism.

At the conclusion of a transaction (e.g., following the totalizing of all accrued charges and having a customer receipt made available), no other advancement of fare, extras, or other charges shall occur until the taximeter has been cleared.
[Nonretroactive as of January 1, 2017

Where permitted, a flat rate or negotiated rate shall be displayed in the "fare" indicating mechanism, provided that once a flat rate or negotiated rate is entered the fare may no longer be advanced by movement of the vehicle or the time mechanism.
(Amended 1988 and 2016)

S.1.2.1. Time Mechanism. – – Means shall be provided on all taximeters designed to calculate fares based on a combination of time elapsed and distance traveled, to enable the vehicle operator to render the time mechanism either operative or inoperative with respect to the fare-indicating mechanism
(Added 2017)

S.1.2.2. Distance Mechanism. – *Means shall be provided on all taximeters designed to calculate fare based on a combination of time elapsed and/or distance traveled to enable the vehicle operator to render the distance mechanism either operative or inoperative with respect to the fare-indicating mechanism.*
[Nonretroactive as of January 1, 2020]
(Added 2017) (Amended 2018)

S.1.3. Visibility of Indications.

S.1.3.1. Taximeter Indications. The indications of fare, including extras, and the mode of operation, such as "time" or "hired," shall be constantly displayed whenever the meter is in operation. All indications of passenger interest shall be easily read from a distance of 1.2 m (4 ft) under any condition of normal operation. This includes any necessary lighting, shading, or other means necessary to make displayed indications clearly visible to operator and passenger.
(Amended 1977, 1986, 1988, and 2017)

S.1.3.2. Minimum Height of Figures, Words, and Symbols. – The minimum height of the figures used to indicate the fare shall be 10 mm and for extras, 8 mm. The minimum height of the figures, words, or symbols used for other indications, including those used to identify or define, shall be 3.5 mm.
(Added 1986)

S.1.3.3. Passenger's Indications. *– A supplementary indicating element installed in a taxi to provide information regarding the taxi service to the passenger (i.e., Passenger Information Monitor or PIM), shall clearly display the current total of all charges incurred for the transaction. The accruing total of all charges must remain clearly visible on the passenger's display (unless disabled by the passenger) at all times during the transaction.*
[Nonretroactive as of January 1, 2016]
(Added 2015) (Amended 2017)

S.1.3.3.1. Additional Information. *– Additional information shall be displayed or made available through a passenger's indicating element (as described in S.1.3.3. Passenger's Indications) and shall be current and reflect any charges that have accrued. This additional information shall include:*

(a) an itemized account of all charges incurred including fare, extras, and other additional charges; and

(b) the rate(s) in use at which any fare is calculated.

Any additional information made available must not obscure the accruing total of charges for the taxi service. This additional information may be made accessible through clearly identified operational controls (e.g., keypad, button, menu, touch-screen).
[Non retroactive as of January 1, 2016]
(Added 2015)

S.1.3.3.2. Fare and Extras Charges. *– The indication of fare and extras charges on a passenger's indicating element shall agree with similar indications displayed on all other indicating elements in the system.*
[Nonretroactive as of January 1, 2016]
(Added 2015)

S.1.4. Actuation of Fare-Indicating Mechanism. – When a taximeter designed to calculate fares upon the basis of a combination of distance traveled and time elapsed, but not both time and distance used concurrently to calculate fare, is operative with respect to fare indication, the fare-indicating mechanism shall be actuated by the distance mechanism whenever the vehicle is in motion at such a speed that the rate of distance revenue equals or

exceeds the time rate, and may be actuated by the time mechanism whenever the vehicle speed is less than this and when the vehicle is not in motion.

(Amended 1977 and 2017)

S.1.5. Operating Condition.

S.1.5.1. General. – When a taximeter is cleared, the indication "Not Registering," "Vacant," or an equivalent expression shall be shown. Whenever a taximeter is set to register charges, it shall indicate "Registering," "Hired," or an equivalent expression and the rate at which it is set shall be automatically indicated (Rate 1 or Rate A, for example).

(Amended 1988)

S.1.5.2. Time not Recording. – When a taximeter is set for fare registration with the time mechanism inoperative, it shall indicate "Time Not Recording" or an equivalent expression.

(Amended 1988)

S.1.5.3. Distance not Recording. *-– When a taximeter is set for fare registration with the distance mechanism inoperative, it shall indicate "Distance Not Recording" or an equivalent expression.*
[Nonretroactive as of January 1, 2020]

(Added 2017) (Amended 2018)

S.1.6. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.7. Extras. – Extras shall be indicated as a separate item and shall not be included in the fare indication. They shall be identified by the word "Extras" or by an equivalent expression. Values shall be defined by suitable words or monetary signs. Means may be provided to totalize the fare and extras if the totalized amount returns to separate indications of fare and extras within 5 seconds or less.

(Amended 1988)

S.1.7.1. Nonuse of Extras. – If and when taximeter extras are prohibited by legal authority or are discontinued by a vehicle operator, the extras mechanisms shall be rendered inoperable or the extras indications shall be effectively obscured by permanent means.

S.1.8. Protection of Indications. – All indications of fare and extras shall be protected from unauthorized alteration or manipulation.

(Amended 2015)

S.1.9. Recorded Representation. *– A printed receipt or electronic issued from a taximeter, whether through an integral or separate recording element, shall include as a minimum, the following information when processed through the taximeter system:*

(a) date;

*(b) unique vehicle identification number, such as the medallion number, taxi number, vehicle identification number (VIN), permit number, or other identifying information as specified by the statutory authority;**

*(c) start and end time of the trip;**

*(d) distance traveled, maximum increment of 0.1 km (0.1 mi);**

(e) fare in $;

*(f) each rate at which the fare was computed and the associated fare at that rate;**

*(g) additional charges (in $) where permitted such as extras, any surcharges, telecommunication charges, and taxes shall be identified and itemized;**

*(h) total charge for service in $ (inclusive of fare, extras, and all additional charges);**

*(i) trip number, if available;*** and*

*(j) telephone number (or other contract information) for customer assistance.; and***

*(k) a statement of chargeable time and chargeable distance for taximeters that calculate fare using time and distance concurrently.****

Note: When processed through the taximeter or taximeter system, any adjustments (in $) to the total charge for service including discounts, credits, and tips shall also be included on the receipt.**
[Nonretroactive as of January 1, 1989]
**[Nonretroactive as of January 1, 2000]*
***[Nonretroactive as of January 1, 2016]*
****[Nonretroactive as of January 1, 2018]*

(Added 1988) (Amended 1999, 2015 and 2017)

S.1.9.1. Multiple Recorded Representations - Duplicate Receipts. *– A recording element may produce a duplicate receipt for the previous transaction provided the information printed is identical to the original with the exception of time issued. The duplicate receipt shall include the words "duplicate" or "copy." The feature to print a duplicate receipt shall be deactivated at the time the meter is hired for the next fare.*
[Nonretroactive as of January 1, 2000]

(Added 1999)

S.1.10. Non-fare Information. *– The fare and extras displays may be used to display auxiliary information provided the meter is in the vacant condition and such information is only displayed for10 seconds, or less. If the information consists of a list of information, the list may be displayed one item after another, provided that each item is displayed for 10 seconds, or less.*
[Nonretroactive as of January 1, 2002]
(Added 2000)

S.2. Basis of Fare Calculations. – A taximeter shall calculate fares only upon the basis of:

(a) distance traveled;

(b) time elapsed; or

(c) a combination of distance traveled and time elapsed.

A taximeter may utilize more than one rate to calculate the fare during a trip. Any change in the applied rate must occur at the completion of the current interval.

(Amended 1977 and 2016)

S.2.1. Initial Time and Distance Intervals. – The time and distance intervals of a taximeter that does not calculate fares based on distance traveled and time elapsed used concurrently shall be directly proportional as expressed in the following formula:

$$\frac{Seconds\ of\ \ Initial\ Time\ Interval}{Seconds\ per\ Non-Initial\ Time\ Interval} = \frac{Distance\ of\ \ Initial\ Mileage\ Interval}{Distance\ per\ Non-Initial\ Mileage\ Interval}$$

(Added 1990) (Amended 2017)

S.3. Design of Operating Control.

S.3.1. Positions of Control. – The several positions of the operating controls shall be clearly defined and shall be so constructed that accidental or inadvertent changing of the operating condition of the taximeter is improbable. Movement of the operating controls to an operating position immediately following movement to the cleared position shall be delayed enough to permit the taximeter to come to a complete rest in the cleared position.

(Amended 1988)

S.3.2. Control for Extras Mechanism. – The knob, handle, or other means provided to actuate the extras mechanism shall be inoperable whenever the taximeter is cleared.

S.4. Interference. – The design of a taximeter shall be such that when a fare is calculated by using time and/or by using distance (but not used concurrently) there will be no interference between the time and the distance portions of the mechanism device at any speed of operation.

(Amended 1977, 1988 and 2017)

S.5. Provision for Security Seals. – Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

(a) any metrological parameter affecting the metrological integrity of the taximeter and associated equipment; or
(b) any metrological parameter controlled by software residing in the taximeter or an associated external computer network.

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.5. Categories of Device and Methods of Sealing)

(Amended 1988, 2000, and 2017)

S.5.1.Taximeters Connected to Networked Systems. - – Metrological features that are not located on the taximeter device installed in the vehicle (i.e., accessed through a computer network, server, or "cloud") shall be secured by means that will:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modifications; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

(Added 2017)

S.5.2.Taximeters Calibrated to Specific Vehicles. - In the case of taximeters where the proper performance and calibration of the device has been verified when used in a specific vehicle and which may be removed from the vehicle (e.g., slide mounting the taximeter), means shall be provided through a physical seal or electronic link between components affecting accuracy or indications of the device to ensure that its performance is not affected and operation is permitted only with those components having the same unique properties.

(Added 2017)

Table S.5. *Categories of Device and Methods of Sealing*	
Categories of Device	***Methods of Sealing***
Category 1: *No remote configuration capability.*	*Seal by physical seal or, for components that may be removed from the vehicle, a combination of physical seals and a physical or electronic link as described in S.5.2. Taximeters Calibrated to Specific Vehicles.*
Category 2: *Remote configuration capability, but access is controlled by physical hardware.* *The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the remote configuration mode.*	*The hardware enabling access for remote access to calibration functions must be at the device and sealed using a physical seal and the device shall include an event logger.* *An event logger must be used to record changes to configuration parameters made through remote access.* *The event logger must include event counters (000 to 999 with a minimum count of 1000 events), the parameter ID, the date and time of the change, and the new value of the parameter. A printed or electronic copy of the information must be available through the device. 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.*
Category 3: *Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).* *The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the remote configuration mode.*	*An event logger must be used to record changes to adjustable parameters that are made through remote access and which is accessible only by authorized persons (using an Internet web browser or other such secure software.* *The event logger shall include event counters, the date and time of the change, the parameter ID, and the new value of the parameter. A printed or electronic copy of the information must be available through the device. The event loggers 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 change to be stored for each parameter.)* *The device shall become inoperable when access to the system's metrological parameters is made through unapproved or unauthorized means. The device shall remain inoperable until cleared by the official having statutory authority.*

[Nonretroactive as of January 1, 2018]
(Added 2017)

S.6. Power Interruption, Electronic Taximeters.

(a) After a power interruption of 3 seconds or less, the fare and extras indications shall return to the previously displayed indications and may be susceptible to advancement without the taximeter being cleared.

(b) After a power interruption exceeding 3 seconds, the fare and extras indications shall return to the previously displayed indications and shall not be susceptible to advancement until the taximeter is cleared.

*After restoration of power following an interruption exceeding 3 seconds, the previously displayed fare shall be displayed for a maximum of 1 minute at which time the fare shall automatically clear and the taximeter shall return to the vacant condition.**
*[*Nonretroactive as of January 1, 2002]*
(Added 1988) (Amended 1989, 1990, and 2000)

S.7. Measurement Signal Loss. – If the measurement signal is interrupted, the taximeter shall be capable of determining any information needed to complete a transaction in progress at the time of signal loss/interruption.

Note: If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time provided the time mechanism is not affected by signal loss.

(Added 2017)

S.7.1. Intermittent Trip Data Loss. – When the measurement signal is lost intermittently during a trip (e.g., traveling through a tunnel), but recovered prior to the end of the trip, the taximeter shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

(Added 2017)

S.7.2. Significant Trip Data Loss. – When the signal is lost for a significant portion of the trip, the taximeter shall calculate the total charge utilizing recorded time and distance measurements and other charges (e.g., tolls and airport fees), and may also include other means in accordance with the terms of service (or other agreement) the passenger has agreed to.

Note: Significant trip data loss refers to instances when the measurement signal is lost to the extent that the taximeter cannot perform an accurate measurement or when the signal is not regained by the end of the trip.

(Added 2017)

S.8. Anti-Fraud Provisions, Electronic Taximeters. – An electronic taximeter may have provisions to detect and eliminate distance input that is inconsistent with the taximeter's source(s) of distance measurement data. When a taximeter equipped with this feature detects input inconsistent with the distance measurement data source(s):

(a) the meter shall either filter out the inconsistent distance input signals or cease to increment fare based on distance until the distance input signal is restored to normal operation. If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time when (1) permitted by the statutory authority; and (2) the time mechanism is not affected by inconsistent signals;

(b) the taximeter shall provide a visible or audible signal that inconsistent input signals are being detected; and

(c) the taximeter shall record the occurrence in an event logger. The event logger shall include an event counter, the date, and the time of at least the last 1000 occurrences.

(Added 2001) (Amended 2017)

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of a taximeter shall be conducted utilizing one or more of the following test methods:

(a) **Road Test.** – A road test consists of driving the vehicle over a precisely measured road course.

(b) **Fifth-Wheel Test.** – A fifth-wheel test consists of driving the vehicle over any reasonable road course and determining the distance actually traveled through the use of a mechanism known as a "fifth wheel" that is attached to the vehicle and that independently measures and indicates the distance.

(c) **Simulated-Road Test.*** – A simulated road test consists of determining the distance traveled by use of a roller device, or by computation from rolling circumference and wheel-turn data.

*Simulated-road testing is not appropriate for taximeters using measurement data from sources other than signal(s) generated by rotation of the wheels of the vehicle.

(Amended 1977 and 2017)

N.1.2. Test Procedures. – The distance test of a taximeter, whether a road test, a simulated-road test, or a fifth-wheel test, shall include at least duplicate runs of sufficient length to cover at least the third money drop or 1 mi, whichever is greater, and shall be at a speed approximating the average speed traveled by the vehicle in normal service. In the case of metric-calibrated taximeters, the test should cover at least the third money drop or 2 km, whichever is greater.

(Amended 1977)

N.1.2.1. Taximeters Using Measurement Data Sources From Other Than Rotation of the Wheels.

N.1.2.1.1. Testing, General. – Testing of taximeters with metrologically significant parameters that do not completely reside within the taximeter device shall include tests performed under variable conditions to verify that any non-compliant issue is generated from a network system rather than a single taximeter device. The variability tests shall include a minimum of three consecutive tests of varying lengths, locations, and/or environment conditions.

(Added 2017)

N.1.2.1.2. Repeatability Testing, Taximeters Using Measurement Data Sources From Other Than Rotation of the Wheels. – Repeatability testing shall be conducted if, during testing, a taximeter registers a distance measurement that does not comply with the tolerance values in T.1.1. Distance Tests. A minimum of three additional tests shall be conducted at the same location and where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

(Added 2017)

N.1.3. Test Conditions.

N.1.3.1. Measurement Data Based on the Rotation of the Vehicle's Wheels. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, the test of the taximeter shall be performed under the following conditions.

(Added 2017)

N.1.3.1.1. Vehicle Lading. – During the distance test of a taximeter, the vehicle shall carry two persons, or in the case of a simulated-road test, 70 kg or 150 lb of test weights may be substituted in lieu of the second person.

N.1.3.1.2. Tire Pressure. – At the completion of test run or runs, the tires of the vehicle under test shall be checked to determine that the tire pressure is that operating tire pressure posted in the vehicle. If not, the tire pressure should be adjusted to the posted tire pressure and further tests may be conducted to determine the operating characteristics of the taximeter.

(Amended 1977)

N.1.3.2. Taximeters Using Other Measurement Data Sources. - Except during type evaluation, all tests shall be performed under conditions that are considered usual and customary for the location(s) where the system is normally operated and as deemed necessary by the statutory authority.

(Added 2017)

N.1.3.2.1. Roads. – All tests shall be conducted on public roads.

(Added 2017)

N.1.3.2.2. Testing for Environmental Influences. – During type evaluation, the distance test may be performed on a route traveled by the vehicle that exposes the system to conditions possibly contributing to the loss of, or interference with, the signal(s) providing measurement data. This may include:

(a) objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) routes that do not follow a straight-line path;

(c) significant changes in altitude; and

(d) any other relevant environmental conditions.

(Added 2017)

N.2. Time Test. – If a taximeter is equipped with a timing device through which charges are made for time intervals, the timer shall be tested at the initial interval, four separate subsequent intervals, and an average time test of at least four consecutive subsequent time intervals.

(Amended 1988)

N.3. Interference Test. – For taximeters that calculate fares based on time and/or distance but not simultaneously, a test shall be conducted to determine whether there is interference between the time and distance elements. During the interference test, the vehicle's operating speed shall be 3 km/h or 4 km/h (2 mi/h or 3 mi/h) faster, and then 3 km/h or 4 km/h (2 mi/h or 3 mi/h) slower than the speed at which the basic distance rate equals the basic time rate. The basic rate per hour divided by the basic rate per mile is the speed (km/h or mi/h) at which the basic time rate and basic distance rate are equal.

Note: Performance of the interference test may not be considered appropriate as a field test while travelling in a vehicle equipped with a taximeter. This test may be performed during type evaluation under controlled conditions for practicality and for safety concerns.

(Amended 1988 and 2017)

T. Tolerances

T.1. Tolerance Values.

T.1.1. On Distance Tests. – Maintenance and acceptance tolerances for taximeters shall be as follows:

(a) On Overregistration: 1 % of the interval under test.

(b) On Underregistration: 4 % of the interval under test, with an added tolerance of 30 m or 100 ft whenever the initial interval is included in the interval under test.

T.1.2. On Time Tests.

T.1.2.1. On Individual Time Intervals. – Maintenance and acceptance tolerances on individual time intervals shall be as follows:

(a) On Overregistration: 3 seconds per minute (5 %).

(b) On Underregistration: 9 seconds per minute (15 %) on the initial interval, and 6 seconds per minute (10 %) on subsequent intervals.

T.1.2.2. On Average Time Interval Computed After the Initial Interval. – Except for the initial interval, maintenance and acceptance tolerances on the average time interval shall be as follows:

(a) On Overregistration: 0.2 second per minute (0.33 %).

(b) On Underregistration: 3 seconds per minute (5 %).

(Amended 1991)

T.1.3. On Interference Tests. For taximeters designed to calculate fares upon the basis of a combination of distance traveled and time elapsed (but not using both simultaneously), the distance registration of a taximeter in the "time on" position shall agree within 1 % of its distance registration in the "time off" position.

(Added 1988) (Amended 2017)

T.2. Tests Using Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard (i.e., fifth-wheel) when compared to the basic reference standard.

(Added 2017)

UR. User Requirements

UR.1. Inflation of Vehicle Tires. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, the operational tire pressure of passenger vehicles and truck tires shall be posted in the vehicle and shall be maintained at the posted pressure.

(Amended 1977 and 2017)

UR.2. Position and Illumination of Taximeter. – A taximeter shall be so positioned and illuminated that its indications, operational markings, and controls of passenger interest can be conveniently read by a passenger seated in a position of up to 1.2 m (4 ft) away from the taximeter under any condition of normal operation.

(Amended 1985, 1986, and 2017)

UR.3. Statement of Rates. – The distance and time rates for which a taximeter is set, including the initial distance interval and the initial time interval, the local tax rate, and the schedule of extras when an extras indication is provided shall be conspicuously displayed inside the front and rear passenger compartments. The words "Rate," "Rates," or "Rates of Fare" shall precede the rate statement. The rate statement shall be fully informative, self-explanatory, and readily understandable by the ordinary passenger, and shall either be of a permanent character or be protected by glass or other suitable transparent material.

(Amended 1977, 1988, 1990, and 1999)

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Section 5.55. Timing Devices

A. Application

A.1. General. – This code applies to devices used to measure time during which services are being dispensed (such as vehicle parking, laundry drying, and car washing). This code also applies to Electric Vehicle Supply Equipment (EVSE) when used to assess charges for time-based services in addition to those charged for electrical energy.
(Amended 2015)

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

S. Specifications

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

S.1.1. Primary Elements.

S.1.1.1. General. – A timing device shall be equipped with a primary indicating element, and may also be equipped with a primary recording element. A timing device incorporated into an Electric Vehicle Supply Equipment system for use in assessing charges for timing separate from charges for electrical energy shall be equipped with the capability to provide a recorded representation of the transaction through a built-in or separate recording element. A readily observable in-service light or other equally effective means that automatically indicates when laundry driers, vacuum cleaners, and car washes are in operation shall be deemed an appropriate primary indicating element.
(Amended 1979 and 2015)

S.1.1.2. Units. – A timing device shall indicate and record, if the device is equipped to record, the time in terms of minutes for time intervals of 60 minutes or less and in hours and minutes for time intervals greater than 60 minutes.

S.1.1.3. Value of Smallest Unit. – The value of the smallest unit of indicated time and recorded time, if the device is equipped to record, shall not exceed the equivalent of:

(a) one-half hour on parking meters indicating time in excess of two hours;

(b) six minutes on parking meters indicating time in excess of one but not greater than two hours; or

(c) five minutes on all other devices, except those equipped with an in-service light.

(Amended 1975)

S.1.1.4. Advancement of Indicating and Recording Elements. – Primary indicating and recording elements shall be susceptible to advancement only during the mechanical operation of the device, except that clocks may be equipped to manually reset the time.

S.1.1.5. Operation of In-Service Indicator Light. – For devices equipped with an in-service indicator light, the indicator shall be operative only during the time the device is in operation.
(Amended 2015)

S.1.1.6. Discontinuous Indicating Parking Meters. – An indication of the time purchased shall be provided at the time the meter is activated in units of no more than one minute for times less than one hour

and not more than two minutes for times of one hour or more. Convenient means shall be provided to indicate to the purchaser the unexpired time.

(Added 1975) (Amended 1976)

S.1.2. Graduations.

S.1.2.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.1.2.2. Width. – In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations and the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in) in width.

S.1.2.3. Clear Interval Between Graduations. – The clear interval shall be not less than 0.75 mm (0.03 in). If the graduations are not parallel, the measurement shall be made:

(a) along the line of relative movement between the graduations at the end of the indicator; or

(b) if the indicator is continuous, at the point of widest separation of the graduations.

S.1.3. Indicators.

S.1.3.1. Symmetry. – The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.

S.1.3.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case the distance between the end 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.1.3.3. Width. – The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than:

(a) the width of the widest graduation; and

(b) the width of the minimum clear interval between the graduations.

S.1.3.4. Parallax. – Parallax effect shall be reduced to a practicable minimum.

S.1.4. Recorded Representations.

S.1.4.1. Recorded Representations, Electric Vehicle Supply Equipment (EVSE) Timing Devices. – A timing device incorporated into an EVSE for use in assessing charges for timing separate from charges for electrical energy shall issue a recorded representation itemizing the charges for these services as defined in Section 3.40. Electric Vehicle Fueling Systems.

(Added 2015)

S.1.4.1.1. Duplicate Receipts. – Duplicate receipts are permissible, provided the word “duplicate” or “copy” is included on the receipt.

(Added 2015)

S.1.4.2. Recorded Representations, All Other Timing Devices. – A printed ticket issued or stamped by a timing device shall have printed clearly thereon:

(a) the time and day when the service ends and the time and day when the service begins, except that a self-service money-operated device that clearly displays the time of day need not record the time and day when the service begins; or

(b) the time interval purchased, and the time and day that the service either begins or ends.

(Added 2015)

(Amended 1983 and 2015)

S.2. Marking Requirements, Operating Instructions. – Operating instructions shall be clearly stated on the device.

S.3. Interference. – The design of the EVSE shall be such that there will be no interference between the time and electrical energy measurement elements of the system.

(Added 2015)

S.4. Provisions for Sealing. – Adequate provisions shall be made to provide security for the timing element.

(Added 2015)

S.5. Power Interruption. – In the event of a power loss, the information needed to complete any transaction (i.e., delivery is complete and payment is settled) in progress at the time of the power loss (such as the quantity and unit price, or sales price) shall be determinable through one of the means listed below or the transaction shall be terminated without any charge for the electrical energy transfer to the vehicle:

(a) at the EVSE;

(b) at the console, if the console is accessible to the customer;

(c) via on site Internet access; or

(d) through toll-free phone access.

For EVSEs in parking areas where vehicles are commonly left for extended periods, the information needed to complete any transaction in progress at the time of the power loss shall be determinable through one of the above means for at least eight hours.

(Added 2015)

S.5.1. Transaction Termination. – In the event of a power loss, either:

(a) the transaction shall terminate at the time of the power loss; or

(b) the EVSE may continue charging without additional authorization if the EVSE is able to determine it is connected to the same vehicle before and after the supply power outage.

In either case, there must be a clear indication on the receipt provided to the customer of the interruption, including the date and time of the interruption along with other information required under S.1.4.2. Recorded Representations, All Other Timing Devices.

(Added 2015)

S.5.2. User Information. – The EVSE memory, or equipment on the network supporting the EVSE, shall retain information on the quantity of time and the sales price totals during a power loss.

(Added 2015)

N. Notes

N.1. Test Method. – A timing device shall be tested with a timepiece with an error of not greater than plus or minus 15 seconds per 24-hour period. In the test of timing devices with a nominal capacity of 1 hour or less, stopwatches with a minimum division of not greater than one-fifth second shall be used. In the test of timing devices with a nominal capacity of more than one hour, the value of the minimum division on the timepiece shall be not greater than one second. Time pieces and stopwatches shall be calibrated with standard time signals as described in National Institute of Standards and Technology Special Publication 432, NIST Time and Frequency Dissemination Services, or any superseding publication.

(Amended 1978)

N.2. Broadcast Times and Frequencies. – Time and frequency standards are broadcast by the stations listed in Table N.2. Broadcast Times and Frequencies.

Table N.2.*
Broadcast Times and Frequencies

Station	Location, Latitude, Longitude	Frequency (MHz)	Times of Transmission (UTC)
WWV	Fort Collins, Colorado 40° 41' N 105° 02' W	2.5 5.0 10.0 15.0 20.0	Continuous
WWVH	Kauai, Hawaii 21° 59' N 159° 46' W	2.5 5.0 10.0 15.0	Continuous
CHU	Ottawa, Canada 45° 18' N 75° 45' W	3.330 7.335 14.670 14.670	Continuous

*From NIST Special Publication 559, "Time and Frequency Users' Manual," 1990.

(Added 1988)

N.3. Interference Tests, EVSE. – On an EVSE equipped with a timing device used to calculate time-based charges in addition to any charges assessed for electrical energy, a test shall be conducted to ensure that there is no interference between time and electrical energy measuring elements.

(Added 2015)

T. Tolerances

T.1. Tolerance Values. – Maintenance and acceptance tolerances for timing devices shall be as follows:

T.1.1. For Timing Devices Other Than Those Specified in T.1.2. For Time Clocks and Time Recorders and T.1.3. On Parking Meters. – The maintenance and acceptance tolerances shall be:

(a) On Overregistration: five seconds for any time interval of one minute or more; and
(Amended 1986)

(b) On Underregistration: six seconds per indicated minute.

(Amended 1975)

T.1.2. For Time Clocks and Time Recorders. – The maintenance and acceptance tolerances on over-registration and underregistration shall be three seconds per hour, but not to exceed one minute per day.

(Amended 1975)

T.1.3. On Parking Meters and Other Timing Devices Used to Assess Charges for Parking. – The maintenance and acceptance tolerances are shown in Table T.1.3. Maintenance and Acceptance Tolerances for Parking Meters and Other Timing Devices Used to Assess Charges For Parking.

(Amended 2015)

Table T.1.3.
Maintenance and Acceptance Tolerances for Parking Meters and Other Timing Devices Used to Assess Charges for Parking

Maintenance and Acceptance Tolerances		
Nominal Time Capacity	**On Overregistration**	**On Underregistration**
30 minutes or less	No tolerance	10 seconds per minute, but not less than 2 minutes
Over 30 minutes to and including 1 hour	No tolerance	5 minutes plus 4 seconds per minute over 30 minutes
Over 1 hour	No tolerance	7 minutes plus 2 minutes per hour over 1 hour

(Amended 2015)

T.2. Tests Involving Digital Indications or Representations. – To the tolerances that would otherwise be applied, there shall be added an amount equal to one-half the minimum value that can be indicated or recorded.

UR. User Requirements

UR.1. Statement of Rates. – The following information shall be clearly, prominently, and conspicuously displayed:

(a) the price in terms of money per unit or units of time for the service dispensed; and

(b) for a timing device other than an EVSE, the number of coins the device will accept and be activated by at one time.

(Amended 1976 and 2015)

UR.2. Time Representations. – Any time representation shall be within plus or minus two minutes of the correct time in effect in the area, except on an individual clock used only for "time out"; in addition, the time indication of the "time-out" clock shall be the same as or less than that of the "time-in" clock.

(Amended 1975)

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Section 5.58. Multiple Dimension Measuring Devices

A. Application

A.1. General. – This code applies to dimension and volume measuring devices used for determining the dimensions and/or volume of objects for the purpose of calculating freight, storage, or postal charges based on the dimensions and/or volume occupied by the object. A multiple dimension measuring device:

(a) is generally used to measure hexahedron-shaped objects; and
(Added 2008)

(b) may be used to measure irregularly-shaped objects.
(Added 2008)

(Amended 2008)

A.2. Other Devices Designed to Make Multiple Measurement Automatically to Determine a Volume. – Insofar as they are clearly applicable, the provisions of this code apply also to devices designed to make multiple measurements automatically to determine a volume for other applications as defined by Section 1.10. General Code paragraph G-A.1. Commercial and Law-Enforcement Equipment.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Multiple Dimension Measuring Devices shall meet the requirements of Section 1.10. General Code.

A.4. Exceptions. – This code does not apply to:

(a) devices designed to indicate automatically (with or without value-computing capabilities) the length of fabric passed through the measuring elements (also see Section 5.50. for Fabric-Measuring Devices);

(b) devices designed to indicate automatically the length of cordage, rope, wire, cable, or similar flexible material passed through the measuring elements (also see Section 5.51. for Wire- and Cordage-Measuring Devices); or

(c) any linear measure, measure of length, or devices used to measure individual dimensions for the purpose of assessing a charge per unit of measurement of the individual dimension (also see Section 5.52. for Linear Measures).

A.5. Type Evaluation. – The National Type Evaluation Program (NTEP) will accept for type evaluation only those devices that comply with all requirements of this code.

S. Specifications

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

S.1.1. Zero or Ready Indication.

(a) Provision shall be made to indicate or record either a zero or ready condition.

(b) A zero or ready condition may be indicated by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a measuring operation when the device is in an out-of-zero or non-ready condition.

S.1.2. Digital Indications. – Indicated and recorded values shall be presented digitally.

S.1.3. Negative Values. – Except when in the tare mode, negative values shall not be indicated or recorded.

S.1.4. Dimensions Indication. – If in normal operation the device indicates or records only volume, a testing mode shall be provided to indicate dimensions for all objects measured.

S.1.5. Value of Dimension/Volume Division Units. – The value of a device division "d" expressed in a unit of dimension shall be presented in a decimal format. The value of "d" for each measurement axis shall be in the same unit of measure and expressed as:

(a) 1, 2, or 5;

(b) a decimal multiple or submultiple of 1, 2, or 5; or

(c) a binary submultiple of a specific U.S. customary unit of measure.

Examples: Device divisions may be 0.01, 0.02, 0.05; 0.1, 0.2, or 0.5; 1, 2, or 5; 10, 20, 50, or 100; 0.5, 0.25, 0.125, 0.0625, etc.

S.1.5.1. For Indirect Sales. – In addition to the values specified in S.1.5. Value of Dimension/Volume Division Units, the value of the division may be 0.3 inch and 0.4 inch.

S.1.5.2. Devices Capable of Measuring Irregularly-Shaped Objects. – For devices capable of measuring irregularly shaped objects, the value of the division size (d) shall be the same for the length axis (x) and the width axis (y) and may be different for the height axis (z), provided that electronic rotation of the object to determine the smallest hexahedron is calculated in only a two-dimension horizontal plane, retaining the stable side plane as the bottom of the hexahedron.

(Added 2008)

S.1.6. Customer Indications and Recorded Representations. – Multiple dimension measuring devices or systems must provide information as specified in Table S.1.6. Required Information to be Provided by Multiple Dimension Measuring Systems. As a minimum, all devices or systems must be able to meet either column I or column II in Table S.1.6. Required Information to be Provided by Multiple Dimension Measuring Systems.

(Amended 2004)

Table S.1.6.
Required Information to be Provided by Multiple Dimension Measuring Systems

Information	Column I[1]	Column II[1]		Column III
	Provided by device	Provided by invoice or other means		Provided by invoice or other means as specified in contractual agreement
		Customer present	Customer not present	
1. Device identification[2]	D or P	P	P	P or A
2. Error message (when applicable)	D or P	P	N/A	N/A
3. Hexahedron dimensions[3]	D or P	P	P	P or A
4. Hexahedron volume (if used)[3]	D or P	P	P	P or A
5. Actual weight (if used)[3]	D or P	P	P	P or A
6. Tare (if used)[3]	D or P	N/A	N/A	N/A
7. Hexahedron measurement statement[4]	D or P or M	P	P	P or G

A = AVAILABLE UPON REQUEST BY CUSTOMER[5]
D = DISPLAYED
G = PUBLISHED GUIDELINES OR CONTRACTS
M = MARKED
N/A = NOT APPLICABLE
P = PRINTED or RECORDED IN A MEMORY DEVICE and AVAILABLE UPON REQUEST BY CUSTOMER[5]

Notes:
[1] As a minimum all devices or systems must be able to meet either column I or column II.

[2] This is only required in systems where more than one device or measuring element is being used.

[3] Some devices or systems may not utilize all of these values; however as a minimum either hexahedron dimensions or hexahedron volume must be displayed or printed.

[4] This is an explanation that the dimensions and/or volume shown are those of the smallest hexahedron in which the object that was measured may be enclosed rather than those of the object itself.

[5] The information "available upon request by customer" shall be retained by the party having issued the invoice for at least 30 calendar days after the date of invoicing.

(Amended 2004)

S.1.7. Minimum Measurement. – Except for entries of tare, the minimum measurement by a device is 12 d. The manufacturer may specify a longer minimum measurement. For multi-interval devices, this applies only to the first measuring range (or segment) of each measurement axis (length, width, and height).

(Amended 2017)

S.1.8. Indications Below Minimum and Above Maximum. – When objects are smaller than the minimum dimensions identified in paragraph S.1.7. Minimum Measurement or larger than any of the maximum dimensions plus 9 d, and/or maximum volume marked on the device plus 9 d, or when a combination of dimensions, including

tare, for the object being measured exceeds the measurement capability of the device, the indicating or recording element shall either:

(a) not indicate or record any usable values; or

(b) identify the indicated or recorded representation with an error indication.

(Amended 2004 and 2017)

S.1.9. Operating Temperature. – An indicating or recording element shall not indicate nor record any usable values until the operating temperature necessary for accurate measuring and a stable zero reference or ready condition has been attained.

S.1.10. Adjustable Components. – Adjustable components shall be held securely in adjustment and, except for a zeroing mechanism (when applicable), shall be located within the housing of the element.

S.1.11. Provision for Sealing.

(a) 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 measuring element.

(b) Audit trails shall use the format set forth in Table S.1.11. Categories of Devices and Methods of Sealing for Multiple Dimension Measuring Systems.

Table S.1.11.
Categories of Devices and Methods of Sealing for Multiple Dimension Measuring Systems

Categories of Devices	Methods of Sealing
Category 1: No remote configuration.	Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 2: Remote configuration capability, but access is controlled by physical hardware. Device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.	The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).	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 through the device or through another on-site device. 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.)

S.2. Design of Zero and Tare.

S.2.1. Zero or Ready Adjustment. – A device shall be equipped with means by which the zero reference or ready condition can be adjusted, or the zero reference or ready condition shall be automatically maintained. The

zero reference or ready control circuits shall be interlocked so that their use is prohibited during measurement operations.

S.2.2. Tare. – The tare function shall operate only in a backward direction (that is, in a direction of under-registration) with respect to the zero reference or ready condition of the device. The value of the tare division or increment shall be equal to the division of its respective axis on the device. There shall be a clear indication that tare has been taken.

S.2.2.1. Maximum Value of Tare for Multi-Interval (Variable Division-Value Devices. – A multi-interval device shall not accept any tare value greater than the maximum capacity of the lowest range of the axis for which the tare is being entered.

(Added 2016)

S.2.2.2. Net Values, Mathematical Agreement. – All net values resulting from a device subtracting a tare entry from a gross value indication shall be indicated and recorded, if so equipped, to the nearest division of the measuring range in which the net value occurs. In instances where the tare value entered on a multi-interval device is in a lower partial measuring range (or segment) than the gross indication, the system shall either alter the tare entered or round the net result after subtraction of the tare in order to achieve correct mathematical agreement.

Consider a multi-interval device having two partial measuring ranges for the "x" axis:

- Partial measuring range 1: 0 to 100 inches in 0.2 inch increments
- Partial measuring range 2: 100 to 300 inches in 0.5 inch increments

The following examples clarify the two acceptable methods this device can use to achieve mathematical agreement when tare has been entered in a lower partial measuring range than the gross indication.

(Added 2016)

Acceptable Example 1.
Altering of a Tare Entry to Achieve Accurate Net Indication

Gross Indication of Item Being Measured	Tare Entered	Value of Tare after Being Altered by the Device	Acceptable Net Indication
154.5 in	41.2 in	41.0 in	113.5 in
154.5 in	41.4 in	41.5 in	113.0 in

(Added 2016)

Acceptable Example 2.
Rounding of the Net Result (Following the Subtraction of Tare) to Achieve Accurate Net Indication

Gross Indication of Item Being Measured	Tare Entered	Net Result Before Rounding (Gross Indication minus Tare Entered)	Acceptable Net Indication Rounded to Nearest 0.5 Inch
154.5 in	41.2 in	113.3 in	113.5 in
154.5 in	41.4 in	113.1 in	113.0 in

(Added 2016)

S.3. Systems with Two or More Measuring Elements. – A multiple dimension measuring system with a single indicating or recording element, or a combination indicating-recording element, that is coupled to two or more measuring elements with independent measuring systems, shall be provided with means to prohibit the activation of

any measuring element (or elements) not in use, and shall be provided with automatic means to indicate clearly and definitely which measuring element is in use.

Note: This requirement does not apply to individual devices that use multiple emitters/sensors within a device in combination to measure objects in the same measurement field.

(Amended 2004)

S.4. Marking Requirements. (Also see G-S.1. Identification, G-S.4. Interchange or Reversal of Parts, G-S.5.2.5. Permanence, G-S.6. Marking Operational Controls, Indications, and Features, G-S.7. Lettering, G-UR.2.1.1. Visibility of Identification, and G-UR.3.1. Method of Operation.)

S.4.1. Multiple Dimension Measuring Devices, Main Elements, and Components of Measuring Devices. – Multiple dimension measuring devices, main elements of multiple dimension measuring devices when not contained in a single enclosure for the entire dimension/volume measuring device, and other components shall be marked as specified in Table S.4.1.a. and explained in the accompanying notes, Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.1.a.

Table S.4.1.a.
Marking Requirements for Multiple Dimension Measuring Systems

	Multiple Dimension Measuring Equipment			
To Be Marked With ⇓	**Multiple Dimension Measuring Device and Indicating Element in Same Housing**	**Indicating Element not Permanently Attached to Multiple Dimension Measuring Element**	**Multiple Dimension Measuring Element not Permanently Attached to the Indicating Element**	**Other Equipment (1)**
Manufacturer's ID	x	x	x	x
Model Designation	x	x	x	x
Serial Number and Prefix	x	x	x	x (2)
Certificate of Conformance Number (8)	x	x	x	x (8)
Minimum and Maximum Dimensions for Each Axis for Each Range in Each Axis (3)(9)	x	x	x	
Value of Measuring Division, d (for each axis and range) (9)	x	x	x	
Temperature Limits (4)(9)	x	x	x	
Minimum and Maximum speed (5)(9)	x	x	x	
Special Application (6)(9)	x	x	x	
Limitation of Use (7)(9)	x	x	x	

(Amended 2016)

Table S.4.1.b.
Multiple Dimension Measuring Systems Notes for Table S.4.1.a.

1. Necessary to the dimension and/or volume measuring system, but having no effect on the measuring value, e.g., auxiliary remote display, keyboard, etc.

2. Modules without "intelligence" on a modular system (e.g., printer, keyboard module, etc.) are not required to have serial numbers.

3. The minimum and maximum dimensions (using upper or lower case type) shall be marked. For example:
   Length: min _____ max _____
   Width: min _____ max _____
   Height: min _____ max _____

4. Required if the range is other than − 10 °C to 40 °C (14 °F to 104 °F).

5. Multiple dimension measuring devices, which require that the object or device be moved relative to one another, shall be marked with the minimum and maximum speeds at which the device is capable of making measurements that are within the applicable tolerances.

6. A device designed for a special application rather than general use shall be conspicuously marked with suitable words visible to the operator and the customer restricting its use to that application.

7. Materials, shapes, structures, combination of object dimensions, speed, spacing, minimum protrusion size, or object orientations that are inappropriate for the device or those that are appropriate.

8. Required only if a Certificate of Conformance has been issued for the equipment.

9. This marking information may be readily accessible via the display. Instructions for displaying the information shall be described in the NTEP CC.

(Amended 2004, 2008, and 2016)

S.4.2. Location of Marking Information. – The required marking 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.

N. Notes

N.1. Test Procedures.

N.1.1. General. – The device shall be tested using test standards and objects of known and stable dimensions.

N.1.2. Position Test. – Measurements are made using different positions of the test object and consistent with the manufacturer's specified use for the device.

N.1.2.1. Irregularly-Shaped Test Object Placement. – Irregularly-shaped test objects must be measured while placed on a stable side. The rotation of the object to determine the smallest hexahedron should be calculated in a two-dimensional plane, retaining the stable side plane as the bottom of the hexahedron.

(Added 2008)

N.1.3. Disturbance Tests, Field Evaluation. – A disturbance test shall be conducted at a given installation when the presence of disturbances specified in T.6. has been verified and characterized if those conditions are considered "usual and customary."

N.1.4. Test Object Size. – Test objects may vary in size from the smallest dimension to the largest dimension marked on the device, and for field verification examinations, shall be an integer multiple of "d."

N.1.4.1. Test Objects. – Verification of devices may be conducted using appropriate test objects of various sizes and of stable dimensions. Test object dimensions must be known to an expanded uncertainty (coverage factor k = 2) of not more than one-third of the applicable device tolerance. The dimensions shall also be checked to the same uncertainty when used at the extreme values of the influence factors.

The dimension of all test objects shall be verified using a reference standard that is traceable to NIST (or equivalent national laboratory) and meet the tolerances expressed in NIST Handbook 44 Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied to the device).

(Added 2004)

N.1.4.2. Irregularly-Shaped Test Objects. – For irregularly-shaped test objects, at least one angle shall be obtuse and the smallest dimension for an axis shall be equal to or greater than the minimum dimension for that axis.

(Added 2008)

(Amended 2008 and 2012)

N.1.5. Digital Zero Stability. – A zero indication change test shall be conducted on all devices which show a digital zero. After the removal of any test object, the zero indication shall not change. (Also see G-UR.4.2. Abnormal Performance.)

T. Tolerances

T.1. Design. – The tolerance for a multiple dimension measuring device is a performance requirement independent of the design principle used.

T.2. Tolerance Application.

T.2.1. Type Evaluation. – For type evaluations, the tolerance values apply to tests within the influence factor limits of temperature and power supply voltage specified in T.5.1. Temperature and T.5.2. Power Supply Voltage.

T.2.2. Subsequent Verification. – For subsequent verifications, the tolerance values apply regardless of the influence factors in effect at the time of the verification. (Also see G-N.2. Testing with Nonassociated Equipment.)

T.2.3. Multi-interval (Variable Division-Value) Devices. – When there exist two or more partial measuring ranges (or segments) specified for any of the "dimensioning" axes (length (x), width (y), or height (z)) and the division values corresponding to those partial measuring ranges (or segments) within the same "dimensioning" axis differ, the tolerance values shall be based on the value of the division of the range in use.
(Amended 2016)

T.2.4. Mixed-Interval Devices. – For devices that measure to a different division value in at least one dimensioning axes and all axes are single range, the tolerance values shall be based on the value of the division of the axis in use.

(Added 2016)

T.3. Tolerance Values. – The maintenance and acceptance tolerance values shall be ± 1 division.

(Amended 2004)

T.4. Position Tests. – For a test standard measured several times in different positions by the device all indications shall be within applicable tolerances.

T.5. Influence Factors. – The following factors are applicable to tests conducted under controlled conditions only.

T.5.1. Temperature. – Devices shall satisfy the tolerance requirements under the following temperature conditions.

T.5.1.1. Temperature Limits. – If not marked on the device, the temperature limits shall be − 10 °C to 40 °C (14 °F to 104 °F).

T.5.1.2. Minimum Temperature Range. – If temperature limits are specified for the device, the range shall be at least 30 °C or 54 °F.

T.5.1.3. Temperature Effect on Zero Indication. – The zero indication shall not vary by more than one division per 5 °C (9 °F) change in temperature.

T.5.2. Power Supply Voltage.

T.5.2.1. Alternating Current Power Supply. – Devices that operate using alternating current must perform within the conditions defined in paragraphs T.3. through T.6., inclusive, from − 15 % to + 10 % of the marked nominal line voltage(s) at 60 Hz, or the voltage range marked by the manufacturer, at 60 Hz.

(Added 2004)

T.5.2.2. Direct Current Power Supply. – Devices that operate using direct current shall operate and perform within the applicable tolerance at any voltage level at which the device is capable of displaying metrological registrations.

(Added 2004)

(Amended 2004)

T.6. Disturbances, Field Evaluation. – The following requirements apply to devices when subjected to disturbances which may normally exist in the surrounding environment. These disturbances include radio frequency interference (RFI), electromagnetic interference (EMI), acoustic changes, ambient light emissions, etc. The difference between the measurement indication with the disturbance and the measurement indication without the disturbance shall not exceed one division "d" or the equipment shall:

(a) blank the indication;

(b) provide an error message; or

(c) the indication shall be so completely unstable that it could not be interpreted, or transmitted into memory or to a recording element, as a correct measurement value.

UR. User Requirements

UR.1. Selection Requirements. – 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 maximum capacity, value of the division, minimum capacity, and computing capability.

UR.1.1. Value of the Indicated and Recorded Division. – The value of the division recorded shall be the same as the division value indicated.

UR.2. Installation Requirements.

UR.2.1. Supports. – A device that is portable and is being used on a counter, table, or the floor shall be so positioned that it is firmly and securely supported.

UR.2.2. Foundation, Supports, and Clearance. – The foundations and support of a device installed in a fixed location shall be such as to provide strength, rigidity, and permanence of all components, and clearance shall be provided around all live parts to the extent that no contacts may result when the measuring element is empty, nor throughout the performance range of the device such that the operation or performance of the device is adversely affected.

UR.2.3. Protection from Environmental Factors. – The indicating and measuring elements of a device shall be adequately protected from environmental factors such as wind, weather, and RFI that may adversely affect the operation or performance of the device.

UR.3. Use Requirements.

UR.3.1. Minimum and Maximum Measuring Ranges. – A device shall not be used to measure objects smaller than the minimum or larger than the maximum dimensions marked on the device.

UR.3.2. Special Designs. – A multiple dimension measuring device designed and marked for a special application shall not be used for other than its intended purpose.

UR.3.3. Object Placement. – If the object being measured must be transported (e.g., shipped) on a stable side, that irregularly-shaped object must be measured while placed on that stable side. The electronic rotation of the object to determine the smallest hexahedron shall be calculated in a two-dimensional horizontal plane, retaining the stable side plane as the bottom of the hexahedron.

(Added 2008)

(Amended 2008)

UR.4. Maintenance Requirements.

UR.4.1. Zero or Ready Condition. – The zero-setting adjustment of a multiple dimension measuring device shall be maintained so that, with no object in or on the measuring element, the device shall indicate or record a zero or ready condition.

UR.4.2. Level Condition. – If a multiple dimension measuring device is equipped with a level-condition indicator, the device shall be maintained in a level condition.

UR.4.3. Device Modification. – The measuring capabilities of a device shall not be changed from the manufacturer's design unless the modification has been approved by the manufacturer and the weights and measures authority having jurisdiction over the device.

UR.5. Customer Information Provided. – The user of a multiple dimension measuring device or system shall provide transaction information to the customer as specified in Table UR.5. Customer Information Provided.

(Added 2004)

Table UR.5.
Customer Information Provided

Information	No Contractual Agreement		Contractual Agreement
	Customer Present	Customer not Present	
1. Object identification	N/A	P	P or A
2. Billing method (scale or dimensional weight if used)	D or P	P	P or A
3. Billing rate or rate chart	D or P or A	P or G or A	P or A
4. Dimensional weight (if used)	P	P	P or A
5. Conversion factor (if dimensional weight is used)	D or P or A	P	P or G
6. Dimensional weight statement[1] (if dimensional weight is used)	D or P	P	P or G
7. Total price	P	P	P or A

A = Available upon Request by Customer[2]

D = Displayed

G = Published Guidelines or Contracts

M = Marked

N/A = Not Applicable

P = Printed

Notes:

[1] This is an explanation that the dimensional weight is not a true weight but is a calculated value obtained by applying a conversion factor to the hexahedron dimensions or volume of the object.

[2] The information "available upon request by customer" shall be retained by the party having issued the invoice for at least 30 calendar days after the date of invoicing.

(Added 2004)

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Section 5.59. Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices

The status of Section 5.59. Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices was changed from "tentative" to "permanent" effective January 1, 2013.

(Added 2005) (Amended 2012)

A. Application

A.1. General. – This code applies to electronic devices or systems for measuring the composition or quality constituents of live animals, livestock and poultry carcasses, and individual cuts of meat or a combination thereof for the purpose of determining value.

A.2. Additional Code Requirements. – In addition to the requirements of this code, Electronic Livestock, Meat, and Poultry Evaluation Systems shall meet the requirements of Section 1.10. General Code.

A.3. Exceptions. – This code does not apply to scales used to weigh live animals, livestock and poultry carcasses, and individual cuts of meat unless the scales are part of an integrated system designed to measure composition or quality constituents. Scales used in integrated systems must also meet NIST Handbook 44, Section 2.20. Scale requirements.

S. Specifications

S.1. Design and Manufacture. – All design and manufacturing specifications shall comply with American Society for Testing Materials (ASTM) International Standard F2342 Standard Specification for Design and Construction of Composition or Quality Constituent Measuring Devices or Systems.

N. Notes

N.1. Method of Test. – Performance tests shall be conducted in accordance with ASTM Standard F2343 Test Method for Livestock, Meat, and Poultry Evaluation Devices.

N.2. Testing Standards. – ASTM Standard F2343 requires device or system users to maintain accurate reference standards that meet the tolerance expressed in NIST Handbook 44 Fundamental Considerations, paragraph 3.2. Tolerances for Standards (i.e., one-third of the smallest tolerance applied).

N.3. Verification. – Device or system users are required to verify and document the accuracy of a device or system on each production day as specified by ASTM Standard F2341 Standard Practice of User Requirements for Livestock, Meat, and Poultry Evaluation Devices or Systems.

N.3.1. Official Tests. – Officials are encouraged to periodically witness the required "in house" verification of accuracy. Officials may also conduct official tests using the on-site testing standards or other appropriate standards belonging to the jurisdiction with statutory authority over the device or system.

T. Tolerances

T.1. Tolerances on Individual Measurements. – Maintenance and acceptance tolerances on an individual measurement shall be as shown in Table T.1. Tolerances.

Table T.1.
Tolerances

Individual linear measurement of a single constituent	± 1 mm (0.039 in)
Measurement of area	± 1.6 cm^2 (0.25 in^2)
For measurements of other constituents	As specified in ASTM Standard F2343

UR. User Requirements

UR.1. Installation Requirements.

UR.1.1. Installation. – All devices and systems shall be installed in accordance with manufacturer's instructions.

UR.2. Maintenance of Equipment.

UR.2.1. Maintenance. – All devices and systems shall be continually maintained in an accurate condition and in accordance with the manufacturer's instructions and ASTM Standard F2341.

UR.3. Use Requirements.

UR.3.1. Limitation of Use. – All devices and systems shall be used to make measurements in a manner specified by the manufacturer.

UR.4. Testing Standards. – The user of a commercial device shall make available to the official with statutory authority over the device testing standards that meet the tolerance expressed in Fundamental Considerations, paragraph 3.2. Tolerances for Standards (i.e., one-third of the smallest tolerance applied). The accuracy of the testing standards shall be verified annually or on a frequency as required by the official with statutory authority and shall be traceable to the appropriate SI standard.

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Section 5.60. Transportation Network Measurement Systems – Tentative Code

This tentative code has a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code. Officials wanting to conduct an official examination of a device or system are advised to see paragraph G-A.3. Special and Unclassified Equipment.

(Tentative Code Added 2017)

A. Application

A.1. General. – This code applies to a transportation network measurement system used in connection with a digital network that determines the actual time elapsed and/or distance travelled during a network-arranged ride to calculate a fare for transportation services.

Note: The fare is calculated by software services residing on the transportation network company servers using data transmitted by the indicating elements present in the vehicle, which are running software applications or services supplied by the transportation network company. The measurement data is generated from sources not physically connected to the vehicle (e.g., a navigation satellite system such as GPS and/or other location services).

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

(a) Any system that charges a flat rate or fixed charge, and/or does not use a measurement of actual time elapsed or distance travelled to calculate a fare for transportation services.

(b) Odometers on vehicles that are rented or hired on a distance basis. (Also see Section 5.53. Odometers.)

(c) Taximeters. (Also see Section 5.54. Taximeters.)

(d) Any system where the fare is calculated by equipment located in the vehicle.

A.3. Additional Code Requirements. – In addition to the requirements of this code, transportation network measurement systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements. – Indicating and recording elements shall provide indications and recorded representations that are clear, definite, accurate, and easily read under any conditions of normal operation of the device(s).

All indicating and recording elements used in a transportation network measurement system shall operate correctly while using the online-enabled technology application service provided by the transportation network company.

S.1.1. General Indicating Elements. – A transportation network measurement system shall include, as a minimum:

(a) an indicating element used by a transportation network company driver that displays information and facilitates the measurements during a network-arranged ride to calculate a fare for transportation services; and

(b) an indicating element used by a transportation network company rider that displays information that allows the rider to review the current rate(s) for the transportation service and to request a ride.

S.1.2. General Recording Elements. – A transportation network measurement system shall be capable of:

(a) recording all information necessary to generate a receipt specified in S.1.10. Receipt;

(b) providing information to transportation network company drivers, including, but not limited to, a summary of rides given as specified in S.1.11. Driver's Summary; and

(c) providing a copy of all metrological data required by law to a weights and measures jurisdiction with statutory authority.

S.1.3. Identification. – All transportation network measurement system indicating elements shall display for the purposes of identification the following information:

(a) the name, initials, or trademark of the transportation network measurement system manufacturer, distributor, or developer; and

(b) the current version or revision identifier of the software application service provided by the transportation network company running on the indicating elements identified in S.1.1. General Indicating Elements.

(1) The version or revision identifier shall be prefaced by words or an abbreviation that clearly identifies the number as the required version or revision.

(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.).

S.1.4. Location of Identification Information. – The information required by S.1.3. Identification shall be accessible through an easily recognized menu and, if necessary, a submenu or other appropriate means. Examples of menu and submenu identification include, but are not limited to, "Help," "About," "System Identification," "Weights and Measures Identification," or "Identification."

S.1.5. Display of Rates and Additional Charges. – The transportation network measurement system shall be designed to make available to transportation network company riders the rate(s) for transportation services before the beginning of a network-arranged ride. The system shall be capable of providing an explanation of the basis for calculating a fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fee, before a rider submits the request for a network-arranged ride.

S.1.6. Fare Estimates. – The transportation network measurement system shall be capable of displaying a fare estimate to the transportation network company rider before a request for a network-arranged ride is made.

S.1.7. Actuation of Measurement System. – Following the initiation of a network-arranged ride by the transportation network company driver, and prior to the conclusion of that network-arranged ride, the transportation network measurement system shall only indicate and/or record measurements resulting from the movement of the vehicle or by the time mechanism.

S.1.8. Fare Adjustment. – *A transportation network measurement system shall be designed with:*

(a) a "time off" mechanism and a "distance off" mechanism provided for the transportation network system driver to render the measurement of time and distance either operative or inoperative during the ride; or

(b) the capability to make post-transaction fare adjustments to reduce the amount of the fare, provided the system creates a record of all location and time data from the time the ride request was accepted by the transportation network company driver.

[Nonretroactive as of January 1, 2018]

S.1.9. Fare Identification and Other Charges.

S.1.9.1. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression when displayed on the transportation network company system receipt required by S.1.10 Receipt. Values shall be defined by suitable words or monetary signs.

S.1.9.2. Other Charges. – Other charges shall be indicated as separate line items when displayed on the receipt required by S.1.10. Receipt. Other charges shall be identified using an appropriate descriptive term, including but not limited to "Booking Fee," "Tolls," "Airport Pickup/Drop-off Surcharge" or an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.10. Receipt. – A transportation network measurement system shall issue a printed or electronic receipt to a transportation network company rider. This receipt shall include as a minimum the following:

(a) date of the start of the trip;

(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;

(c) start and end time of trip, total time of trip (maximum increment of one second), and if applicable, the total elapsed time during any time-off period;

(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;

(e) the associated fare in $;

(f) other charges where permitted shall be identified and itemized;

(g) total charge in $;

(h) the start and end addresses or locations of the trip;

(i) a map showing the route taken; and

(j) a means to obtain transportation network company rider assistance.

S.1.11. Driver's Summary. – A transportation network measurement system shall be capable of providing a summary of the driver's activity regarding network-arranged rides. The summary shall include, but not be limited to, the following information about each ride:

(a) date and time for start of trip;

(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;

(c) total time of trip, maximum increment of one second;

(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;

(e) the total fare received;

(f) other charges where permitted; and

(g) a means to obtain transportation network company driver assistance.

S.2. Provision for Sealing.

S.2.1. System Security. – Adequate provision shall be made to provide security for a transportation network measurement system. The system shall be designed to:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modification using industry-standard technological protection mechanisms such as data encryption; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

S.2.2. System Audit. – The transportation network measurement system shall be designed in a manner that permits officials having statutory authority to verify compliance with this transportation network measurement system code.

S.2.3. Change Tracking. – Changes made by the manufacturer, distributor, or developer of a transportation network measurement system to any algorithms or code, which have a metrological effect, shall be logged and recorded. The period covered by this change record is not required to exceed one year.

S.3. Provision for Trip Data Loss. – If a portion of the trip data is lost due to power or signal interruption by the transportation network company driver's indicating element, the transportation network measurement system shall be capable of determining the information needed to complete any transaction in progress at the time of the power or signal loss.

S.3.1. Intermittent Trip Data Loss. – When the location services signal is lost intermittently during a prearranged ride (e.g., traveling through a tunnel), but recovered prior to the end of the ride, the transportation network measurement system shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

S.3.2. Significant Trip Data Loss. – When the location services signal is lost for a significant portion of the network-arranged ride, the transportation network measurement system shall provide for alternative fare structures.

Note: Significant trip data loss refers to instances when the location services signal is lost to the extent the transportation network measurement system is not capable of calculating an accurate fare in accordance with T.1. Tolerance Values using actual time and actual distance, or when the signal is not regained by the end of the ride.

S.3.3. Alternative Fare Structures. – If the transportation network measuring system is not using actual time and actual distance for a particular trip (e.g., zone-based fares, signal loss), that portion of the fare not based on actual time and actual distance is not subject to this code. Charges not based on actual time and actual distance measurements may be based on the terms of service.

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, distance test(s) of a transportation network measurement system shall be conducted. The distance test(s) shall consist of a road test unless safety or other practical concerns prohibit road testing. A transfer standard test may be performed in the absence of a road test. At least one test shall be of a length sufficient to exceed the minimum fare.

N.1.1.1. Road Test. – The test consists of operating the conveyance over a precisely measured course calibrated to a traceable linear measure of at least one mile in length

N.1.1.2. Transfer Standard Test. – The test consists of operating the conveyance over an unmeasured course while using a calibrated transfer standard, such as a fifth-wheel, to measure the distance travelled.

Note: Field examinations of transportation network measurement systems need not include testing of all individual devices used as driver/passenger indicating elements in connection with the service provided. It is considered sufficient that a representative sample of various indicating elements be incorporated in testing to verify proper operation of the system.

N.1.2. Test Procedures.

N.1.2.1. Test Length. – All tests must be at least one mile in length. If a measured course or testing equipment is not readily available that will enable a test of a length sufficient to exceed the minimum fare, after completing the testing specified in N.1.1. Test Methods, an additional unmeasured test may be conducted. The purpose of this additional unmeasured test is to verify compliance with S.1.10. Receipt.

N.1.2.2. Additional Tests. – If during testing a transportation network measurement system produces a measurement that does not comply with the tolerance values in T.1.1. Distance Tests, a minimum of three additional tests shall be conducted at the same location where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

To verify system-wide noncompliance, tests for variability shall be conducted, including a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

N.1.3. Test Conditions.

N.1.3.1. General. – Except during type evaluation, all tests shall be performed under the conditions that are considered usual and customary within the location(s) where the system is normally operated as deemed necessary by the statutory authority.

N.1.3.2. Roads. – All tests shall be conducted on public roads.

N.1.3.3. Testing for Environmental Influences. – During type evaluation, the distance test may include a route traveled by the vehicle that will expose the system to conditions that could contribute to the loss of, or interference with, the location service's signal. This may include:

(a) objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) routes that do not follow a straight-line path;

(c) significant changes in altitude; and

(d) any other relevant environmental conditions.

N.2. Time Test. – A transportation network measurement system, which determines time elapsed, shall be tested for compliance with the tolerances values specified in T.1.2. Time Tests, using a certified, traceable standard.

T. Tolerances

T.1. Tolerance Values. – The tolerances will be as specified in T.1.1. Distance Tests and T.1.2. Time Tests. (The following proposed tolerance values will be confirmed based on performance data evaluated by the NIST U.S. National Work Group on Taximeters before the transportation network measurement systems code becomes a permanent code.)

T.1.1. Distance Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) On Overregistration: 2.5 %

(b) On Underregistration: 2.5 %

T.1.2. Time Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) On Overregistration: 5 seconds or 0.5 %, whichever is greater

(b) On Underregistration: 5 seconds or 0.5 %, whichever is greater

T.2. Tests Using Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.

UR. User Requirements

UR.1. System Indications. – The indicating elements identified in S.1.1. General Indicating Elements shall display indications and information in a manner such that they can be conveniently read by the user of the device, computer, website, or online-enabled technology application service.

UR.1.1. Statement of Rates. – The transportation network company rider shall be able to view the basis for calculating the fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fees.

UR.2. Change Tracking. – Upon request by an official having statutory authority, the transportation network company shall provide an explanation of changes that are logged pursuant to S.2.3. Change Tracking requirement during the time period covered by the request. Any such request shall be answered within two business days, unless extended by the official having statutory authority. Records provided pursuant to S.2.3. Change Tracking shall be treated as confidential and proprietary to the extent permitted by any applicable law.

UR.3. System Installation and Operation. – The transportation network company driver shall use the indicating elements identified in S.1.1.(a) General Indicating Elements in accordance with the requirements of the manufacturer, distributor, or developer.

UR.4. Fare Estimates. – Estimates for fare charges shall be provided by the transportation network measurement system when requested by the transportation network company rider and following the input of a final destination for the trip being requested. The recipient of the fare estimate shall be able to access information about the fare estimate, including key variables that may lead to discrepancies between actual fare charged and the fare estimate provided as required by law.

UR.5. Determination of Total Charges When Location Service Data Is Lost. – At the conclusion of the trip, the transportation network company shall disclose to the transportation network measurement service rider and driver the manner in which total charges are determined when there is significant data loss from location services.

Appendix D. Definitions

D

digital network. – An online-enabled technology application service, website, or system offered or used by a transportation network company that enables a transportation network company rider to arrange a network-arranged ride with a transportation network company driver. [5.60]

N

network-arranged ride. **–** The provision of transportation by a transportation network company driver to a transportation network company rider, or other persons selected by the transportation network company rider, arranged through a digital network. [5.60]

T

transportation network company. – An entity that uses a digital network to connect transportation network company riders with transportation network company drivers who provide network-arranged rides, and offers or provides a transportation network measurement system, subject to an agreement or terms of service between the transportation network company and transportation network company rider or driver. [5.60]

transportation network company driver. – An individual authorized by the transportation network company to access the digital network and receive connections to transportation network company riders for the purpose of providing network-arranged rides. [5.60]

transportation network company rider. – An individual who has obtained an account with a transportation network company and uses the transportation network company's digital network to connect with a transportation network company driver who can offer or provide a network-arranged ride to the transportation network company rider or other persons selected by the transportation network company rider. [5.60]

transportation network measurement system. – The information technology infrastructure and services offered or used by a transportation network company that receives data collected through a digital network and calculates a fare for a network-arranged ride. [5.60]

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