# Division of Measurement Standards
# Department of Food and Agriculture

# FIELD REFERENCE MANUAL
**2014**

**California Code of Regulation**
**Title 4, Division 9**

**Chapter 1**
**Article 1. National Uniformity, Exceptions and Additions**

**Part 5: NIST Handbook 44, Other Measuring Devices**
**Sections 5.50. Fabric-Measuring Devices through**
**5.59. Electronic Livestock, Meat, and**
**Poultry Evaluation Systems and/or Devices**


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

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

**http://ccr.oal.ca.gov/linkedslice/default.asp?SP=CCR-1000&Action=Welcome**

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**.

Links to NIST Handbook 44 (2014 Edition) - Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as adopted by the 98th National Conference on Weights and Measures 2013 are available for viewing and downloading by simultaneously holding the "Ctrl" key and clicking the mouse on the desired format.

| SECTION | FORMAT (MS Word or Adobe) | |
|---|---|---|
| **Full Document** | | **PDF** |
| **5.50** Fabric-Measuring Devices | **DOC** | **PDF** |
| **5.51** Wire- and Cordage- Measuring Devices | **DOC** | **PDF** |
| **5.52** Linear Measures | **DOC** | **PDF** |
| **5.53** Odometers | **DOC** | **PDF** |
| **5.54** Taximeters | **DOC** | **PDF** |
| **5.55** Timing Devices | **DOC** | **PDF** |
| **5.56.(a)** Grain Moisture Meters | **DOC** | **PDF** |
| **5.56.(b)** Grain Moisture Meters | **DOC** | **PDF** |
| **5.58** Multiple Dimension Measuring Devices | **DOC** | **PDF** |
| **5.59** Electronic Livestock, Meat and Poultry Evaluation Systems and/or Devices | **DOC** | **PDF** |
| **Link to NIST Weights and Measures Handbook 44:** **http://www.nist.gov/pml/wmd/pubs/hb44-14.cfm** | | |

## Article 1. – HB 44 Sections 5.50. to 5.59. - Other Measuring Devices

# 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 in terms of 10 cm ($^1/_8$ yd), 25 cm (¼ yd), 50 cm (½ yd), and meters (yd). In addition, lengths may be indicated in terms of any or all of the following subdivisions: 30 cm (⅓ yd), 6 cm ($^1/_{16}$ yd), meters and centimeters (feet and inches). 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 ($^1/_8$ 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 2-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 ($^1/_8$ 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 | 1/4 | 1/4 | 1/8 |
| 3 | 3/8 | 5/16 | 1/4 | 5/32 |
| 4 | 1/2 | 5/16 | 1/4 | 5/32 |
| 5 | 5/8 | 3/8 | 5/16 | 3/16 |
| 6 | 3/4 | 3/8 | 3/8 | 3/16 |
| 7 and 8 | 1 | 1/2 | 1/2 | 1/4 |
| 9 | 1 1/4 | 5/8 | 5/8 | 5/16 |
| 10 and 11 | 1 1/2 | 3/4 | 3/4 | 3/8 |
| 12 and 13 | 1 3/4 | 7/8 | 7/8 | 7/16 |
| 14 and 15 | 2 | 1 | 1 | 1/2 |
| 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.

**[THIS PAGE INTENTIONALLY LEFT BLANK]**

# 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 ($^{3}/_{8}$ 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 ½ 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.

**[THIS PAGE INTENTIONALLY LEFT BLANK]**

# 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.

A 1-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 show⅓ 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 | 1/4 |

# 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 kilometer; or

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

(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 the 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)

**[THIS PAGE INTENTIONALLY LEFT BLANK]**

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

(Amended 1977)

**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 and may be equipped with a recording element.

(Amended 1988)

**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.

(Amended 1988)

**S.1.3. Visibility of 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.

(Amended 1977, 1986, and 1988)

**S.1.3.1. 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.1.3.2. Lighting of Indications.*** *– Integral lighting shall be provided to illuminate the fare, extras, the rate or rate code, and the taximeter status (i.e., vacant, hired, and time off).*
*[Nonretroactive as of January 1, 1989]*

(Added 1988) (Amended 1990)

**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 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. Means shall be provided for the vehicle operator to render the time mechanism either operative or inoperative with respect to the fare-indicating mechanism.

(Amended 1977)

**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.1.6. 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.** – Indications of fare and extras shall be displayed through and entirely protected by glass or other suitable transparent material securely attached to the housing of the taximeter.

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

*(a) date;*

*(b) unique vehicle identification number, such as the medallion number, taxi number, vehicle identification number (VIN) or permit number;**

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

*(d) distance traveled, maximum increment of 0.1 kilometer (0.1 mile);**

*(e) fare in $;*

*(f) for multi-rate taximeters, each rate at which fare was computed and the associated fare at that rate;**

*(g) additional charges where permitted such as extras, surcharge, telephone use, tip and tax shall be identified and itemized;* and*

*(h) total fare in $ (total charge).**

*[Nonretroactive as of January 1, 1989] *[Nonretroactive as of January 1, 2000]*

(Added 1988) (Amended 1999)

**S.1.9.1. Multiple Recorded Representations.**

***S.1.9.1.1. 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.

(Amended 1977)

**S.2.1. Initial Time and Distance Intervals.** – The time and distance intervals of a taximeter 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)

**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. Flag.** – If the control for the operating condition is a lever-arm and flag, the flag shall be at its highest position when the taximeter is cleared, and in this position the whole of the flag shall be above the level of the taximeter housing.

**S.3.3. 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 there will be no interference between the time and the distance portions of the mechanism device at any speed of operation.

(Amended 1977 and 1988)

**S.5. Provision for Security Seals.** – Adequate provision shall be made to provide security for a taximeter. Security may be provided either by:

(a) Affixing security seals to the taximeter and to all other components required for service operation of a complete installation on a vehicle, so that no adjustments, alterations, or replacements affecting accuracy or indications of the device or the assembly can be made without mutilating the seal or seals; or

(b) Using a combination of security seals described in paragraph (a) and, in the case of a component that may be removed from a vehicle (e.g., slide mounting the taximeter), providing a physical 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.

The sealing means shall be such that it is not necessary to disassemble or remove any part of the device or of the vehicle to apply or inspect the seals.

(Amended 1988 and 2000)

***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. Anti-fraud Provisions, Electronic Taximeters. -** An electronic taximeter may have provisions to detect and eliminate distance input that is inconsistent with output of the vehicle's distance sensor. When a taximeter equipped with this feature detects input inconsistent with the distance sensor:

(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 returns to normal. If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time;

(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 (000 to 999), the date, and the time of at least the last 1000 occurrences.

(Added 2001)

## 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.

(Amended 1977)

**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.1.3. Test Conditions.**

**N.1.3.1. 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.1.3.2. 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 odometer.

(Amended 1977)

**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.** – If a taximeter is equipped with a timing device through which charges are made for time intervals, 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, or 2 mi/h or 3 mi/h faster 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.

(Amended 1988)

## 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.**

**T.1.3.1.** The registration of a taximeter in the "time on" position shall agree within 1 % of its performance in the "time off" position.

(Added 1988)

## UR. User Requirements

**UR.1. Inflation of Vehicle Tires.** – 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)

**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 the back seat of the vehicle.

(Amended 1985 and 1986)

**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)

# 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).

**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 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)

**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 2 hours;

(b) six minutes on parking meters indicating time in excess of one but not greater than 2 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.** – The in-service light indicator shall be operative only during the time the device is in operation.

**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. Printed Tickets.** – 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.

(Amended 1983)

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

## 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<br>40E41' N<br>105E02' W | 2.5<br>5.0<br>10.0<br>15.0<br>20.0 | Continuous |
| WWVH | Kauai, Hawaii<br>21E59' N<br>159E46' W | 2.5<br>5.0<br>10.0<br>15.0 | Continuous |
| CHU | Ottawa, Canada<br>45E18' N<br>75E45' W | 3.330<br>7.335<br>14.670<br>14.670 | Continuous |

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

(Added 1988)

## 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: 5 seconds for any time interval of 1 minute or more; and
(Amended 1986)

(b) On Underregistration: 6 seconds per indicated minute.
(Amended 1975)

**T.1.2. For Time Clocks and Time Recorders.** – The maintenance and acceptance tolerances on overregistration and underregistration shall be 3 seconds per hour, but not to exceed 1 minute per day.
(Amended 1975)

**T.1.3. On Parking Meters.** – The maintenance and acceptance tolerances are shown in Table T.1.3. Maintenance and Acceptance Tolerances for Parking Meters.

| Table T.1.3. Maintenance and Acceptance Tolerances for Parking Meters | | |
|---|---|---|
| **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 |

**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 price in terms of money per unit or units of time for the service dispensed and the number of coins the device will accept and be activated by at one time, shall be clearly, prominently, and conspicuously displayed.

(Amended 1976)

**UR.2. Time Representations.** – Any time representation shall be within plus or minus 2 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)

# Section 5.56.(a) Grain Moisture Meters

**Section 5.56. was reorganized into two sections beginning with the 1997 Edition of NIST Handbook 44. This Section, 5.56.(a), applies to all NTEP grain moisture meters. It also applies to any grain moisture meter manufactured or placed into service after January 1, 1998.** (Code reorganized and renumbered 1996.)

## A. Application

**A.1. General Code.** – This code applies to grain moisture meters, that is, devices used to indicate directly the moisture content of cereal grain and oil seeds. The code consists of general requirements applicable to all moisture meters and specific requirements applicable only to certain types of moisture meters. Requirements cited for "test weight per bushel" indications or recorded representations are applicable only to devices incorporating an automatic test weight per bushel measuring feature.

(Amended 2003)

**A.2. Exceptions.** – This code does not apply to devices used for in-motion measurement of grain moisture content or seed moisture content.

**A.3. Type Evaluation.** – The National Type Evaluation Program (NTEP) will accept for type evaluation only those devices that comply with this code. State enforcement will be based upon the effective dates identified with each requirement when specific dates are shown.

(Added 1993)

**A.4. Additional Code Requirements.** – In addition to the requirements of this code, 5.56.(a) Grain Moisture Meters shall meet the requirements of Section 1.10. General Code.

## S. Specifications

### S.1. Design of Indicating, Recording, and Measuring Elements.

#### S.1.1. Digital Indications and Recording Elements.

(a) Meters shall be equipped with a digital indicating element.

(b) The minimum height for the digits used to display moisture content shall be 10 mm.

(c) Meters shall be equipped with a communication interface that permits interfacing with a recording element and transmitting the date, grain type, grain moisture results, test weight per volume results, and calibration version identification.

(d) A digital indicating element shall not display, and a recording element shall not record, any moisture content values or test weight per volume values before the end of the measurement cycle.

(e) Moisture content results shall be displayed and recorded as percent moisture content, wet basis. Test weight per bushel results shall be displayed and recorded as pounds per bushel. Subdivisions of these units shall be in terms of decimal subdivisions (not fractions).

(f) A meter shall not display or record any moisture content or test weight per volume values when the moisture content of the grain sample is beyond the operating range of the device, unless the moisture and test weight representations include a clear error indication (and recorded error message with the recorded representation).

(g) On multi-constituent meters (e.g., meters which also measure grain protein), provision shall be made for displaying and recording the constituent label (such as moisture, protein, etc.) to make it clear which constituent is associated with each of the displayed and recorded values.

(Added 1995)

(Amended 1993, 1994, 1995, 1996, and 2003)

**S.1.2. Selecting or Recording Grain or Seed Type and Class.** – Provision shall be made for selecting and recording the type and class or multi-class group (as appropriate) of grain or seed to be measured. The means to select the type and class or multi-class group of grain or seed shall be readily visible and the type and class or multi-class group of grain or seed selected shall be clearly and definitely identified. Abbreviations for grain types and multi-class groups indicated on the meter must meet the minimum acceptable abbreviations listed in Table S.1.2. Grain Types and Multi-Class Groups Considered for Type Evaluation and Calibration and Their Minimum Acceptable Abbreviations.

(Amended 1993, 1995, and 2007)

***Table S.1.2. Grain Types and Multi-Class Groups Considered for Type Evaluation and Calibration and Their Minimum Acceptable Abbreviations***

| *Grain Type* | *Grain Class* | *Minimum Acceptable Abbreviation* |
|---|---|---|
| *Barley* | *All-Class Barley** | *BARLEY* |
| | *Six-Rowed Barley* | *SRB* |
| | *Two-Rowed Barley* | *TRB* |
| *Corn* | --- | *CORN* |
| *Grain Sorghum* | --- | *SORG or MILO* |
| *Oats* | --- | *OATS* |
| *Rice* | *All-Class Rough Rice** | *RGHRICE* |
| | *Long Grain Rough Rice* | *LGRR* |
| | *Medium Grain Rough Rice* | *MGRR* |
| *Small Oil Seeds (under consideration)* | --- | --- |
| *Soybeans* | --- | *SOYB* |
| *Sunflower seed (Oil)* | --- | *SUNF* |
| *Wheat* | *All-Class Wheat** | *WHEAT* |
| | *Durum Wheat* | *DURW* |
| | *Hard Red Spring Wheat* | *HRSW* |
| | *Hard Red Winter Wheat* | *HRWW* |
| | *Hard White Wheat* | *HDWW* |
| | *Soft Red Winter Wheat* | *SRWW* |
| | *Soft White Wheat* | *SWW* |
| | *Wheat Excluding Durum** | *WHTEXDUR* |

**Note:** Grain Types marked with an asterisk (*) are "Multi-Class Calibrations."
*[Nonretroactive as of January 1, 1998]*

(Table Added 1993) (Amended 1995, 1998, and 2007)

**S.1.3. Operating Range.** – A meter shall automatically and clearly indicate when the operating range of the meter has been exceeded. The operating range shall specify the following:

(a) **Temperature Range of the Meter.** – The temperature range over which the meter may be used and still comply with the applicable requirements shall be specified. The minimum temperature range shall be 10 °C to 30 °C. No moisture value may be displayed when the temperature range is exceeded. An appropriate message shall be displayed when the temperature of the meter is outside its specified operating range.

(b) **Temperature Range of each Grain or Seed.** – The temperature range for each grain or seed for which the meter is to be used shall be specified. The minimum temperature range for each grain shall be 0 °C to 40 °C. No moisture value may be displayed when the temperature range is exceeded. An appropriate error message shall be displayed when the temperature of the grain sample exceeds the specified temperature range for the grain.

(c) **Moisture Range of the Grain or Seed.** – The moisture range for each grain or seed for which the meter is to be used shall be specified. Moisture and test weight per bushel values may be displayed when the moisture range is exceeded if accompanied by a clear indication that the moisture range has been exceeded.

(Amended 2003)

(d) **Maximum Allowable Meter/Grain Temperature Difference.** – The maximum allowable difference in temperature between the meter and the sample for which an accurate moisture determination can be made shall be specified. The minimum temperature difference shall be 10 °C. No moisture value may be displayed when the maximum allowable temperature difference is exceeded. An appropriate error message shall be displayed when the difference in temperature between the meter and the sample exceeds the specified difference.

(Added 1993) (Amended 1995)

**S.1.4. Value of Smallest Unit.** – The display shall permit moisture value determination to both 0.01 % and 0.1 % resolution. The 0.1 % resolution is for commercial transactions; the 0.01 % resolution is for type evaluation and calibration purposes only, not for commercial purposes. Test weight per bushel values shall be determined to the nearest 0.1 pound per bushel.

(Amended 2003)

**S.1.5. Operating Temperature.**

(a) Warm-up period: When a meter is turned on it shall not display or record any usable values until the operating temperature necessary for accurate determination has been attained, or the meter shall bear a conspicuous statement adjacent to the indication stating that the meter shall be turned on for a time period specified by the manufacturer prior to use.

(b) A meter shall meet the requirements of T.2. Tolerance Values when operated in the temperature range of 10 °C to 30 °C (50 °F to 86 °F) or within the range specified by the meter manufacturer.

(c) If the manufacturer specifies a temperature range, the range shall be at least 20 °C (36 °F).

(Added 1993) (Amended 1995 and 1996)

**S.2. Design of Grain Moisture Meters.**

**S.2.1. Minimum Sample Size.** – Meters shall be designed to measure the moisture content of representative-size grain samples. The minimum allowable sample size used in analysis shall be 100 g or 400 kernels or seeds, whichever is smaller.

(Added 1993) (Amended 1995)

**S.2.2. Electric Power Supply.**

**S.2.2.1. Power Supply, Voltage and Frequency.**

(a) A meter that operates using alternating current must perform within the tolerances defined in Section T.2. Tolerances over the line voltage range 100 V to 130 V, or 200 V to 250 V rms as designed, and over the frequency range of 59.5 Hz to 60.5 Hz.

(b) Battery-operated instruments shall not indicate or record values outside the applicable tolerance limits when battery power output is excessive or deficient.

**S.2.2.2. Power Interruption.** – A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.

(Added 1988)

**S.2.3. Level Indicating Means.** – A meter shall be equipped with a level indicator and leveling adjustments if its performance is changed by an amount greater than the applicable tolerance when the meter is moved from a level position to a position that is out of level in any upright direction by up to 5 % (approximately three degrees). The level-indicating means shall be readable without removing any meter parts requiring a tool.

(Added 1988) (Amended 1994)

**S.2.4. Calibration Integrity.**

**S.2.4.1. Calibration Version.** – A meter must be capable of displaying either calibration constants, a unique calibration name, or a unique calibration version number for use in verifying that the latest version of the calibration is being used to make moisture content and test weight per bushel determinations.

(Added 1993) (Amended 1995 and 2003)

**S.2.4.2. Calibration Corruption.** – If calibration constants are digitally stored in an electronically alterable form, the meter shall be designed to make automatic checks to detect corruption of calibration constants. An error message must be displayed if calibration constants have been electronically altered.

(Added 1993) (Amended 1995)

***S.2.4.3. Calibration Transfer.*** *– The instrument hardware/software design and calibration procedures shall permit calibration development and the transfer of calibrations between instruments of like models without requiring user slope or bias adjustments.*

*[**Note:** Only the manufacturer or the manufacturer's designated service agency may make standardization adjustments on moisture meters. This does not preclude the possibility of the operator installing manufacturer-specified calibration constants under the instructions of the manufacturer or its designated service agency.] Standardization adjustments (not to be confused with grain calibrations) are those physical adjustments or software parameters which make meters of like type respond identically to the grain(s) being measured. [Nonretroactive as of January 1, 1999]*

(Added 1994) (Amended 1998)

**S.2.5. Provision for Sealing.** – Provision shall be made for applying a security seal in a manner that requires the security seal to be broken, or for using other approved means of providing security (e.g., audit trail available at the time of inspection as defined in Table S.2.5. Categories of Device and Methods of Sealing) before any change that affects the metrological integrity of the device can be made to any mechanism.

| *Table S.2.5. Categories of Device and Methods of Sealing* | |
|---|---|
| ***Categories of Device*** | ***Methods of Sealing*** |
| ***Category 1:*** *No remote configuration capability.* | *Seal by physical seal or two event counters: one for calibration parameters (000 to 999) and one for configuration parameters (000 to 999). If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.* |
| ***Category 2:*** *Remote configuration capability, but access is controlled by physical hardware.*<br><br>*A device shall clearly indicate that it is in the remote configuration mode and shall not be capable of operating in the measure mode while enabled for remote configuration.* | *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 (000 to 999) and one for configuration parameters (000 to 999). If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.* |
| ***Category 3:*** *Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).*<br><br>*When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.* | *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 (for calibration changes consisting of multiple constants, the calibration version number may be used rather than the calibration constants). 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 twenty-five (25) 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 3a:*** *No remote capability, but operator is able to make changes that affect the metrological integrity of the device (e.g., slope, bias, etc.) in normal operation.*<br><br>**When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.* | *Same as Category 3* |
| ***Category 3b:*** *No remote capability, but access to metrological parameters is controlled through a software switch (e.g., password).*<br><br>**When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.* | *Same as Category 3* |

[*Nonretroactive as of January 1, 1999]*
[**Nonretroactive as of January 1, 2014]*
(Amended 1998 and 2013)

Note: Zero-setting and test point adjustments are considered to affect metrological characteristics and must be sealed.
(Added 1993) (Amended 1995 and 1997)

**S.2.6. Determination of Quantity and Temperature.** – The moisture meter system shall not require the operator to judge the precise volume or weight and temperature needed to make an accurate moisture determination. External grinding, weighing, and temperature measurement operations are not permitted. In addition, if the meter is capable

of measuring test weight per bushel, determination of sample volume and weight for this measurement shall be fully automatic *and means shall be provided to ensure that measurements of test weight per volume are not allowed to be displayed or printed when an insufficient sample volume is available to provide an accurate measurement. [Nonretroactive as of January 1, 2004]*

(Added 1994) (Amended 1995 and 2003)

**S.3. Accessory Equipment.** – When the operating instructions for a moisture meter require accessory equipment separate from and external to the moisture meter, such equipment shall be appropriate and complete for the measurement.

**S.4. Operating Instructions and Use Limitations.** – The manufacturer shall furnish operating instructions for the device and accessories that include complete information concerning the accuracy, sensitivity, and use of accessory equipment necessary in obtaining a moisture content. Operating instructions shall include the following information:

(a) name and address or trademark of the manufacturer;

(b) the type or design of the device with which it is intended to be used;

(c) date of issue;

(d) the kinds or classes of grain or seed for which the device is designed to measure moisture content and test weight per bushel;
(Amended 2003)

(e) the limitations of use, including but not confined to the moisture measurement range, grain or seed temperature, maximum allowable temperature difference between grain sample and meter, kind or class of grain or seed, moisture meter temperature, voltage and frequency ranges, electromagnetic interferences, and necessary accessory equipment.

(Added 1984)

## N. Notes

**N.1. Testing Procedures.** – Field evaluation of grain moisture meters shall be performed by one of the following methods:

**N.1.1. Air Oven Reference Method Transfer Standards.** – Official grain samples shall be used as the official transfer standards with moisture content and test weight per bushel values assigned by the reference methods. The reference methods for moisture shall be the oven drying methods as specified by the USDA GIPSA. The test weight per bushel value assigned to a test weight transfer standard shall be the average of 10 test weight per bushel determinations using the quart kettle test weight per bushel apparatus as specified by the USDA GIPSA. Tolerances shall be applied to the average of at least three measurements on each official grain sample. Official grain samples shall be clean and naturally moist, but not tempered (i.e., water not added).

(Amended 1992, 2001, and 2003)

**N.1.2. Minimum Test.** – A minimum test of a grain moisture meter shall consist of tests using samples (need not exceed three) of each grain or seed type for which the device is used, and for each grain or seed type shall include the following:

(a) tests of moisture indications, using samples having at least two different moisture content values within the operating range of the device; and

(b) if applicable, tests of test weight per volume indications, with at least the lowest moisture samples used in above.
(Added 2003)

(Amended 1986, 1989, and 2003)

**N.1.3. Meter to Like-Type Meter Method Transfer Standards.** – Properly standardized reference meters using National Type Evaluation Program approved calibrations shall be used as transfer standards. A reference meter shall

be of the same type as the meter under test. Tests shall be conducted side-by-side using, as a comparison medium, grain samples that are clean and naturally moist, but not tempered (i.e., water not added).

(Added 2001)

## 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. Tolerances.**

**T.2.1. Air Oven Reference Method.** – Maintenance and acceptance tolerances shall be as shown in Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance.

(Amended 2001)

**Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method**

| Type of Grain, Class, or Seed | Tolerance | Minimum Tolerance |
|---|---|---|
| Corn, oats, rice, sorghum, sunflower | 0.05 of the percent moisture content | 0.8 % in moisture content |
| All other cereal grains and oil seeds | 0.04 of the percent moisture content | 0.7 % in moisture content |

(Amended 2001)

**T.2.2. Meter to Like-Type Meter Method.** – Maintenance and acceptance tolerances shall be as shown in Table T.2.2. Acceptance and Maintenance Tolerances Meter to Like-Type Meter Method. The tolerances shall apply to all types of grain and seed.

(Added 2001)

**Table T.2.2. Acceptance and Maintenance Tolerances Meter to Like-Type Meter Method**

| Sample Reference Moisture | Tolerance |
|---|---|
| Up to 22 % | 0.5 % in moisture content |

(Added 2001)

**T.3. For Test Weight Per Bushel Indications or Recorded Representations. -** The maintenance and acceptance tolerances on test weight per bushel indications or recorded representations shall be as shown in Table T.3. Acceptance and Maintenance Tolerances Test Weight per Bushel. Tolerances are (+) positive or (-) negative with respect to the value assigned to the official grain sample.

(Amended 1992 and 2003)

**Table T.3. Acceptance and Maintenance Tolerances Test Weight per Bushel**

| Type of Grain or Seed | Tolerance (Pounds Per Bushel) |
|---|---|
| Corn, oats | 0.8 |
| All wheat classes | 0.5 |
| Soybeans, all barley classes, all rice classes, sunflower, sorghum | 0.7 |

(Added 2003)

## UR. User Requirements

**UR.1. Selection Requirements.**

**UR.1.1. Value of the Smallest Unit on Primary Indicating and Recording Elements. -** The resolution of the moisture meter display shall be 0.1 % moisture and 0.1 pounds per bushel test weight during commercial use.
(Amended 2003)

**UR.1.2. See G-UR.1.2. Environment.**

**UR.2. Installation Requirements. -** The grain moisture meter shall be installed in an environment within the range of temperature and/or other environmental factors specified in the operating instructions.

**UR.3. Use Requirements.**

**UR.3.1. Operating Instructions. -** The operating instructions for the use of the grain moisture meter shall be readily available to the user, service technician, and weights and measures official at the place of installation. It shall include a list of accessory equipment and the kinds of grain or seed to be measured with the moisture meter.
(Amended 1988)

**UR.3.2. Other Devices not used for Commercial Measurement. -** If there are other moisture meters on the premises not used for trade or determining other charges for services, these devices shall be clearly and conspicuously marked "Not for Use in Trade or Commerce."

**UR.3.3. Maintaining Integrity of Grain Samples. -** Whenever there is a time lapse (temperature change) between taking the sample and testing the sample, means to prevent condensation of moisture or loss of moisture from grain samples shall be used. For example, a cold grain sample may be kept in a closed container in order to permit the cold grain to come to the operating temperature range of the meter before the grain moisture measurements are made.

**UR.3.4. Printed Tickets.**

(a) Printed tickets shall be free from any previous indication of moisture content or type of grain or seed selected.

(b) The customer shall be given a printed ticket at the time of the transaction or as otherwise specified by the customer. The printed ticket shall include the date, grain type, grain moisture results, test weight per bushel, and calibration version identification. The ticket information shall be generated by the grain moisture meter system.

(Amended 1993, 1995, 2003, and 2013)

**UR.3.5. Accessory Devices. -** Accessory devices, if necessary in the determination of a moisture content value, shall be in close proximity to the moisture meter and allow immediate use.

**UR.3.6. Sampling. -** A grain sample shall be obtained by following appropriate sampling methods and equipment. These include, but are not limited to grain probes of appropriate length used at random locations in the bulk, the use of a pelican sampler, or other techniques and equipment giving equivalent results. The grain sample shall be taken such that it is representative of the lot.

**UR.3.7. Location. -** See G-UR.3.3. Position of Equipment.

**UR.3.8. Level Condition. -** If equipped with a level indicator, a meter shall be maintained in a level condition.
(Added 1988)

**UR.3.9. Current Calibration Data. -** Grain moisture determinations shall be made using only the most recently published calibration data.
(Added 1988)

**UR.3.10. Posting of Meter Operating Range. -** The operating range of the grain moisture meter shall be clearly and conspicuously posted in the place of business such that the information is readily visible from a reasonable customer position. The posted information shall include the following:

(a) The temperature range over which the meter may be used and still comply with the applicable requirements. If the temperature range varies for different grains or seed, the range shall be specified for each.

(b) The moisture range for each grain or seed for which the meter is to be used.

(c) The temperature range for each grain or seed for which the meter is to be used.

(d) The maximum allowable difference in temperature that may exist between the meter and the sample for which an accurate moisture determination can be made.

(Added 1988)

**[THIS PAGE INTENTIONALLY LEFT BLANK]**

# Section 5.56.(b) Grain Moisture Meters

**Section 5.56. was reorganized into two sections beginning with the 1997 Edition of NIST Handbook 44. This Section, 5.56.(b), applies to all non-NTEP grain moisture meters manufactured or placed into service before January 1, 1998.**
(Code reorganized and renumbered 1996.)

## A. Application

**A.1. General.** – This code applies to grain moisture meters; that is, devices used to indicate directly or through conversion and/or correction tables the moisture content of cereal grain and oil seeds. The code consists of general requirements applicable to all moisture meters and specific requirements applicable only to certain types of moisture meters.

**A.2. Exceptions**. – This code does not apply to devices used for in-motion measurement of grain moisture content or seed moisture content.

**A.3. Additional Code Requirements.** – In addition to the requirements of this code, 5.56.(b) Grain Moisture Meters 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, General.** – A meter shall be equipped with a primary indicating element and may also be equipped with a primary recording element. If the meter indicates directly and/or is equipped to record, the meter shall indicate and/or record its measurements in terms of percent moisture content, wet basis. Subdivisions of this unit shall be in terms of decimal subdivisions (not fractions). If the meter indicates in the conventional scale and requires conversion or correction tables, the resulting values after use of such tables shall be in terms of percent moisture content, wet basis. Subdivisions of this unit shall be in terms of decimal subdivisions (not fractions).

**S.1.2. Digital Indications.**

**S.1.2.1. Measurement Completion.** – A digital indicating element shall not display any values (either moisture content or conventional scale) before the end of the measurement cycle.

**S.1.3. Graduations.**

**S.1.3.1. Length.** – Graduations shall be so varied in length that they may be conveniently read.

**S.1.3.2. 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 the 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.1.3.3. Clear Interval Between Graduations.** – The clear interval shall be not less than 0.75 mm (0.03 in) between graduations. 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.1.4. Indicators.**

**S.1.4.1. 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.1.4.2. 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.1.4.3. 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, nor

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

When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width as the graduation throughout the length of the index that coincides with the graduation.

**S.1.4.4. 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.1.4.5. Parallax.** – Parallax effects shall be reduced to the practicable minimum.

**S.1.5. Recording Elements.**

**S.1.5.1. General.** – If a meter is equipped with a recording element, it shall record in terms of percent moisture content, wet basis only, and not in terms of conventional scale.

**S.1.5.2. Measurement Completion.** – A recording element shall not record any values before the end of the measurement cycle.

**S.1.5.3. Range of Moisture Content.** – A recording element shall not record any values when the moisture content of the grain sample is beyond the operating range of the device.

**S.1.6. Design of Direct Reading Grain Moisture Meters.**

**S.1.6.1. Grain or Seed Kind and Class Selection and Recording.** – Provision shall be made for selecting and recording, if equipped to record, the kind and class (as appropriate) of grain or seed to be measured. The means to select the kind and class of grain or seed shall be readily visible and the kind and class of grain or seed selected shall be clearly and definitely identified in letters (such as Wheat or WHT, HRWW, etc.).

***S.1.6.2. Operating Range.*** *– A meter shall automatically and clearly indicate when the operating range of the meter has been exceeded or the manufacturer shall:*

*(a) clearly and conspicuously mark the operating ranges on the meter; or*

*(b) furnish the operating ranges of the meter and the means to clearly and conspicuously display this information on or immediately adjacent to the device.*

*The operating range shall specify the following:*

*(a)* the temperature range over which the meter may be used and still comply with the applicable requirements;

*(b) the moisture range for each grain or seed for which the meter is to be used;*

*(c) the temperature range for each grain or seed for which the meter is to be used; and*

*(d) the maximum allowable difference in temperature between the meter and the sample for which an accurate moisture determination can be made.*

*Examples of clearly indicating these conditions include an error indication, flashing the displayed moisture value, or blanking the display.*
*[Nonretroactive as of January 1, 1989]*

(Amended 1986 and 1988)

**S.1.6.3. Value of Smallest Unit.** – The value of the minimum indicated or recorded moisture indication shall not be greater than 0.1 %.

***S.1.7. Electric Power Supply.***

***S.1.7.1. Power Supply, Voltage and Frequency.***

*(a)* A meter that operates using alternating current must perform within the tolerances defined in Section T.2. Tolerance Values over the line voltage range 100 V to 130 V, or 200 V to 250 V rms as designed, and over the frequency range of 59.5 Hz to 60.5 Hz.

*(b) Battery-operated instruments shall not indicate or record values outside the applicable tolerance limits when battery power output is excessive or deficient.*

*[Nonretroactive as of January 1, 1989]*

***S.1.7.2. Power Interruption.*** *– A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.*
*[Nonretroactive as of January 1, 1989]*

(Added 1988)

***S.1.8. Level Indicating Means.*** *– A meter shall be equipped with a level indicator and leveling adjustments if its performance is changed by an amount greater than the applicable tolerance when the meter is moved from a level position to a position that is out of level in any upright direction by up to 5 % (approximately 3 degrees).*

*The level-indicating means shall be readable without removing any meter parts requiring a tool.*
*[Nonretroactive as of January 1, 1989]*

(Added 1988) (Amended 1994)

***S.1.9. Operating Temperature.***

*(a) A meter shall not display or record any usable values until the operating temperature necessary for accurate determination has been attained, or the meter shall bear a conspicuous statement adjacent to the indication stating that the meter shall be turned on for a time period specified by the manufacturer prior to use.*

*(b) A meter shall meet the requirements of T.2. Tolerance Values when operated in the temperature range of 2 °C to 40 °C (35 °F to 104 °F) or within the range specified by the meter manufacturer.*

*(c) If the manufacturer specifies a temperature range, the range shall be at least 10 °C (20 °F) and shall be marked on the device.*

*[Nonretroactive as of January 1, 1989]*

(Added 1988)

**S.2. Design of Measuring Elements.**

**S.2.1. Design of Zero-Setting and Test Point Mechanisms.** – If a grain moisture meter is equipped with a zero setting and/or test point mechanism(s), this (these) mechanism(s) shall be adjustable only with a tool outside and entirely separate from this mechanism or enclosed in a cabinet. This requirement shall not apply to manual operations that the operator must make (following operating instructions) in order to obtain a meter reading on a grain sample.

**S.2.2. Provision for Sealing.** – Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component of the grain moisture meter that is set by the manufacturer or authorized service representative and not intended to be adjusted by the user.

**S.3. Accessory Equipment.** – When the operating instructions for a moisture meter require accessory equipment separate from and external to the moisture meter, such equipment shall be appropriate and complete for the measurement.

**S.3.1. Grain-Test Scale.** – If the moisture meter requires the weighing of the grain sample, the weighing device shall meet the requirements of the General Code and those applicable portions of the Scales Code.

**S.3.2. Thermometers or Other Temperature Sensing Equipment.**

(a) The temperature sensing equipment or thermometer shall be designed to be in direct contact with a grain sample in a closed container. It is acceptable to insert thermometer through a small hole in the lid of the container used to hold the grain sample.

(b) A separate thermometer or other temperature sensing equipment shall have temperature divisions not greater than the temperature increments used by the manufacturer in the correction table.

(Amended 1988)

**S.3.3. Conversion and Correction Tables.** – Conversion and correction tables, charts, graphs, slide rules, or other apparatus to convert the conventional scale values read from a moisture meter to moisture content values, if such apparatus is required, shall be appropriate and correct for the moisture meter being used and shall be marked with the following information:

(a) name and address or trademark of the manufacturer;

(b) the type or design of the device with which it is intended to be used;

(c) date of issue;

(d) the kinds or classes of grain or seed for which the device is designed to measure moisture content;

(e) the limitations of use, including but not confined to the moisture measurement range, grain or seed temperature, kind or class of grain or seed, moisture meter temperature, voltage and frequency ranges, electromagnetic interferences, and necessary accessory equipment; but

(f) values exceeding any measurement range shall not be included.

(Added 1984)

**S.3.4. Operating Instructions and Use Limitations.** – Operating instructions shall be furnished by the manufacturer with each device with all of the information required by paragraph S.3.3. Conversion and Correction Tables. Complete information concerning the accuracy, sensitivity, and use of accessory equipment (e.g., test weight per bushel equipment, thermometer, etc.) necessary in obtaining a moisture content shall be included.

## N. Notes

**N.1. Testing Procedures.**

**N.1.1. Transfer Standards.** – Official grain samples shall be used as the official transfer standards with moisture content values assigned by the reference methods. The reference methods shall be the oven drying methods as specified by the USDA GIPSA. Tolerances shall be applied to the average of at least three measurements on each official grain sample. Official grain samples shall be clean and naturally moist, but not tempered (i.e., water not added).

(Amended 1992)

**N.1.2. Minimum Test.** – A minimum test of a grain moisture meter shall consist of tests:

(a) with samples (need not exceed three) of each grain or seed for which the device is used, and

(b) with samples having at least two different moisture content values within the operating range of the device.

(Amended 1986 and 1989)

**N.1.3. Temperature Measuring Equipment.** – The accuracy of accessory temperature measuring equipment shall be determined by comparison with a calibrated temperature sensor, such as a total immersion thermometer with 0.1 °C (0.2 °F) subdivisions, indicating over a range of from 0 °C to 40 °C (32 °F to 104 °F) with a maximum error of ± 0.1 °C (0.2 °F). Tests shall be conducted at two temperatures using liquid baths (e.g., ice water and room temperature water). The two temperatures selected shall not exceed the range of temperatures identified in the moisture meter operating instructions.

(Amended 1988)

## T. Tolerances[1]

**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.** – Maintenance and acceptance tolerances shall be as shown in Table T.2. Acceptance and Maintenance Tolerances for Grain Moisture Meters. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance.

**Table T.2. Acceptance and Maintenance Tolerances for Grain Moisture Meters**

| Type of Grain or Seed | Tolerance | Minimum Tolerance |
|---|---|---|
| Corn, oats, rice, sorghum, sunflower | 0.05 of the percent moisture content | 0.8 % in moisture content |
| All other cereal grains and oil seeds | 0.04 of the percent moisture content | 0.7 % in moisture content |

**T.3. For Test Weight Per Bushel Devices.** – The maintenance and acceptance tolerances on separate test weight per bushel devices used to determine the test weight per bushel of grain samples for the purposes of making density corrections in moisture determination shall be 0.193 kg/hL or 0.15 lb/bu. The test methods used shall be those specified by the USDA GIPSA using a dockage-free sample of dry hard red winter wheat.

(Amended 1992 and 2003)

**T.4. Thermometers or Other Temperature Sensing Equipment.** – The tolerance for a separate thermometer or temperature sensing equipment used to determine the temperature of grain samples for the purpose of making temperature corrections in moisture determinations shall be ± 0.5 °C (1 °F).

(Added 1988)

## UR. User Requirements

**UR.1. Selection Requirements.**

**UR.1.1. Value of the Smallest Unit on Primary Indicating and Recording Elements.** – The value of the smallest unit on a moisture meter, whether the moisture meter reads directly in terms of moisture content, or when the conventional scale unit is converted or corrected to moisture content, shall be equal to or less than 0.1 %.

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

[1] These tolerances do not apply to tests in which grain moisture meters are the transfer standards.

**UR.2. Installation Requirements.** – The grain moisture meter shall be installed in an environment within the range of temperature and/or other environmental factors specified (a) in the operating manual, and (b) on the conversion or correction tables if such tables are necessary for the operation of the device.

**UR.3. Use Requirements.**

**UR.3.1. Operating Instructions.** – The operating instructions for the use of the grain moisture meter shall be readily available to the user, service technician, and weights and measures official at the place of installation. It shall include a list of accessory equipment, conversion and correction charts if any are required to obtain moisture content values, and the kinds of grain or seed to be measured with the moisture meter.

(Amended 1988)

**UR.3.2. Other Devices not used for Commercial Measurement.** – If there are other moisture meters on the premises not used for trade or determining other charges for services, these devices shall be clearly and conspicuously marked "Not for Use in Trade or Commerce."

**UR.3.3. Maintaining Integrity of Grain Samples.** – Whenever there is a time lapse (temperature change) between taking the sample and testing the sample, means to prevent condensation of moisture or loss of moisture from grain samples shall be used. For example, a cold grain sample may be kept in a closed container in order to permit the cold grain to come to the operating temperature range of the meter before the grain moisture measurements are made.

**UR.3.4. Printed Tickets.** – Printed tickets shall be free from any previous indication of moisture content or type of grain or seed selected.

**UR.3.5. Accessory Devices.** – Accessory devices, if necessary in the determination of a moisture content value, shall be in close proximity to the moisture meter and allow immediate use.

**UR.3.6. Sampling.** – A grain sample shall be obtained by following appropriate sampling methods and equipment. These include, but are not limited to, grain probes of appropriate length used at random locations in the bulk, the use of a pelican sampler, or other techniques and equipment giving equivalent results. The grain sample shall be taken such that it is representative of the lot.

**UR.3.7. Location.** – See G-UR.3.3. Position of Equipment.

**UR.3.8. Level Condition.** – If equipped with a level indicator, a meter shall be maintained in a level condition.

(Added 1988)

**UR.3.9. Operating Limitation.** – Unless otherwise specified by the meter manufacturer, moisture determinations shall not be made when the difference in temperatures between the grain sample and the meter exceeds 10 °C (20 °F).

(Added 1988)

**UR.3.10. Current Calibration Chart or Data.** – Grain moisture determinations shall be made using only the most recently published calibration charts or calibration data.

(Added 1988)

**UR.3.11. Posting of Meter Operating Range.** – The operating range of the grain moisture meter shall be clearly and conspicuously posted in the place of business such that the information is readily visible from a reasonable customer position. The posted information shall include the following:

(a) The temperature range over which the meter may be used and still comply with the applicable requirements. If the temperature range varies for different grains or seed, the range shall be specified for each.

(b) The moisture range for each grain or seed for which the meter is to be used.

(c) The temperature range for each grain or seed for which the meter is to be used.

(d) The maximum allowable difference in temperature that may exist between the meter and the sample for which an accurate moisture determination can be made.

(Added 1988)

**[THIS PAGE INTENTIONALLY LEFT BLANK]**

# 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 (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 (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 (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 with the value of the division expressed as:

(a) 1, 2, or 5; or

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

(c) a binary submultiple of a specific inch-pound 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 Lengths.** – Except for entries of tare, the minimum length to be measured by a device is 12 divisions. The manufacturer may specify a longer minimum length.

**S.1.8. Indications Below Minimum and Above Maximum.** – When objects are smaller than the minimum dimensions identified in paragraph S.1.7. Minimum Lengths 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 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)

**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.<br><br>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.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.** (See also 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**

| To Be Marked With ∴ | Multiple Dimension Measuring Equipment | | | |
|---|---|---|---|---|
| | **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 (3) | x | X | x | |
| Value of Measuring Division, d (for each axis and range) | x | X | x | |
| Temperature Limits (4) | x | X | x | |
| Minimum & Maximum speed (5) | x | X | x | |
| Special Application (6) | x | X | x | |
| Limitation of Use (7) | x | X | x | |

**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 seria

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.

(Amended 2004 and 2008)

**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)

**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.** – For multi-interval devices, the tolerance values are based on the value of the device division of the range in use.

**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, or

(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)

**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)

# 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 America n Society for Testing Materials (ASTM) International Standard F 2342 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 F 2343 Test Method for Livestock, Meat, and Poultry Evaluation Devices.

**N.2. Testing Standards. –** ASTM Standard F 2343 requires device or system users to maintain accurate reference standards that meet the tolerance expressed in NIST Handbook 44 Fundamental Considerations, paragraph 3.2. (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 F 2341 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.

| 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 F 2343 |

## 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 F 2341.

**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. (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.