Section 5.58. Multiple Dimension Measuring Devices - Tentative Code

This tentative code has only a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final Code for Multiple Dimension Measuring Devices. If upgraded to become a permanent code, all requirements, except those for tolerances, will be non-retroactive as of the effective date of the permanent code; tolerance requirements will apply retroactively as of the effective date of the permanent code.

(Tentative code Added 1995)

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.2. 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 General Code paragraph G-A.1.

A.3. In addition to the requirements of this code, multiple dimension measuring devices shall meet the requirements of Section 1.10. General Code.

A.4. 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 Sec. 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 Sec. 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 Sec. 5.52. for Linear Measures).

A.5. Type Evaluation. - The National Type Evaluation Program 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., the value of the division may be 0.3 inch and 0.4 inch.

S.1.6. Customer Indications and Recorded Representations. - Multiple dimension measuring systems must provide information as specified in Table S.1.6. (See Table Appendix at the end of this code.)

S.1.7. Minimum Lengths. - The minimum length to be measured by a device is 12 d. The manufacturer may specify a longer minimum length.

S.1.8. Indications Below Minimum and Above Maximum. - Except for entries of tare, when objects are smaller than the minimum dimensions identified in paragraph S.1.7. or larger than 105 percent of the maximum dimensions and/or volume marked on the device, the indicating or recording element shall either:

(a) not display or record any usable values, or

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

S.1.9. Operating Temperature. - An indicating or recording element shall not display nor record any usable values until the operating temperature necessary for accurate measuring and a stable zero reference or ready condition have 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. (See Table Appendix at the end of this code.)

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 underregistration) 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.

S.4. Marking Requirements. [See also G-S.1., G-S.4., G-S.5.2.5., G-S.6., G-S.7., G-UR.2.1.1., and G-UR.3.1.]

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. (See Table Appendix at the end of this code.)

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.1.3. Disturbance Tests, Field Evaluation. - A disturbance test shall be conducted at a given installation when the presence of disturbances specified in T.7. 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.1.5. 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.)

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. and T.5.2.

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.)

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 d. These tolerances apply regardless of the shape or material of the object being measured unless otherwise marked on the device.

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. - Devices shall satisfy the applicable tolerances when subjected to power supply voltage variation of -15 percent to +10 percent of the voltage rating specified by the manufacturer.

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.

T.7. Electric Power Supply. - Battery-operated instruments shall not indicate nor record values outside the applicable tolerance limits when battery power output is excessive or deficient.
(Added 1999)

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.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.

D. Definitions

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

"d," dimension division value. The smallest increment that the device displays for any axis and length of object in that axis.

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

measuring element. That portion of a complete device which does not include the indicating element.

Table S.1.6 Information to be Provided

Scenarios ⇒ Information ⇓	Scenario 1.1 Customer present (printer only)	Scenario 1.2 Customer present (display only)	Scenario 1.3 Customer present (printer and display)	Scenarios 2, 3, 4 Customer is not present.
System ID	P (only in multi-system applications)	D (only in multi-system applications)	D or P (only in multi-system applications)	P or A
Object ID	N/A	N/A	N/A	P or A
Dimensions and/or volume, units	P	D	D and P	P or A
Error indicator	P	D	D and P	N/A
Billing method	P	D	D or P	N/A
Billed weight	P	D	D or P	N/A
Total price	P	D	D or P	N/A
Dim weight (if applicable)	P	D	D or P	P or A
Scale weight (if applicable)	P	D	D or P	P or A
Tare (if applicable)	P	D	D or P	P or A
Oversized indicator	P	D	D or P	P or A
Dimensions are of smallest box	P or M	D or M	D or P or M	P or A
Billing rate or rate chart, conversion factors	A	A	A	P or A

D = DISPLAYED
A = AVAILABLE UPON REQUEST (retained for at least 30 days after invoice)
N/A: NOT APPLICABLE
P = PRINTED
M = MARKED ON THE DEVICE

Table S.1.11. Categories of Devices and Methods of Sealing	
Categories of Devices	**Method of Sealing**
Category 1: No remote configuration.	Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 2: Remote configuration capability, but access is controlled by physical hardware. Device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.	The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).	An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to ten 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.)**

Table S.4.1.a. Marking Requirements				
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)
Minimum and Maximum Dimensions for Each Side (3)	x	x	x	
Value of Measuring Division, d	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. Notes for Table S.4.1.a.

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

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

3. The minimum and maximum dimensions can be shown as follows:
   Length: min._____ max. _____
   Width: min._____ max. _____
   Height: min._____ max. _____

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

5. If the multiple dimension measuring device requires that the object or device be moved relative to one another, the minimum and maximum speeds are marked which enable the device to make measurements that are within the applicable tolerances shall be marked.

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, or object orientations that are inappropriate for the device or those that are appropriate.