ATTACHMENT II

FINAL RULE

United States Department of Commerce

Technology Administration

National Institute of Standards and Technology

SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR WEIGHING AND MEASURING DEVICES

as adopted by the 89th National Conference on Weights and Measures 2004

NIST Handbook 44

2005

(b) Whenever a grade, brand, blend, or mixture is offered for sale from a device at more than one unit price, then all of the unit prices at which that product is offered for sale shall be displayed or shall be capable of being displayed on the dispenser using controls available to the customer prior to the delivery of the product. It is not necessary that all of the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed prior to the delivery of the product. This subsection shall not apply to fleet sales, other contract sales, or truck refueling sales (e.g., sales from dispensers used to refuel trucks).

[Effective and nonretroactive as of January 1, 1991]
(Amended 1989 and 1997)

S.1.6.4.2. Product Identity.

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

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

S.1.6.5. Money-Value Computations.

(a) A computing device shall compute the total sales price at any single-purchase unit price (i.e., excluding fleet sales, other price contract sales, and truck stop dispensers used only to refuel trucks) for which the product being measured is offered for sale at any delivery possible within either the measurement range of the device or the range of the computing elements, whichever is less.
~~[Effective and nonretroactive as of January 1, 1991]~~

(b) The analog sales price indicated for any delivered quantity shall not differ from a mathematically computed price (quantity x unit price = total sales price) by an amount greater than the value in Table 1.
(Amended 1984, 1989, and 1993)

S.1.6.5.1. Money-Value Divisions, Analog. - The values of the graduated intervals representing money values on a computing type device shall be no greater than those in Table 1.
(Amended 1991)

Table 1.
Money-Value Divisions and
Maximum Allowable Variations for Money-Value
Computations on Mechanical Analog Computers

Unit Price		Money Value Division	Maximum Allowable Variation	
From	To and including		Design Test	Field Test
0	0.25/liter or $1.00/gallon	1¢	± 1¢	± 1¢
0.25/liter or $1.00/gallon	0.75/liter or $3.00/gallon	1¢ or 2¢	± 1¢	± 2¢
0.75/liter or $3.00/gallon	2.50/liter or $10.00/gallon	1¢ or 2¢	± 1¢	± 2¢
0.75/liter or $3.00/gallon	2.50/liter or $10.00/gallon	5¢	± 2 1/2¢	± 5¢

S.1.6.5.2. Money-Value Divisions, Digital. - A computing type device with digital indications shall comply with the requirements of paragraph G.S.5.5. Money Values, Mathematical Agreement, and the total

2004 Amendments

The following table lists the codes, paragraphs, and pages in which the 89th National Conference on Weights and Measures made amendments. In the column headed "Action," changes are noted as "added," "amended," "deleted," or "renumbered." Each code, section, or paragraph that has been changed will be noted as "Added 2004" or "Amended 2004."

SECTION	CODE	S&T ITEM NO.	PARAGRAPH	ACTION	PAGE
Section 2	Table of Contents	324-1	2.24.	Deleted text "Tentative Code"	2-1
2.20	Scales	320-1	S.1.12.	Amended	2-9
			UR.3.9.	Amended	2-38
		320-3	Table S.6.3.a.	Amended	2-16
			Table S.6.3.b. Note 24	Added Note	2-18
		320-4	N.3.2.	Added	2-24
		320-5	N.1.5.	Amended	2-22
		320-6	Table 3 Footnote 5	Added Footnote	2-14
2.21	Belt-Conveyor Scale Systems	321-1	S.1.5.	Amended	2-46
			UR.1.	Amended	2-51
		321-2	N.2.	Amended	2-48
			N.2.1., N.2.2., N.2.3.	Added	2-48
		321-3	N.3.1.2., N.3.1.3.	Amended	2-49
			T.1.1.	Added	2-50
		321-4	N.3.1.4.	Amended	2-49
		321-5	T.3.1.1.	Amended	2-51
		321-6	UR.2.2.(b)	Amended	2-52
		321-7	UR.3.2.	Amended Added new subsection (b) and renumbered existing U.R.3.2.(b) through UR.3.2.(e) to UR.3.2.(c) through UR.3.2.(f)	2-53 through 2-54
2.24	Automatic Weighing Systems	324-1	Preface	Amended to reflect change in status of code from "tentative" to "permanent"	2-65
			A.1.	Amended	2-65
			A.1. Footnote 1, Footnote 2	Added	2-65
			A.2.(g), Footnote 3	Added	2-66
			A.4.	Deleted	2-66
			S.1.1.(a), S.1.1.1.(c)	Amended	2-66
			S.1.2.1.	Amended	2-66
			S.1.3.(b)	Amended	2-67
			S.2.1.1.	Amended	2-67
			S.2.2. Note	Amended	2-68
			S.4.1.	Deleted; subsequent paragraphs renumbered	2-68
			Table S.6.	Amended	2-69
			N.1.4.	Added	2-72
			N.2.	Title deleted	2-72
			N.2.1. and N.2.2.	Renumbered to paragraphs N.1.5. and N.1.6.	2-72

SECTION	CODE	S&T ITEM NO.	PARAGRAPH	ACTION	PAGE
			N.3.	Renumbered to N.2. Amended paragraph and note.	2-72
2.24 (cont'd)	Automatic Weighing Systems	324-1 (cont'd)	N.3.1.	Amended title Renumbered paragraph and subparagraphs to N.2.1.	2-73
			N.3.1.6.	Deleted	
			N.3.2., N.3.2.1.	Deleted	
			N.3.3	Amended title	2-73
			N.3.3.1., N.3.3.2.	Amended Renumbered to N.2.2.1. and N.2.2.2.	2-73
			N.4.	Renumbered to N.3.	2-73
			N.4.1. and N.4.2.	Amended, Renumbered to N.3.1. and N.3.2.	2-73
			N.4.3., N.4.3.1., N.4.3.2.	Deleted	
			T.2.2.	Amended	2-74
			T.3.1.1., T.3.1.2.	Amended title	2-74
			T.3.2.1.	Amended	2-74
			T.3.2.2.	Amended	2-74
			Table T.3.2.1., Table T.3.2.2.	Amended title	2-74
			T.3.3.1.1., T.3.3.1.2.	Amended title	2-75
			T.3.3.1.2.(a), (b)	Amended	2-75
			T.3.3.2.1., T.3.3.2.2.	Amended title	2-75
			T.3.3.2.2.(b)	Amended	2-75
			T.5.	Amended	2-76
			T.6.	Amended	2-76
			T.7.2.	Deleted	
			T.7.3.	Renumbered to T.7.2., Amended, and Added new note	2-76
			T.8.	Amended	2-77
			UR.3.2.	Amended	2-77
			automatic gravimetric filling machine (instrument)	Moved to Appendix D	D-2
			automatic checkweigher	Amended and moved to Appendix D	D-1
			automatic weighing systems (aws)	Amended and moved to Appendix D	D-1
			non-automatic checkweigher	Moved to Appendix D	D-13
			non-automatic weighing system	Moved to Appendix D	D-13
			systematic (average) error ($\overline{X}$)	Moved to Appendix D	D-19
			random error(s)	Moved to Appendix D	D-16
			test puck	Amended and moved to Appendix D	D-20
			weigh-labeler	Amended and moved to Appendix D	D-2

SECTION	CODE	S&T ITEM NO.	PARAGRAPH	ACTION	PAGE
3.30.	Liquid-Measuring Devices	330-1	S.2.2.1.	Added	3-8
		330-2	S.4.4.2.	Amended	3-12
Section 5	Table of Contents	358-7	5.58	Deleted text "Tentative Code"	5-1
5.58.	Multiple Dimension Measuring Devices	358-1	S.1.6.	Amended	5-50
			Table S.1.6.	Amended	5-50
			UR.5., Table UR.5.	Added	5-55 through 5-56
		358-2	S.1.8.	Amended	5-51
			Table S.4.1.b.	Amended	5-53
		358-3	S.3.	Amended	5-52
		358-4	N.1.4.1.	Added	5-53
		358-5	T.3.	Amended	5-54
		358-6	T.5.2., T.5.2.1., T.5.2.2.	Amended	5-54
			T.7.	Deleted	
		358-7	Preface	Amended to reflect change in status of code from "tentative" to "permanent"	5-49
			billed weight	Moved to Appendix D	D-3
			"d," dimension division value	Moved to Appendix D	D-5
			dimensional Weight (or dim, weight)	Moved to Appendix D	D-6
			measuring element	Moved to Appendix D	D-11
		330-5	Retail Device	Amended	D-17
		358-3	Measurement Field	Added	D-11
		358-4	Test Object	Added	D-20

POS nominal capacity or the Universal Product Code is illegible, but the weight and unit price information are available on the item label and can be entered in the POS to calculate a price.

Handbook 44 includes provisions to deter fraudulent use of the manual weight entry feature. Paragraph S.1.12. describes when a scale can accept such as entry and how it must be identified. Paragraph UR.3.9. specifies only four applications where the use of manual weight entries are permitted. Handbook 44 also requires that a scale shall be suitable for use, which includes its weighing capacity. The feature is not intended as a substitute for a system with insufficient weighing capacity.

The Committee acknowledges that manual weight entries occur with gross and net weight packages. The Committee considered several proposals to address this practice. These proposals were either limited in the applications they covered, unclear on what tare information that must be recorded, or appeared to prohibit manual tare entries. After lengthy discussion at the 2003 NCWM Annual Meeting, the Committee agreed to keep the following proposal an information item to allow sufficient time for these deficiencies to be addressed:

> *S.1.12. Manual ~~Gross~~ Weight Entries. - A device shall accept an entry of a manual ~~gross~~ weight value only when the scale is at gross load zero and the scale gross or net* weight indication is at zero ~~in the gross weights display mode~~. Recorded manual weight entries, except those on labels generated for packages of standard weights, shall identify the weight value as a manual weight entry by one of the following terms: "Manual Weight," "Manual Wt," or "MAN WT." The use of a symbol to identify multiple manual weight entries on a single document is permitted, provided that the symbol is defined on the same page on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.*
> *[Nonretroactive as of January 1, 1993]*
> *[*Nonretroactive as of January 1, 2004.]*
>
> UR.3.9. Use of Manual ~~Gross~~ Weight Entries. - Manual ~~gross~~ weight entries are permitted for use in the following applications only: (1) on a point-of-sale system interfaced with scales when credit is given for a weighed item ~~on point-of-sale systems interfaced with scales~~, or when an item is pre-weighed and marked with the correct net weight; (2) when a device or system is generate~~e~~ing labels for standard weight packages; (3) when postal scales or weight classifiers are generate~~e~~ing manifests for packages to be picked up at a later time; ~~or~~ and (4) ~~when~~ on livestock scale and vehicle scale systems generate weight tickets to correct erroneous tickets.

The Central Weights and Measures Association did not take a position on this issue until it had a chance to review positions taken by the NTETC Weighing Sector when the Sector meets later in 2003.

During its September 2003 Annual Conference, the WWMA examined the recommendation developed by the 2003 S&T Committee and an alternate proposal that limited use of the manual weight entry feature to point-of-sale (POS) systems. The WWMA agreed that limiting the feature to POS systems was too restrictive. The WWMA also agreed that the S&T Committee's recommendation would make the current practice of entering preset tare values with a load on the scale during direct sale transactions very difficult. Consequently, the WWMA recommended the alternate proposal for paragraph S.1.12. shown in the recommendation above and modified paragraph U.3.9. to limit manual weight entries to either gross or net weighed items as follows:

> UR.3.9. Use of Manual ~~Gross~~ Weight Entries. - Manual gross or net weight entries are permitted for use in the following applications only: (1) on a point-of-sale system interfaced with scales when credit is given for a weighed item ~~on point-of-sale systems interfaced with scales~~, or when an item is pre-weighed and marked with the correct net weight; (2) when a device or system is ~~generate~~ing labels for standard weight packages; (3) when postal scales or weight classifiers are generate~~e~~ing manifests for packages to be picked up at a later time; and (4) on livestock scale and vehicle scale systems that generate weight tickets to correct erroneous tickets.

The Northeastern Weights and Measures Association opposed the carryover recommendation developed by the 2003 S&T Committee because it found the language too cumbersome to address all possible scenarios where a manual weight entry is used.

The Scale Manufacturers Association (SMA) supported the WWMA proposal to modify paragraph S.1.12. and recommended an alternate proposal to modify paragraph UR.3.9. shown in the recommendation above. The SMA

Modify paragraph S.6.4. as follows:

S.6.4. Railway Track Scales.

(a) A railway track scale shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Such marking shall be accurately and conspicuously presented on, or adjacent to the identification or nomenclature plate that is attached to the indicating element of the scale.

(b) *The nominal capacity of a railway track scale ~~with more than two sections~~ shall not exceed ~~twice its rated section capacity~~* the lesser of; 640 000 lb or 80 000 lb for each 5 feet of weigh rail length or portion thereof and; the section capacity (SC) multiplied by the number of sections (N) of the scale minus 0.5. The formula is stated as Nominal Capacity = SC x (N - 0.5). *~~The nominal capacity of a two section scale shall not exceed its rated section capacity.~~*
*[*Nonretroactive as of January 1, 2002]*

Add new paragraph UR.X. as follows:

UR.X. Railcars weighed statically shall be uncoupled and alone on the load-receiving element as the weight is recorded.

The Committee has not heard sufficient technical grounds for modifying the formula to permit unlimited nominal capacities for railway track scales. The proposal appears to have little support from parties that would be most affected by the changes to paragraph S.6.4., if the proposal were adopted. Additionally, there remains some concern about the difficulty of locating sufficient test weights and the ability to concentrate a test load on scales with capacities that exceed 640 000 lb. Consequently, the Committee withdraws the proposal from the agenda and asks the AAR and Systems Associates, Inc. to find an alternate proposal that is amenable to both parties and the industries they represent.

The Committee acknowledged that the NEWMA proposal to modify Table 4, Minimum Test Weights and Test Loads begins to address the maximum test load on all large capacity scales. However, the proposal erroneously appeared in Interim Agenda Item 320-2 when it is a separate issue that has merit, but is insufficiently developed for Committee action. Consequently, NEWMA's proposal now appears in Appendix A as developing item Part 2, Scales Code in the 2004 Interim Report.

320-3 V S.6.4.3. Section Capacity Prefix and Table S.6.3.a. Marking Requirements

Source: Central Weights and Measures Association (CWMA)

Recommendation: Modify Table S.6.3.a. Marking Requirements as follows:

Table S.6.3.a.
Marking Requirements

	Weighing Equipment				
To Be Marked With ⇓	**Weighing, load-receiving, and indicating element in same housing or covered on the same CC[1]**	**Indicating element not permanently attached to weighing and load-receiving element or covered by a separate CC**	**Weighing and load-receiving element not permanently attached to indicating element or covered by a separate CC**	**Load cell with CC (11)**	**Other equipment or device (10)**
Manufacturer's ID (1)	**X**	**X**	**X**	**X**	**X**
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.		.
Section Capacity **and Prefix** (14)(20)(22)**(24)**		**X**	**X**		

Note: For applicable notes, see Table S.6.3.b.

[1]Weighing/load-receiving elements and indicators which are in the same housing or which are permanently attached will generally appear on the same CC. If not in the same housing, elements shall be hard wired together or sealed with a physical seal or an electronic link. This requirement does not apply to peripheral equipment that has no input or effect on device calibrations or configurations.

(Added 1990) (Amended 1992, 1999, 2000, 2001 ~~and~~ 2002**, and 2004**) (Footnote 1 Added 2001)

Add new Note 24. to Table S.6.3.b. Notes for Table S.6.3.a. as follows:

24. The section capacity shall be prefaced by the words "Section Capacity" or an abbreviation of that term. Abbreviations shall be "Sec Cap" or Sec C." All capital letters and periods may be used. (Added 2004)

Discussion: The CWMA believes that current Handbook 44 may be interpreted to prohibit the abbreviation of section capacity. Because some device identification badges are limited in space, manufacturers abbreviate marking information. The CWMA recommends adding a new paragraph S.6.4.3. that requires identification of section capacity information with a prefix and defines acceptable abbreviations for that prefix. The CWMA did not submit specific language for addressing the abbreviation of section capacity in Table S.6.3.a. Marking Requirements and Table S.6.3.b. Notes For Table S.6.3.a.

The Western Weights and Measures Association (WWMA) heard that the NTETC Weighing Sector and manufacturers support the intent of the proposal. However, the WWMA believes the CWMA proposal should be simplified and modified for clarity. The WWMA agreed that use of the abbreviations "SC" and "S Cap" to identify section capacity are not acceptable because they might be interpreted to represent scale capacity. The WWMA considered a recommendation to include identification requirements for section capacity in General Code paragraph G-S.1. Identification since that requirement specifies other marking information and prefixes. Ultimately, the WWMA decided to address the abbreviation of "section capacity" as a Scale Code requirement. The WWMA worked with the NTETC Weighing Sector Technical Advisor to develop the alternate proposal to modify Table S.6.3.a. and Table S.6.3.b. as shown in the recommendation above.

The Scale Manufacturers Association supported the proposal for including in Table S.6.3.a. and Table S.6.3.b. language that that requires a prefix to identify the scale's section capacity and specifies how the prefix must be abbreviated.

The Committee agreed that the best approach for designating a prefix that identifies the scale's section capacity is the WWMA alternate proposal. The WWMA proposal is consistent with the current practice of listing other scale marking requirements in one table. The Committee modified the WWMA proposal for new Note 24. by removing the word "Acceptable." The Committee does not believe it is necessary to qualify that the abbreviation is acceptable since this text does not appear in other marking requirements and it is understood what abbreviation is acceptable because they are adequately defined in the note's text. Consequently, the Committee recommends modifying Table S.6.3.a. to include a marking requirement for a prefix that identifies the scale's section capacity and a corresponding note be added to Table S.6.3.b.

320-4 V N.3.2. Field Standard Weight Carts

Source: Carryover Item 320-11. (This item originated from the Northeastern Weights and Measures Association (NEWMA) and first appeared on the Committee's 2003 agenda.)

Recommendation: Add new paragraph N.3.2.

> **N.3.2. Field Standard Weight Carts. - Field Standard Weight Carts that comply with the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied) may be included as part of the minimum required test load for shift tests and other test procedures. (Added 2004)**

Discussion: The original NEWMA proposal was intended to modify the NIST Handbook 44 Scales Code to recognize the use of weight carts during a shift test. During its October 2003 Interim Meeting, NEWMA indicated that its original proposal was not ready for adoption by the NCWM. New York noted that NEWMA's proposal shown below should include a reference to the Handbook 44 Fundamental Considerations 3.2 Tolerances for Standards. New York also recommended modifying NEWMA's proposal to eliminate any requirements that specify a particular type of information that must be included in the weight cart's calibration report as follows:

> N.1.3.4.1. Weight Carts. - Weight carts may be included as part of the minimum required test load required in N.1.3.4. provided that the mass value of the weight cart has been determined by weights and measures and is clearly marked thereon. Further, a certificate of calibration issued by the weights and measures jurisdiction that issued the weight certificate must be available at all times. ~~Said certificate shall contain at a minimum the following information: the date of calibration, name, model, and serial number of the weight cart; the minimum graduation of the scale used in the calibration of the weight cart; and the name of the jurisdiction and inspector or metrologist who determined the mass value~~.

At the 2004 NCWM Interim Meeting, the Committee heard that the NEWMA proposal was unclear as to how the mass value is determined by a weights and measures jurisdiction. The Committee agreed that the portions of the proposed language intended to address the reference standard should include information about the uncertainty of the scale used as the reference standard rather than the scale's minimum graduation size. The uncertainty of the reference scale is essential in the calibration report for the weight cart to establish the accuracy of measurements made with the field standard.

The Central Weights and Measures Association (CWMA) developed an alternate proposal that specified weight carts may be used as part of the minimum load for shift tests on vehicle scales. The CWMA believes that an additional proposal is needed to permit the use of weight carts in tests other than shift tests. The CWMA also recommended that the proposal make reference to weight carts meeting the Fundamental Considerations Tolerance for Standards when a weight cart is used as the testing apparatus in accordance with the requirements for calibration of a field test standard in NIST Handbook 105-8, Specification and Tolerances for Field Standard Weight Carts.

The Committee agreed that the test note should include language that permits use of weight carts for shift tests and other test as well as specify a standard for the weight cart. The Fundamental Considerations prescribes the error in a field test standard used by weights and measures officials. The Committee also noted that the proposed paragraph designation is already in use. Consequently, the Committee modified the CWMA proposal as shown in the recommendation above to include a new paragraph designation and require that field standard weight carts comply with the guidelines for test apparatus in the Fundamental Considerations.

The Committee acknowledges that it is general knowledge that NIST Handbook 105-8 is available through the NIST Weights and Measures Division web site at www.nist.gov/own and was published in December 2003.

320-5 V N.1.5. Discrimination Test

Source: Central Weights and Measures Association (CWMA)

Recommendation: Modify paragraph N.1.5. as follows:

> ***N.1.5. Discrimination Test. -*** *A discrimination test shall be conducted on all automatic indicating scales with the weighing device in equilibrium* ~~*at*~~ ***near*** *zero load and* ~~*at*~~ ***near*** *maximum test load, and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained.* ***For scales equipped with the Automatic Zero-Setting Mechanism (AZSM), the discrimination test may be conducted at a range outside of the AZSM range.***
> *[Nonretroactive as of January 1, 1986]*
> (Added 1985) **(Amended 2004)**

Discussion: The CWMA agreed that it is impossible to conduct a discrimination test and verify the zone of uncertainty *at* zero if the Automatic Zero-Setting Mechanism (AZSM) is operational. The CWMA believes the test should be conducted *near* zero without the weights and measures official having to disable AZSM. The CWMA does not want officials having to access the inside of scales to disable and then make operational AZSM or any other feature.

The Scale Manufacturers Association supports this item.

The Committee heard no opposition to the proposal. The Committee recognizes that there are environmental and scale design factors that can affect the results of a discrimination test. The Committee also acknowledges that it is acceptable to perform a discrimination test at zero load just above the zero tracking range for scales that are equipped with AZSM. The test is also acceptable when performed just below the scale's maximum capacity in the event that a scale is set up to display an indication of over capacity that is less than maximum total load in excess of scale capacity established in paragraph S.1.7. Capcacity Indication, Weight Ranges, and Unit Weights.

320-6 V Table 3 Parameters for Accuracy Classes; Footnote 5 Grain Hopper Scales

Source: Central Weights and Measures Association (CWMA)

Recommendation: Add a new footnote to Table 3 as follows:

Table 3
Parameters for Accuracy Classes

Class	*Value of the verification scale division (d or e[1])*	*Number of scale[4] divisions (n)*	
		Minimum	*Maximum*
	SI Units		
.	.	.	.
.	.	.	.
.	.	.	.
III[2, 5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
.	.	.	.
.	.	.	.
.	.	.	.
	INCH-POUND Units		
III[2, 5]	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
.	.	.	.
.	.	.	.
.	.	.	.

[1]For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

.
.
.

[5]The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.

[Nonretroactive as of January 1, 1986]
(Amended 1986, 1987, 1997, 1998, 1999, ~~and~~ 2003, **and 2004**) (Footnote 4 Added 1997) **(Footnote 5 Added 2004)**

Discussion: Requirements for the minimum and maximum number of scale divisions are listed in Table 3 Parameters for Accuracy Classes; however, the table presently does not recognize a limitation to the minimum and maximum number of scale divisions included in user requirement, paragraph UR.1.2. Grain Hopper Scales. To ensure both manufacturer and users are aware of this limitation, the CWMA recommends adding a new footnote 5 to Table 3 making the information about grain hopper scales available in paragraphs intended for device manufacturers. The CWMA believes the paragraph UR.1.2. for the minimum number of scale divisions for a Class III Hopper Scale used for grain weighing is missed.

The Scale Manufacturers Association (SMA) opposes this proposal because it introduces a new application into Table 3. SMA prefers that Table 3 not include any application requirements.

The Committee believes that adding a new note to Table 3 helps to clarify the allowable minimum number of scale divisions for a Class III Hopper Scale used in grain weighing application for the manufacturer and official. Adding the text from the user requirement into Table 3 is consistent with current Table 3 requirements for hopper scales and further explains the parameters that apply for this device type.

320-7 W Appendix D; Definition of Counter Scale, S.2.1.3. Scales Equipped with an Automatic Zero-Setting Mechanism, N.1.3.1. Bench Counter Scales, and N.1.3.8. All Other Scales Except Crane Scales

Source: Carryover Item 320-4. (This item originated from the National Type Evaluation Technical Committee (NTETC) Weighing Sector and first appeared on the Committee's 2003 agenda.)

1.10. General Code
G-S.5.2.2.(d) Digital Indication and Representation
G-S.5.2.4. Values.
G-S.5.3.1. On Devices That Indicate in More Than One Unit
G-S.6. Marking Operational Controls, Indications and Features
G-UR.3.3. Position of Equipment

2.20. Scales
S.1. Design of Indicating and Recording Elements and of Recorded Representations
S.1.4. Indicators
S.1.5.4. Readability
S.1.8.3. Customer Indications
S.1.12. Manual Gross Weight Entries
S.4.3. Multiple Load-Receiving Elements
Table S.6.3.b. Note 13 – A scale designed for a special application . . . trade."

NIST WMD also believed that changes were required to Scales Code paragraph S.1.1.(c) to clarify the intent of the past S&T Committee and to prevent further misinterpretation. The S&T Committee concurred with this position and consequently proposed changes to paragraph S.1.1.(c) as outlined above.

During the 2004 NCWM Interim Meeting, the Committee was briefed on some ongoing discussions about zero indications within the Weighing Sector for the past several years. The Weighing Sector was presented with a retail scale using a touch screen with a screen saver that extends the screen's life. The scale screen saver changes to display the indications when the scale is off zero. In this example, the Weighing Sector agreed there was no fraud, but the scale should display a zero indication prior to a subsequent weighment. Because discussions are still ongoing some Weighing Sector members believe the proposal may be premature.

Weights and measures officials indicate there may be "not-built-for-purpose" devices which do not comply with the proposed interpretation. The "not-built-for-purpose" devices are interfaced with approved devices; however, they continue weighing when off of zero. Consequently, officials question whether the proposed changes to paragraph S.1.1.(c) are intended to be nonretroactive requirements.

The Committee agreed that its interpretation of paragraph S.1.1.(c) is consistent with the original intent. After hearing comments about how some systems are designed to operate, the Committee recommends that additional language is needed to clarify that no marking is required if operator intervention is necessary to verify a zero condition before the start of a transaction. The Committee made the proposal an information item to provide sufficient time for input from the Weighing Sector, who did not have the proposal available at its 2003 meeting and for suggested language to address operator intervention.

321 BELT-CONVEYOR SCALE SYSTEMS

321-1 V S.1.5. Rate of Flow Indicators and Recorders and UR.1. Use Requirements

Source: Western Weights and Measures Association (WWMA)

Recommendation: Amend paragraphs S.1.5. and UR.1. as follows:

S.1.5. *Rate of Flow Indicators and Recorders. - A belt-conveyor scale shall be equipped with a rate of flow indicator and an analog or digital recorder. Permanent means shall be provided to produce an audio or visual signal when the rate of flow is equal to or less than* ~~*35*~~ ***20*** *% and when the rate of flow is equal to or greater than* ~~*98*~~ ***100*** *% of the rated capacity of the scale. The type of alarm (audio or visual) shall be determined by the individual installation.*
[Nonretroactive as of January 1,1986]
(Amended 1989 **and 2004**)

UR.1. Use Requirements. - A belt-conveyor scale system shall be operated between ~~35~~**20** % and ~~98~~ **100** % of its rated capacity.
(Amended 2004)

Discussions: During the 2002 Belt-Conveyor Scale Technical Seminar, there was considerable discussion about harmonization of the NIST Handbook 44 Belt-Conveyor Scale Systems Code with OIML R 50 Continuous Totalizing Automatic Weighing Instruments. Preliminary data was presented to provide evidence that belt-conveyor scales tested only at zero and a single flow rate as specified by Handbook 44 may have excessive errors at other flow rates.

Occasionally, there are periods of varying duration, when a scale operates at different flow rates even though most belt-conveyor scales tend to operate a majority of the time at relatively the same flow rate. Other devices in Handbook 44 are tested throughout their rated operating range; therefore, belt-conveyor scales should be subject to similar testing to ensure accuracy at all ranges.

The WWMA heard comments in support of the proposal from a manufacturer and user. The WWMA recommended that the NCWM S&T Committee move the proposal forward as a voting item.

The Southern Weights and Measures Association recommended this proposal as written.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA.

The Committee considered input from NIST indicating that the original proposal to change the nonretroactive enforcement date from 1986 to 2005 would make the requirement in paragraph S.1.5. less restrictive than the current requirements. The Committee agreed that systems installed prior to 2005 would meet the less restrictive requirement for a signal to indicate a rate of flow outside of the 20 % to 100 % range of scale capacity. The Committee acknowledged that it is acceptable for systems to operate within a range that is narrower than the proposed 20 % to 100 % of the scale's capacity as long as it complies with other Handbook 44 requirements. Consequently, the Committee kept the year at 1986 in paragraph S.1.5. and removed the proposed requirement for different enforcement dates based on an installation before or after January 1, 2005, from the proposal to modify paragraph UR.1. The Committee agreed that the proposal was ready for a vote with the modifications show in the recommendation above.

321-2 V N.2. Conditions of Test, N.2.1. Initial Verification, N.2.2. Subsequent Verification, and N.2.3. Minimum Test Load

Source: Western Weights and Measures Association (WWMA)

Recommendation: Modify paragraph N.2. as follows:

N.2. Conditions of Test. - A belt-conveyor scale shall be tested after it is installed on the conveyor system with which it is to be used and under such environmental conditions as may normally be expected. ~~**It shall be tested at normal use capacity and may also be tested at any other rate of flow that may be used at the installation.**~~ Each test shall be conducted ~~**for**~~ **with test loads no less than the minimum test load.**

~~**(a) not less than 1000 scale divisions**~~
~~**(b) at least three revolutions of the belt, and**~~
~~**(c) at least 10 minutes of operation, or for a normal weighment.**~~
(Amended 1986 **and 2004**)

Add new paragraphs N.2.1., N.2.2., and N.2.3., as follows:

N.2.1. Initial Verification. - A belt-conveyor scale system shall be tested at an intermediate flow rate, near 35 % flow rates and normal use capacity. The system may also be tested at any other rate of flow that may be used at the installation.
(Added 2004)

N.2.2. Subsequent Verification. - Subsequent testing shall include testing at the normal flow rate and other flow rates used at the installation. The official with statutory authority may determine that testing only at the normal flow rate is necessary for subsequent verifications if evidence is provided that the system is used to operate no less than 70 % of the maximum flow rate at least 80 % of the time, or that normal operational flow rate does not vary by more that 10 % (e.g. If the normal flow rate is 70 % an acceptable range can be 63 to 73 %).
(Added 2004)

N.2.3. Minimum Test Load. - The minimum test load shall not be less than the largest of the following values.

(a) 800 scale divisions,
(b) The load obtained at maximum flow rate in one revolution of the belt, or
(c) At least 10 minutes of operation.

The official with statutory authority may determine that a shorter time down to 2 % of the load totalized in one hour at the maximum flow rate may be used, provided that:

2 % of the load totalized in one hour at the maximum flow rate is greater than the time to achieve (a) and (b) and testing is performed that demonstrates that the system can perform within tolerances with both the shorter test time and with minimum totalized loads described in N.2.3. (a), (b), or (c).
(Added 2004)

Discussion: Participants at the 2002 NIST Belt Conveyor Scale Systems Technical Seminar, developed a proposal that requires testing a belt-conveyor scale at several flow rates to verify that it maintains accuracy over a range of flow rates for a specific installation. The seminar participants also developed guidelines for an appropriate minimum test load.

Current NIST Handbook 44 test procedures do not clearly require tests at flow rates other than the normal operating flow rate. Belt-conveyor scales often operate at other flow rates for varying time periods and thus need to provide accurate weighing at all flow rates.

The WWMA heard comments in support of this item from a manufacturer and user. There was also a comment that a corresponding definition for minimum test load would be redundant and may not be necessary. The WWMA believes the proposal provides additional clarification of the "minimum test load" thus eliminating the need to amend Appendix D Definitions.

The Southern Weights and Measures Association supports the proposal as written.

The Committee modified the proposal for paragraph N.2.3. to clarify the amount of testing necessary when performing a shorter test so the time period is sufficient in length and does not contribute to scale error. The Committee concluded that defining terms such as "minimum test load," "initial verification," and "subsequent verification" is not necessary since those terms are commonly used in reference to tests on many other types of weighing devices and thought to be well understood.

321-3 V N.3.1.2. Initial Stable Zero, N.3.1.3. Test of Zero Stability, and T.1.1. Tolerance Values-Test of Zero Stability

Source: Western Weights and Measures Association (WWMA)

Recommendation: Amend paragraphs N.3.1.2. and N.3.1.3 as follows:

N.3.1.2. Initial Stable Zero. - The conveyor system shall be operated to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out until three consecutive zero-load tests each indicate an error which does not exceed ± 0.06 % ~~**of the full scale capacity**~~ **of the totalized load at full scale capacity for the duration time of the test,** or ± 1 division, whichever is less. No adjustments can be made during the three consecutive zero-load test readings.
(Added 2002) **(Amended 2004)**

N.3.1.3. Test of Zero Stability. - The conveyor system shall be ~~run~~ **operated** to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out immediately before the simulated or materials test until the three consecutive zero-load tests each indicate an error which does not exceed ± 0.06 % ~~of the full scale capacity~~ **of the totalized load at full scale capacity for the duration time of the test,** or ± 1 division, whichever is less. No adjustments can be made during the three consecutive zero-load test readings.

~~Immediately after material has been weighed over the belt-conveyor scale during the conduct of the materials test, the zero-load test shall be repeated. The zero error from this test shall not exceed ± 0.12 % of the full scale capacity or ± 2 divisions, whichever is less.~~
(Added 2002) **(Amended 2004)**

Add a new paragraph T.1.1. Tolerance Values – Test of Zero Stability as follows:

T.1.1. Tolerance Values – Test of Zero Stability. – Immediately after material has been weighed over the belt-conveyor scale during the conduct of the materials test, the zero-load test shall be repeated. The change in the accumulated or subtracted weight on the Master Weight Totalizer during the zero test shall not exceed 0.12 % of the totalized load at full scale capacity for the duration time of the test, or ± 2 divisions, whichever is less.
(Added 2004)

Discussion: In 2002, paragraphs N.3.1.2. and N.3.1.3. were added to the Belt-Conveyor Scale Systems Code to define a stable zero and establish an acceptable variation in zero (zero error), when the system is operated at a no load condition. The change was made, in part, to make the code consistent with requirements in OIML R 50 Continuous Totalizing Automatic Weighing Instrument. R 50 defines the allowable zero error in terms of a percent of the totalized load at the system's maximum flow-rate only for the time-period it takes to complete the test. Current paragraphs N.3.1.2. and N.3.1.3. specify the allowable zero error only as a percent of full scale capacity which can be a rather large value and usually results in an error stated in scale divisions since that value is the lesser of the two values. Some comparisons of the allowable zero error in terms of scale divisions, percent of full scale capacity, and percent of capacity for the test duration are shown in the table below:

Comparison of 0.06 % of Scale Capacity to 0.06 % of Test Load											
Full Scale Capacity (ton/ hour)	Belt Speed (ft/ min)	Belt Load (lb/ft)	Belt Length (ft)	Belt Rev Time (rev/ min)	Time Per 3 Rev (min)	3 Rev Load (ton)	10 Min Load (ton)	"d" Size (ton)	Min Test Load (ton)	0.06 % of Capacity (ton)	0.06 % of MTL (ton)
250	250	33.33	200	0.8	2.40	10.00	41.67	0.02	41.67	0.15	0.025
500	300	55.56	250	0.83	2.50	20.83	83.33	0.05	83.33	0.3	0.05
650	300	72.22	225	0.75	2.25	24.38	108.33	0.1	108.33	0.39	0.065
1000	650	51.28	1500	2.31	6.92	115.38	166.67	0.1	166.67	0.6	0.1
3000	700	142.86	1800	2.57	7.71	385.71	500.00	0.5	500.00	1.8	0.3
5000	500	333.33	1800	3.6	10.8	900.00	833.33	0.5	900.00	3.0	0.57

The proposal modifies current Handbook 44 language to redefine the maximum allowable change of zero that is more appropriate for the master weight totalizer.

The Southern Weights and Measures Association supports the WWMA proposal as written.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA. Hearing no opposition, the Committee made the proposal a voting item.

321-4 V N.3.1.4. Check For Consistency of the Conveyor Belt Along Its Entire Length

Source: Western Weights and Measures Association (WWMA)

Recommendation: Modify paragraph N.3.1.4. as follows:

> **N.3.1.4. Check For Consistency of the Conveyor Belt Along Its Entire Length.** - After a zero-load test with flow rate filtering disabled, the totalizer shall not change more than ± three scale divisions from its initial indication during one complete belt revolution.
> (Added 2002) **(Amended 2004)**

Discussion: The intent of paragraph N.3.1.4. is to ensure that the conveyor belt is consistent in weight throughout its entire length. To meet this requirement, a belt must be the same size and thickness throughout its entire length. The types of splices, belt material, and construction are a major contributing factor to maintaining uniform belt weight. During the stability tests, adjustments are made to the scale totalizer to average the entire belt weight to provide a zero reading over complete revolutions of the belt. The belt should not have variances large enough to affect the tolerance of the weighed load because a material load seldom fully captures a complete revolution of the belt and is not able to use the same averaging process that occurs during the stability tests.

Different interpretations exist over the true value of three scale divisions. The addition of the "±" symbol will ensure that all officials and commercial operators are reading, interpreting, and applying the requirement consistently.

The Southern Weights and Measures Association recommends the proposal as written.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA. After hearing only favorable comments, the Committee made the proposal a voting item.

321-5 V T.3.1.1. Effect on Zero-Load Balance

Source: Western Weights and Measures Association (WWMA)

Recommendation: Modify paragraph T.3.1.1. as follows:

> **T.3.1.1. Effect on Zero-Load Balance.** - The zero-load indication shall not change by more than ~~0.07~~ **0.035** % of the rated capacity of the scale (without the belt) for a change in temperature of 10 °C (18 °F) at a rate not to exceed 5 °C (9 °F) per hour.
> **(Amended 2004)**

Discussion: The current 0.07 % tolerance for change in the zero-load indication was originally added in 1986 to paragraph T.3.1.1. to ensure consistency between NIST Handbook 44 and R 76 Non-Automatic Weighing Instruments. The 0.07 value was recognized prior to the 1994 edition of R 50 Continuous Totalizing Automatic Weighing Instrument, which unlike the 1980 edition of R 50 it superceded, does include influence factor testing.

The proposal amends paragraph T.3.1.1. to reduce the allowable variation regarding temperature effect on zero-load balance to harmonize the requirements with OIML R 50. The appropriate tolerance value for a belt-conveyor scale is 0.035 %. Modification of the tolerance would require reevaluation of existing data for devices with "Active" NTEP Certificates of Conformance to ensure those scales meet the more stringent tolerance.

The WWMA heard comments in support of this item from a manufacturer and user.

The WWMA and Southern Weights and Measures Association support the proposal as written. The WWMA acknowledges the proposal is a retroactive requirement. The WWMA agreed that the proposal may require a reevaluation of existing data for devices with "Active" Certificates of Conformance.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA. Hearing no opposition, the Committee made the proposal a voting item.

321-6 V UR.2.2.(b) Conveyor Installation; Live Portions of Scale

Source: Western Weights and Measures Association (WWMA)

Recommendation: Modify paragraph UR.2.2.(b) as follows:

UR.2.2. Conveyor Installation

(b) Live Portions of Scale. - All live portions of the scale shall be protected ~~by~~**with** appropriate guard devices **and clearances, as recommended by the scale manufacturer,** to prevent accidental interference with the weighing operation. **Also, see UR. 3.2.**
(Amended 2004)

Discussion: Existing installation requirements only provide guidelines for using guards to prevent objects from obstructing the live portions of the scale. Adequate clearance for live portions of the scale is equally important to prevent materials or other objects from jamming or impeding the free motion of moving components of metrological criticality.

In the period following a routine installation, scale components and/or the scale structure may need more clearance due to the physical properties of materials or other environmental factors at the site. A user requirement is necessary since installers may not anticipate the future influence of these factors on the device's performance.

The WWMA heard comments in support of this item from a manufacturer and user. The WWMA's work further modified the proposal to reduce any ambiguity and emphasize compliance with corresponding installation and operation requirements in General Code paragraphs G-UR.2.1. Installation and G-UR.3.1. Method of Operation.

The Southern Weights and Measures Association support the proposal as written.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA. Hearing no opposition, the Committee made the proposal a voting item.

321-7 V UR.3.2.(b) Maintenance

Source: Western Weights and Measures Association (WWMA)

Recommendation: Amend paragraph UR.3.2.(b) as follows:

UR.3.2. Maintenance. - Belt-conveyor scales and idlers shall be maintained and serviced in accordance with manufacturer's instructions and the following:

(a) The scale and area surrounding the scale shall be kept clean of debris or other foreign material that can detrimentally affect the performance of the system.

(b) There shall be provisions to ensure that weighed material does not adhere to the belt and return to the weighing area.
(Added 2004)

Renumber existing paragraphs UR.3.2.(b) through UR.3.2.(e) to become UR.3.2.(c) through UR.3.2.(f).

Discussion: This proposal is intended to prevent the re-circulation of previously weighed material that has accumulated on the belt. The existing user requirements for belt maintenance only require clean up or removal of debris or foreign

material. When the material that is being weighed as a saleable commodity is allowed to stick or freeze to a conveyor belt, then the true weight of delivered product determined by the scale is in question since the weight of the material may continue to be reweighed by the scale. Current requirements do not include specific language to address this concern. Some possible examples of mechanisms that can be used to prevent material from adhering to the belt are a belt scraper installed at the head-pulley and/or a secondary scraper elsewhere on the conveyor belt system.

The WWMA agreed with comments it heard in support of this item from a manufacturer and user.

The Committee received additional industry support for the proposal as written. The Committee recognizes that the proposal is the result of work by the Belt-Conveyor Scale Technical Seminar representatives, the NIST Technical Advisor to the Seminar, and the WWMA. Hearing no opposition, the Committee made the proposal a voting item.

322 AUTOMATIC BULK WEIGHING SYSTEMS

322-1 I Tolerances

Source: Carryover Item 322-1. This item originated from the Northeastern Weights and Measures Association (NEWMA) and first appeared on the Committee's 2002 agenda.

Recommendation: Delete paragraphs T.1.4., T.2., T.2.1, T.3.2. and T.3.3.as follows:

~~**T.1.4. To 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 value of the scale division. This does not apply to digital indications or recorded representations that have been corrected for rounding using error weights.**~~

~~**T.2. Minimum Tolerance Values. - The minimum tolerance value shall not be less than half the value of the scale division.**~~

~~**T.2.1. For Systems used to Weigh Construction Materials. The minimum maintenance and acceptance tolerance shall be 0.1 % of the weighing capacity of the system, or the value of the scale division, whichever is less.**~~

~~**T.3.2. For Systems used to Weigh Grain. - The basic maintenance tolerance shall be 0.1 % of test load.**~~

~~**T.3.3. For all Other Systems. The basic maintenance tolerance shall be 0.2 % of test load.**~~

Renumber paragraph T.3. and renumber and modify T.3.1. as follows:

T.~~3~~.2. Basic Tolerance Values.

T.~~3~~.2.1. Acceptance Tolerance. -The basic acceptance tolerance shall be one-half the basic maintenance tolerance, **but never less than 1 division.**

Add new paragraphs T.2.2., T.2.3., and T.2.3.1. and Table 1 and Table 2 as follows:

T.2.2. General. - The tolerance applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table 1. below.

Table 1. Tolerance for Unmarked Scales

Type of Device	Tolerance	Decreasing Load Multiplier	Other applicable Requirements
Grain Hoppers	Class III, T.2.3 (table 2)	1.0	T.2.1., T.2.3.1
Other Systems	Class III L, T.2.3 (table 2)	1.0	T.2.1., T.2.3.1

tolerances additional time to compare data and come to an amendable and appropriate solution for ABWS tolerances. A USNWG should be given serious consideration as a possible forum to work on suitable ABWS tolerances.

For more background information, refer to the 2002 and 2003 S&T Final Report.

324 AUTOMATIC WEIGHING SYSTEMS

324-1 V Tentative Status of the Automatic Weighing Systems Code

Source: Carryover Item 324-1. (This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Change the status of the Automatic Weighing Systems Code from tentative to permanent.

Discussion: Since 2002, the Committee considered a proposal to change the status of the Automatic Weighing Systems (AWS) Code from tentative to permanent to provide requirements that can be enforced by weights and measures officials. The item was maintained as an information item to provide time for the AWS Working Group to resolve issues with the limits on units of measurement, inconsistencies in the text, and laboratory tests. The Committee recognized that, although the AWS Working Group addressed many issues, industry still has concerns about devices that comply with NIST Handbook 44, but generate packages that do not meet NIST Handbook 133 requirements for net content.

At its September 2003 Technical Conference, the WWMA heard comments from manufacturers that continue to oppose changing the current status of the tentative code because of allowable device errors permitted in Handbook 44 that may present inconsistencies with package lot requirements in Handbooks 130 and 133. A scale that complies with Handbook 44 accuracy requirements, when used for packaging, may produce package lots that do not meet allowable variance restrictions under Handbook 133. The manufacturers recommended further work by the AWS Working Group to resolve the remaining issues. The WWMA considered a proposal to amend the application of the AWS code exclusively to automatic weigh-labelers used in USDA facilities, but concluded that this proposed solution would not eliminate the concerns about packages checked at the point-of-pack. The WWMA recommended that this item remain informational.

The Scale Manufacturers Association (SMA) supports the WWMA recommendation to keep the proposal an information item.

During the January 2004 Interim Meeting, the Committee reviewed a proposal to amend the AWS Code that included modifications recommended by the AWS Working Group as well as language that addresses manufacturers concerns expressed at the WWMA Technical Conference. Manufacturers indicated that with minor changes to this alternate proposal the AWS Code is ready for permanent status. The Committee agreed that the alternate proposal should also be part of this proposal to change the code status to permanent. The alternate proposal to modify the AWS Code is included in Appendix B. The Committee recognized that the AWS Working Group must be balloted on modifications recommended by manufacturers. The Committee asked that the NIST Technical Advisor to the AWS Working Group report on the results of the work group's ballot and any further modifications beyond editorial changes become separate voting items at the July 2004 NCWM Annual Meeting.

For more background information, refer to the 2002 and 2003 S&T Final Report.

330 LIQUID-MEASURING DEVICES

330-1 V S.2.1. Multiple Measuring Elements With a Single Provision for Sealing

Source: Carryover Item 330-1. (This item originated from the National Type Evaluation Technical Committee Measuring Sector and first appeared on the Committee's 2003 agenda.)

Recommendation: Add a new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing as follows:

Appendix B

Item 324-1: Tentative Status of the Automatic Weighing Systems Code

Section 2.24. Automatic Weighing Systems ~~– Tentative Code~~

~~**This tentative code has only a trial or experimental status and is not intended to be enforced by weights and measures officials. The requirements are designed for study prior to the development and adoption of a final Code for Automatic Weighing Systems. The tentative code is intended to be used by the National Type Evaluation Program for type evaluation of automatic weighing systems. If upgraded to become a permanent code, all requirements, except those for tolerances, will be nonretroactive 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) (Amended 1998)**~~

The status of Section 2.24. Automatic Weighing Systems was changed from tentative to permanent in July 2004 and will go into effect on January 1, 2005.

NTEP has been evaluating devices under the provisions of this code since it was added to Handbook 44 in 1995. In addition, a number of weights and measures jurisdictions as well as organizations such as USDA have implemented this code using the provisions of General Code Paragraph G-A.3. - Special and Unclassified Equipment. It is recommended that the jurisdictions who have not implemented this code, work with industry to expedite implementation its use.

A. Application

A.1. - This code applies to devices used to **automatically** weigh **pre-assembled discrete loads or single loads of loose materials in applications where automatic weighing systems[1] are used or employed in the determination of quantities, things, produce, or articles for distribution, purchase, offered or submitted for sale, for distribution, purchase, offered or submitted for sale, or in computing any basic charge or payment for services rendered on the basis of weight, and in packaging plants subject to regulation by the United States Department of Agriculture (USDA).** ~~**or fill packages while the object is in motion**~~ Some weigh-labelers **and check-weighers** may also include a scale that is incorporated in a conveyor system that weighs packages in a static **or non-automatic** weighing mode[2].

This includes:

(a) **Automatic** ~~**W**~~**w**eigh-labelers~~**, static and dynamic**~~

(b) Combination automatic and non-automatic weigh-lablers

(c) Automatic checkweighers
~~**(Amended 1997)**~~

(d) Combination automatic and non-automatic checkweighers

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1 An automatic weighing system does not require the intervention of an operator during the weighing process. The necessity to give instructions to start a process or to release a load, or the function of the instrument (static, dynamic, set-up, etc.) are not relevant in deciding the category of automatic or non-automatic instruments.

2 Prepackaging scales (and other commercial devices) used for putting up packages in advance of sale are acceptable for use in commerce if all appropriate provisions of Handbook 44 are met. Users of such devices must be alert to the legal requirements relating to the declaration of quantity on a package. Such requirements are to the effect that, on the average, the contents of the individual packages of a particular commodity comprising a lot, shipment, or delivery must contain at least the quantity declared on the label. The fact that a scale or other commercial device may overregister, but within established tolerances, and is approved for commercial service is not a legal justification for packages to contain, on the average, less than the labeled quantity.

(e) **Automatic gravimetric filling machines that weigh discrete loads or single loads of lose materials and determine package and production lot compliance with net weight representations.**

(Amended 1997 **and 2004)**

A.2. - This code does not apply to:

(a) Belt-Conveyor Scale Systems

(b) Railway Track Scales

(c) Monorail Scales

(d) Automatic Bulk-Weighing Systems

(e) Devices that measure quantity on a time basis

(f) Controllers or other auxiliary devices except as they may affect the weighing performance

(g) Automatic gravimetric filling machines and other automatic weighing systems employed in the determining the weight of a commodity in a plant or business with a quantity control program (e.g., a system of statistical process control) using suitable weighing instruments and measurement standards traceable to national standards to determine production lot compliance with net weight representations3. (Added 2004)

A.3. - Also see General Code requirements.

~~**A.4. Type Evaluation. The National Type Evaluation Program will accept for type evaluation only those devices that comply with all requirements of this code.**~~
~~**(Added 1998)**~~

S. Specifications

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

S.1.1. Zero Indication.

(a) A weigh-labeler shall be equipped with an indicating or recording element. ~~**It**~~ **Additionally, a weigh-labeler equipped with an indicating or recording element** shall either indicate or record a zero-balance condition and an out-of-balance condition on both sides of zero.
(Amended 2004)

(b) An automatic checkweigher may be equipped with an indicating or recording element.

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

S.1.1.1. Digital Indicating Elements.

(a) A digital zero indication shall represent a balance condition that is within ± ½ scale division.

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3 **See NIST Handbook 130, Uniform Laws and Regulations In the Area of Legal Metrology and Engine Fuel Quality, Interpretations and Guidelines paragraph 2.6.11. Good Quantity Control Practices.**

(b) A digital indicating device shall either automatically maintain a "center of zero" condition to ± ¼ scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± ¼ scale division or less.

(c) Verification of the accuracy of the center of zero indication to ± ¼ scale division or less during ~~dynamic~~ **automatic** operation is not required on automatic checkweighers.
(Amended 2004)

S.1.2. Value of Division Units. - The value of a division "d" expressed in a unit of weight shall be equal to:

(a) 1, 2, or 5; or

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

S.1.2.1. Weight Units. – Except for postal scales, indicating and recording elements for shipping and postal applications, and scales used to print standard pack labels, ~~A~~ a device shall indicate weight values using only a single unit of measure.
(Amended 2004)

S.1.3. Provision for Sealing.

(a) **Automatic Weighing Systems, Except Automatic Checkweighers.** - A device shall be designed with provision(s) as specified in Table S.1.3., "Categories of Device and Methods of Sealing," for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.

(b) **For Automatic Checkweighers.** - Security seals are not required in ~~field~~ applications where it would prohibit an authorized user from having access to the calibration functions of a device.

Table S.1.3.
Categories of Device and Methods of Sealing

Categories of Device	Method of Sealing
Category 1: No Remote configuration capability.	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. The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.	The 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.)

S.1.4. Automatic Calibration. - A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

S.1.5. Adjustable Components. - Adjustable components shall be held securely in adjustment and, except for a zero-load balance mechanism, shall be located within the housing of the element.

S.2. Design of Zero and Tare Mechanisms.

S.2.1. Zero Load Adjustment.

S.2.1.1. Automatic Zero-Setting Mechanism (Zero-tracking). - Except for automatic checkweighers, under normal operating conditions the maximum load that can be "rezeroed," when either placed on or removed from the platform all at once, shall be 1.0 scale division.
(Amended 2004)

S.2.1.2. Initial Zero-Setting Mechanism. - Except for automatic checkweighers, an initial zero-setting mechanism shall not zero a load in excess of 20 % of the maximum capacity of the automatic weighing system unless tests show that the scale meets all applicable tolerances for any amount of initial load compensated by this device within the specified range.

S.2.2. Tare. - On any automatic weighing system the value of the tare division shall be equal to the value of the division. The tare mechanism shall operate only in a backward direction (i.e., in a direction of underregistration) with respect to the zero-load balance condition of the automatic weighing system. A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing of tare until a complete transaction has been indicated.

Note: On a computing automatic weighing system, this requires the input of a unit price, the display of the unit price, and a computed positive total price at a readable equilibrium. Other devices require a ~~**complete . weighing operation, including tare, net, and gross weight determination**~~ **transaction or lot run ~~has been~~ be completed (Amended 2004)**

S.3.1. Multiple Range and Multi-Interval Automatic Weighing System. The value of "e" shall be equal to the value of "d."

S.3.2. Load Cell Verification Interval Value. - The relationship of the value for the load cell verification scale interval, v_{min}, to the scale division "d" for a specific scale installation shall be:

$$v_{min} \leq \frac{d}{\sqrt{N}}$$, where N is the number of load cells in the scale.

Note: When the value of the scale division "d" differs from the verification scale division "e" for the scale, the value of "e" must be used in the formula above.

S.3.3. - For automatic checkweighers, the value of "e" shall be specified by the manufacturer and may be larger than "d," but in no case can "e" be more than 10 times the value of "d."

S.4. Weight Indicators, Weight Displays, Reports, and Labels.

~~**S.4.1. Weight Units. - An indicating or recording element shall indicate weight values using only a single unit of measure.**~~

S.4.1~~2~~. Additional Digits in Displays. - Auxiliary digital displays that provide additional digits for use during performance evaluation may be included on automatic checkweighers. However, in cases where these indications are not valid for determining the actual weight of a package (e.g., only appropriate for use in statistical process control programs by users) they shall be clearly and distinctly differentiated from valid weight displays by indicating them to the user.

For example, the additional digits may be differentiated by color, partially covered by placing crosshatch overlays on the display, or made visible only after the operator presses a button or turns a key to set the device in a mode which enables the additional digits.

S.4.23. Damping. - An indicating element equipped with other than automatic recording elements shall be equipped with effective means to permit the recording of weight values only when the indication is stable within plus or minus one scale division. The values recorded shall be within applicable tolerances.

S.4.34. Over Capacity Indication. - An indicating or recording element shall not display nor record any values when the scale capacity is exceeded by nine scale divisions.

S.4.45. Label Printer. - A device that produces a printed ticket to be used as the label for a package shall print all values digitally and of such size, style of type, and color as to be clear and conspicuous on the label.

S.4.45.1. Label Printing. - If an automatic checkweigher prints a label containing weight information that will be used in a commercial transaction, it must conform to all of the requirements specified for weigh-labelers so that the printed ticket meets appropriate requirements.

S.5. Accuracy Class.

S.5.1. Marking. - Weigh-labelers and automatic checkweighers shall be Class III devices and shall be marked accordingly, except that a weigh-labeler marked Class IIIS may be used in package shipping applications. (Amended 1997)

S.6. Parameters for Accuracy Classes. - The number of divisions for device capacity is designated by the manufacturer and shall comply with parameters shown in Table S.6.

Table S.6.
Parameters for Accuracy Classes

		Number of divisions (n)	
Class	**Value of the verification division (~~d or~~ e)**	**Minimum**	**Maximum**
SI Units			
III	0.1 to 2g inclusive	100	10 000
	equal to or greater than 5g	500	10 000
INCH-POUND Units			
III	0.0002 lb to 0.005 lb, inclusive	100	10 000
	0.005 oz to 0.125 oz, inclusive	100	10 000
	equal to or greater than 0.01 lb	500	10 000
	equal to or greater than 0.25 oz	500	10 000
IIIS	greater than 0.01 lb	100	1000
	greater than 0.25 oz	100	1000
For Class III devices, the value of "e" is specified by the manufacturer as marked on the device; "d" shall not be smaller than 0.1 "e." "e" shall be differentiated from "d" by size, shape, or color. **(Amended 2004)**			

S.7. Marking Requirements. [See also G-S.1., G-S.4., G-S.6., G-S.7., G-U.2.1.1., and UR.3.3.]

S.7.1. Location of Marking Information. - Automatic weighing systems which are not permanently attached to an indicating element, and for which the load-receiving element is the only part of the weighing/load-receiving element visible after installation, may have the marking information required in G-S.1. of the General Code and Table S.7.a. and S.7.b. of the Automatic Weighing Systems Code located in an area that is accessible only through the use of a tool; provided that the information is easily accessible (e.g., the information may appear on the junction box under an access plate). The identification information for these automatic weighing systems shall be located on the

(ii) stable while in motion, hence the length and width of a puck or package should be greater than its height.

(b) For type evaluation the manufacturer shall supply the test pucks or packages for each range of test loads. (Amended 1997)

N.1.2. Accuracy of Test Pucks or Packages. - The error in any test puck or package shall not exceed one-fourth (1/4) of the acceptance tolerance. If packages are used to conduct field tests on automatic weighing systems, the package weights shall be determined on a reference scale or balance with an inaccuracy that does not exceed one-fifth (1/5) of the smallest tolerance that can be applied to the device under test.

N.1.3. Verification (Testing) Standards. - Field standard weights shall comply with requirements of NIST Handbook 105-1 (Class F) or the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied).

N.1.4. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility, Field Evaluation. - An RFI test shall be conducted at a given installation when the presence of RFI has been verified and characterized if those conditions are considered "usual and customary."
(Added 2004)

~~**N.2. Test Requirements for Automatic Weighing Systems.**~~

N. ~~2.1~~1.5. Tests Loads. - A performance test shall consist of four separate test runs conducted at different test loads according to Table N. ~~3.2~~1.5.

Table N. ~~3.2~~1.5. Test Loads
At or near minimum capacity
At or near maximum capacity
At two (2) critical points between minimum and maximum capacity
Test may be conducted at other loads if the device is intended for use at other specific capacities

N. ~~2.2~~1.6. Influence Factor Testing. - Influence factor testing shall be conducted statically.

N. ~~3~~2. Test Procedures - Weigh-Labelers. - If the device is designed for use in ~~**static**~~ **a non-automatic** weighing **mode**, it shall be tested ~~**statically using mass standards**~~ **in the non-automatic mode according to Handbook 44 Section 2.20 Scales Code**.

Note: If the device is designed for only ~~**dynamic**~~ **automatic** weighing, it shall only be tested ~~**dynamically**~~ **automatically**.
(Amended 2004)

N.2~~3~~.1. ~~Laboratory Static~~ Non-automatic Tests.

N.1.12~~3~~. Increasing-Load Test. - The increasing-load test shall be conducted with the test loads approximately centered on the load-receiving element of the scale.

N. 1.22~~3~~.. Decreasing-Load Test. - The decreasing-load test shall be conducted with the test loads approximately centered on the load-receiving element of the scale.

N. 1.32~~3~~. Shift Test. - To determine the effect of off-center loading, a test load equal to one-half (½) maximum capacity shall be placed in the center of each of the four points equidistant between the center and front, left, back, and right edges of the load receiver.

N. 1.42~~3~~.. Discrimination Test. - A discrimination test shall be conducted with the weighing device in equilibrium at zero load and at maximum test load, and under controlled conditions in which environmental

factors are reduced to the extent that they will not affect the results obtained. This test is conducted from just below the lower edge of the zone of uncertainty for increasing load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests.

N. 1.52~~3~~.. Zero-Load Balance Change. - A zero-load balance change test shall be conducted on all automatic weighing systems after the removal of any test load. The zero-load balance should not change by more than the minimum tolerance applicable. (Also see G-UR.4.2.)

~~**N.3.1.6. Influence Factor Testing. - Influence factor testing shall be conducted.**~~
(Amended 2004)

~~**N.3.2. Laboratory – Dynamic Tests. The device shall be tested at the highest speed for each weight range using standardized test pucks or packages. Test runs shall be conducted using four test loads as described in Table N.3.2. Each test load shall be run a minimum of 10 consecutive times.**~~

~~**N.3.2.1. Shift Test. To determine the effect of eccentric loading, for devices without a means to align packages, a test load equal to one third (1/3) maximum capacity shall be passed over the load receiver or transport belt (1) halfway between the center and front edge, and (2) halfway between the center and back edge.**~~

N. ~~3.3~~2.2.~~.~~ ~~Field~~ Automatic Test Procedures.

N. ~~3.3~~. 2.2.1. Tests Non-automatic ~~Static~~. - If the automatic weighing system is designed to operate **non-automatically~~statically~~**, and used in that manner, during normal use operation, it shall be tested **non-automatically~~statically~~** using mass standards. The device shall not be tested ~~**statically**~~ **non-automatically** if it is used only ~~**dynamically**~~**in the automatic mode.**

N. ~~3.3~~2.2..2. ~~Dynamic~~Automatic Tests. - The device shall be tested at the normal operating speed using packages. Test runs should be conducted using at least two test loads distributed over its normal weighing range (e.g., ~~**at**~~ **near** the lowest and highest ranges in which the device is typically operated.) Each test load should be run a minimum of 10 consecutive times.
(Amended 2004)

N.3. Test Procedures - Automatic Checkweigher.

N. 34.1. ~~Laboratory – Static –~~Tests Non-Automatic. - If the scale is designed to operate **non-~~statically~~ automatically** during normal user operation, it shall be tested ~~**statically – non-automatically**~~ **according to paragraphs N.2.1.1. Increasing Load Tests through N.2.1.5. Zero-Balance Change** ~~**using the applicable weigh-labeler requirements.**~~
(Amended 2004)

N. 34.2. ~~Laboratory – Dynamic~~ Automatic Tests. - The device shall be tested at the highest speed in each weight range using standardized test pucks or packages. Test runs shall be conducted using **two~~four~~** test loads. The number of consecutive test weighments shall **one-half (1/2) of those specified ~~be as described~~** in Table N.3.4.2. **but not less than 10.**
(Amended 2004)

Table N.3.4.2. Number of Sample Weights per Test for Automatic Checkweighers	
Weighing Range m = mass of test load	**Number of sample weights per test**
20 divisions ≤ m ≤ 10 kg 20 divisions ≤ m ≤ 22 lb	60
10 kg <m ≤ 25 kg 22 lb <m ≤ 55 lb	32
25 kg <m ≤ 100 kg 55 lb <m ≤ 220 lb	20
100 kg (220 lb) < m	10

~~**N.4.3. Field Test Procedures.**~~

~~**N.4.3.1. Static Tests. If the scale is designed to operate statically during normal user operation, it shall be tested statically according to Sections N.3.1.1. through N.3.1.5.**~~

~~**N.4.3.2. Dynamic Tests. - The device shall be tested dynamically at the highest normal operating speed using packages at two test loads distributed over its normal weighing range. The number of consecutive weighments shall be one half (½) of those specified in Table N.4.2., but not less than 10.**~~

T. Tolerances

T.1. Principles.

T.1.1. Design. - The tolerance for a weighing device is a performance requirement independent of the design principle used.

T.1.2. Scale Division. - The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e. The random tolerance for automatic checkweighers is expressed in terms of Maximum Allowable Variance (MAV).

T.2. Tolerance Application.

T.2.1. General. - The tolerance values are positive (+) and negative (-) with the weighing device adjusted to zero at no load. When tare is in use, the tolerance values are applied from the tare zero reference; the tolerance values apply to certified test loads only.

T.2.2. Type Evaluation Examinations. - For type evaluation examinations, the tolerance values apply to increasing and decreasing load tests within the temperature, **and** power supply, ~~**and barometric pressure limits**~~ specified in T.7. **Influence Factors.**
(Amended 2004)

T.2.3. Multiple Range and Multi-Interval Automatic Weighing System. - For multiple range and multi-interval devices, the tolerance values are based on the value of the scale division of the range in use.

T.3. Tolerance Values.

T.3.1. Tolerance Values - Class III Weigh-Labeler. (See Section T.3.2. Class IIIS Weigh-Labelers)

T.3.1.1. ~~Static~~ Non-automatic Tests. - Tolerance values shall be as specified in Table T.3. Class III - Tolerances in Divisions.
(Amended 2004)

T.3.1.2. ~~Dynamic~~Automatic Tests. - Acceptance tolerance values shall be the same as maintenance tolerance values specified in Table T.3., Class III - Tolerances in Divisions.
(Amended 2004)

Table T.3. Class III - Tolerance in Divisions (~~d~~e)		
Test Load in Divisions	**Tolerance in Divisions**	
Class III	**Acceptance**	**Maintenance**
0 - 500	± 0.5	± 1
501 - 2000	± 1	± 2
2001 - 4000	± 1.5	± 3
4001 +	± 2.5	± 5

T.3.2. Tolerance Values - Class IIIS Weigh-labelers in Package Shipping Applications.
(Added 1997)

T.3.2.1. ~~Static~~ Non-automatic Tests. - Tolerance values shall be as specified in Table T.3.2.1. ~~**Static**~~ **Non-automatic** Tolerances for Class IIIS Weigh-labelers.
(Amended 2004)

T.3.2.2. ~~Dynamic~~Automatic Tests. - Tolerance values specified in Table T.3.2.2. Dynamic Tolerances for Class IIIS Weigh-labelers shall be applied.
(Amended 2004)

Table T.3.2.1. ~~Static~~ Non-automatic Tolerance for Class IIIS Weigh-labelers		
Test Load in Divisions	**Tolerance in Divisions**	
Class IIIS	**Acceptance**	**Maintenance**
0 - 50	± 0.5	± 1
51 - 200	± 1	± 2
201 - 1000	± 1.5	± 3

(Added 1997) **(Amended 2004)**

Table T.3.2.2. ~~Dynamic~~Automatic Tolerance for Class IIIS Weigh-labelers		
Test Load in Divisions	**Tolerance in Divisions**	
Class IIIS	**Acceptance**	**Maintenance**
0 - 50	± 1.5	± 2
51 - 20	± 2	± 3
201 - 1000	± 2.5	± 4

(Added 1997) **(Amended 2004)**

T.3.3. Tolerance Values. - Automatic Checkweighers.

T.3.3.1. Laboratory Tests for Automatic Checkweighers.

T.3.3.1.1. ~~Static~~Non-automatic Tests. - The acceptance tolerance values specified in Table T.3., Class III-Tolerances in Divisions, shall be applied.
(Amended 2004)

T.3.3.1.2. ~~Dynamic~~Automatic Tests.

(a) The systematic error for each test run must be within the acceptance tolerances for the test load as specified in Table N. **~~3.2.~~ 1.5.**

(b) The standard deviation of the results shall not exceed one-ninth (1/9) of the Maximum Allowable Variation (MAV) for specific package weights (3 standard deviations cannot exceed one-third (1/3) of the MAV value) as required in the **~~4th~~latest** Edition of NIST Handbook 133. This value does not change regardless of whether acceptance, or maintenance tolerances are being applied to the device under test.
(Amended 2004)

(i) For U.S. Department of Agriculture (USDA) inspected meat and poultry products packaged at a plant subject to inspection by the USDA Food Safety and Inspection Service, use Handbook 133 Table 2-9, U.S. Department of Agriculture, Meat and Poultry, Groups and Lower Limits for Individual Packages, or

(ii) for all other packages with a labeled net quantity in terms of weight use Handbook 133 Table 2-5, Maximum Allowable Variations for Packages Labeled by Weight.

(iii) For all packages with a labeled net quantity in terms of liquid or dry volume use Handbook 133 Table 2-6, Maximum Allowable Variations for Packages Labeled by Liquid or Dry Volume.

(Amended 2004)

T.3.3.2. Field Tests for Automatic Checkweighers.

T.3.3.2.1. ~~Static~~Non-automatic Test Tolerances. - The tolerance values shall be as specified in Table T.3., Class III-Tolerances in Divisions.

T.3.3.2.2. ~~Dynamic~~Automatic Test Tolerances. -

(a) The systematic error requirement is not applied in a field test.

(b) The standard deviation of the test results shall not exceed one-ninth (1/9) of the Maximum Allowable Variation (MAV) for specific package weights (3 standard deviations cannot exceed one-third (1/3) of the MAV value) as required in the **~~4th~~ latest** Edition of NIST Handbook 133.

This value does not change regardless of whether acceptance or maintenance tolerances are being applied to the device under test.
(Amended 2004)

(i) For U.S. Department of Agriculture (USDA) inspected meat and poultry products packaged at a plant subject to inspection by the USDA Food Safety and Inspection Service, use Handbook 133 Table 2-9, U.S. Department of Agriculture, Meat and Poultry, Groups and Lower Limits for Individual Packages, or

(ii) For all other packages with a labeled net quantity in terms of weight use Handbook 133 Table 2-5, Maximum Allowable Variations for Packages Labeled by Weight.

(iii) For all packages with a labeled net quantity in terms of liquid or dry volume use Handbook 133 Table 2-6. Maximum Allowable Variations for Packages Labeled by Liquid or Dry Volume.

T.4. Agreement of Indications. - In the case of a weighing system equipped with more than one indicating element or indicating element and recording element combination, the difference in the weight value indications of any load shall not be greater than the absolute value of the applicable tolerance for that load, and shall be within tolerance limits.

T.5. Repeatability. - The results obtained from several weighings of the same load under reasonably **~~static~~ constant** test conditions shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.
(Amended 2004)

T.6. Discrimination. - A test load equivalent to 1.4 d shall cause a change in the indicated or recorded value of at least 2.0 d. This requires the zone of uncertainty to be not greater than 0.3 d (See N. **~~3~~2**.1.4.)

T.7. Influence Factors. - The following factors are applicable to tests conducted under controlled conditions only.

T.7.1. Temperature. - Devices shall satisfy the tolerance requirements under the following temperature conditions:

T.7.1.1. - If not specified in the operating instructions or if not marked on the device, the temperature limits shall be: -10 °C to 40 °C (14 °F to 104 °F).

T.7.1.2. - If temperature limits are specified for the device, the range shall be at least 30 °C (54 °F).

T.7.1.3. Temperature Effect on Zero-Load Balance. - The zero-load indication shall not vary by more than one division per 5 °C (9 °F) change in temperature.

T.7.1.4. Operating Temperature. - The indicating or recording element shall not display nor record any usable values until the operating temperature necessary for accurate weighing and a stable zero balance condition have been attained.

~~**T.7.2. Barometric Pressure. - The zero indication shall not vary by more than one division for a change in barometric pressure of 1 kPa over the total barometric pressure range of 95 kPa to 105 kPa (28 in to 31 in of Hg).**~~

T.7.~~3~~2. Electric Power Supply.

~~**T.7.2~~3.1. Power Supply, Voltage and Frequency.**~~

(a) ~~**Alternating Current.**~~ **Automatic weighing systems that operate using alternating current must perform within the conditions defined in paragraphs T3. through T.N.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.**~~**Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.3. through T.7., inclusive, over the line voltage range of 100 V to 130 V or 200 V to 250 V rms as appropriate, and over the frequency range of 59.5 Hz to 60.5 Hz.**~~

(b) **Automatic weighing systems that operate using DC current must perform within the conditions defined in paragraphs T3. through T.N.6., inclusive, from minimum operating voltage to + 20 % of the voltage marked on the instrument (nominal voltage).**

(c) **Battery-operated electronic automatic weighing systems with external or plug-in power supply (AC or DC) shall either continue to function correctly or not indicate any weight values if the voltage is below the manufacturer's specified value, the latter being larger or equal to the minimum operating voltage.**

Note: The minimum operating voltage is defined as the lowest possible operating voltage before the automatic weighing no longer does not indicate nor records weigh values.

Note: This requirement applies only to metrologically significant voltage supplies.
(Amended 2001)

~~**Battery. - Battery operated instruments shall not indicate nor record values outside the applicable tolerance limits when battery power output is excessive or deficient.**~~
(Amended 2004)

T.7.3.2. Power Interruption. - A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.

T.8. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. - The difference between the weight indication with the disturbance and the weight indication without the disturbance **(see also N.1.4.)** shall not exceed one scale division (d) or the equipment shall:
(Amended 2004)

(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 capacity, number of scale divisions, value of the scale division or verification scale division, minimum capacity, and computing capability.

UR.1.1. General. - Automatic Weighing Systems shall be designated by the manufacturer for that service.

UR.1.2. Value of the Indicated and Recorded Scale Division. - The value of the division as recorded shall be the same as the division value indicated.

UR.2. Installation Requirements.

UR.2.1. Protection From Environmental Factors. - The indicating elements, the lever system or load cells, and the load-receiving element of a permanently installed scale, and the indicating elements of a scale not intended to be permanently installed, 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.2.2. Foundation, Supports, and Clearance. - The foundation and supports of any scale 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 load-receiving element is empty, nor throughout the weighing range of the scale.

UR.2.3. Entry and Departure From Weighing Area. - The belt or other conveyance that introduces the weighed load to the weighing zone and that carries the weighed load away from the weighing zone shall be maintained per the manufacturers recommendations.

UR.3. Use Requirements.

UR.3.1. Minimum Load. - The minimum load shall be as specified by the manufacturer, but not less than 20 divisions since the use of a device to weigh light loads is likely to result in relatively large errors.

UR.3.1.1. Minimum Load for Class IIIS Weigh-labelers. - The minimum load shall be as specified by the manufacturer, but not less than 10 divisions since the use of a device to weigh light loads is likely to result in relatively large errors.
(Added 1997)

UR.3.2. Maximum Load. - An automatic weighing system shall not be used to weigh a load of more than ~~**the**~~**its** maximum capacity ~~**of the automatic weighing system**~~**.**
(Amended 2004)

UR.3.3. Special Designs. - An automatic weighing system designed and marked for a special application shall not be used for other than its intended purpose.

UR.3.4. Use of Manual Gross Weight Entries. - Manual entries are permitted only when a device or system is generating labels for standard weight packages.

UR.4. Maintenance Requirements.

UR.4.1. Balance Condition. - If an automatic weighing system is equipped with a zero-load display, the zero-load adjustment of an automatic weighing system shall be maintained so that the device indicates or records a zero-balance condition.

UR.4.2. Level Condition. - If an automatic weighing system is equipped with a level-condition indicator, the automatic weighing system shall be maintained in level.

UR.4.3. Automatic Weighing System Modification. - The length or the width of the load-receiving element of an automatic weighing system shall not be increased beyond the manufacturer's design dimension, nor shall the capacity of an automatic weighing system be increased beyond its design capacity by replacing or modifying the original primary indicating or recording element with one of a higher capacity, except when the modification has been approved by competent engineering authority, preferably that of the engineering department of the manufacturer of the automatic weighing system, and by the weights and measures authority having jurisdiction over the automatic weighing system.

D. Definitions

automatic gravimetric filling machine (instrument). - A filling machine or instrument that fills containers or packages with predetermined and virtually constant mass of product from bulk by automatic weighing, and which comprises essentially an automatic feeding device or devices associates with one or more weighing units and the appropriate discharge devices.
(Added 2004)

automatic checkweigher. - A**n** ~~**dynamic**~~ automatic weighing system **that does not require the intervention of an operator during the weighing process** used to subdivide items of different weights into one or more subgroups, such as identifying packages that have acceptable or unacceptable fill levels **according to the value of the difference between their weight and a pre-determined set point.** These systems may be used to fill standard packages for compliance with net weight requirements.
(Amended 2004)

automatic weighing system (AWS). - An automatic weighing system is a weighing device that, in combination with other hardware and/or software components, automatically weighs discrete items **and that does not require the intervention of an operator during the weighing process.** Examples include, but are not limited to, weigh-labelers and checkweighers.
(Amended 2004)

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

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

Deciding that the weighing result is an acceptable means making a decision regarding the acceptance of each weighing result on observing the indication or releasing a print out. The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable.
(Added 2004)

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

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

Deciding that the weighing result is an acceptable means making a decision regarding the acceptance of each weighing result on observing the indication or releasing a print out. The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable.
(Added 2004)

package rate. - PPM - Packages per minute.

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

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

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

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

$$\overline{X} = \frac{\sum x}{n}$$ where: x = error of a load indication
n = the number of loads

test puck. – A metal**, ~~or~~** plastic**, or other suitable** object **that remains stable for the duration of the test, ~~object~~** used **as a test load** to simulate a package. Pucks can be made in a variety of dimensions and have different weights to represent a wide range of package sizes. Metal versions may be covered with rubber cushions to eliminate the possibility of damage to weighing and handling equipment. The puck mass is adjusted to **~~specific~~ an** accuracy **specified in N.1.2.Accuracy of Test Pucks or Packages ~~so that pucks can be used to conduct performance tests~~**.
(Amended 2004)

weigh-labeler. - An automatic weighing system that determines the weight of a package and prints a label or other document bearing a weight declaration for each discrete item (usually a label also includes unit and total price declarations). **~~Typically, this type of weighing system determines the weight of packages dynamically, but may also include a scale that is incorporated in a conveyor system that weighs packages in a static weighing mode.~~** Weigh-labelers are sometimes used to weigh and label standard and random packages (also called "Prepackaging Scales").
(Amended 2004)

S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing. - A change to the adjustment of any measuring element shall be individually identified.
[Nonretroactive as of January 1, 2005]

Note: Examples of acceptable identification of a change to the adjustment of a measuring element include but are not limited to:

1. **A broken, missing, or replaced physical seal on an individual measuring element.**
2. **A change in a calibration factor for each measuring element.**
3. **Display of the date of or the number of days since the last calibration event for each measuring element.**
4. **A counter indicating the number of calibration events per measuring element.**

Background/Discussion: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories indicated that field officials in their jurisdiction are having difficulty with multi-product dispensers that have only one sealing mechanism for two or more measuring elements. If a field official rejects a meter for not meeting performance requirements, they have no way of determining which measuring elements have been recalibrated when they return to reinspect the dispenser after a service agency has made adjustments or repairs on the rejected device. During the performance of a subsequent inspection following adjustment or repair of the device, the field official may be required to test all grades and blends offered through the dispenser to determine that only the rejected measuring element was adjusted.

At its October 2002 meeting, the NTETC Measuring Sector developed a proposal to add a new paragraph S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing, to address this concern and forwarded the proposal through the Southern Weights and Measures Association (SWMA) to the NCWM S&T Committee for consideration.

At its October 2002 Annual Meeting, the SWMA recommended that the NTETC Measuring Sector proposal be forwarded to the NCWM S&T Committee as an information item.

At the 2003 NCWM Interim Meeting, the NCWM S&T Committee heard support for identifying, in a manner that is readily available to the field official, any measuring element that is adjusted and agreed that the proposal has merit. Liquid measuring device manufacturers at the meeting stated that identifying any measuring element that is adjusted is possible on dispensers that have only one sealing mechanism for two or more measuring elements. The manufacturers requested time to develop an appropriate mechanism on the device for providing that information. The Committee gave the item informational status to provide device manufacturers the opportunity to study the issue and develop means for meeting the proposed requirements.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed that this issue is an enforcement problem that affects only certain jurisdictions and recommends that the NCWM S&T Committee withdraw this item from its agenda.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments indicating that the National Type Evaluation Technical Committee (NTETC) Measuring Sector would review this item at their October 2003 meeting. The WWMA expressed concern that the integrity of all adjustments protected by the security means is lost when a physical security seal is removed, replaced, broken, or damaged. The WWMA recommended that this item remain informational until the NTETC Measuring Sector addresses the concerns of the WWMA in its recommendation to the NCWM S&T Committee.

At its October 2003 Meeting, the Northern Weights and Measures Association (NEWMA) recommended that this proposal should remain an information item.

At its October 2003 Meeting, the NTETC Measuring Sector modified the proposed language and agreed to forward it to the NCWM S&T Committee for consideration at the 2004 NCWM Interim Meeting.

At its October 2003 Meeting, the SWMA supported the proposal as modified by the 2003 NTETC Measuring Sector and agreed to recommend to the NCWM S&T Committee that it consider the proposal as a voting item for the NCWM July 2004 Annual Meeting.

At the 2004 NCWM Interim Meeting, the S&T Committee received comments from two weights and measures officials indicating that when a field official in their jurisdiction conducts a performance test on a retail motor-fuel dispenser (RMFD) with multiple measuring elements and only a single sealing mechanism for all the measuring elements, extra time and effort is required to perform a reinspection of the dispenser if one or more of the measuring elements fails the initial test and requires adjustment. At the time of the reinspections, the field official has no way of knowing what measuring elements were actually adjusted and must perform at least an audit test on all of the measuring elements to verify that only those elements rejected on the initial inspection have been adjusted. The manufacturer of (RMFDs) that presently utilizes this sealing option informed the S&T Committee that his company has developed a means to indicate, to field officials, what measuring elements have been adjusted between an initial inspection and the reinspection of a rejected dispenser. The Committee agreed to move the item forward, with a nonretroactive date of January 1, 2005, for a vote at the NCWM Annual Meeting in July.

330-2 V S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers

Source: NIST Weights and Measures Division

Recommendation: Modify NIST Handbook 44, Section 3.30. Liquid-Measuring Devices S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers (RMFD) as follows:

> ***S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers. -*** *The required marking information in the General Code, Paragraph G-S.1. shall appear as follows:*
>
> *(a) Placement of this information shall not be on a portion of the device that can be readily removed or interchanged without the use of a tool separate from the device.*
> *(b) The information shall appear 24 to 60 inches from the base of the dispenser* ~~***when placed on the outside of the device.***~~
>
> ***(c)*** ~~***When placed behind an access door or panel the information shall appear 24 inches to 60 inches from the base of the dispenser in a readily legible position. The use of a dispenser key shall not be considered a tool separate from the device.***~~ ***May be internal and/or external provided the information is permanent and easily read; and***
>
> ***(d) May require a key or tool for access.***
> *[Nonretroactive as of January 1, 2003]*
> (Added 2002) **(Amended 2004)**

Background/Discussion: The current language in paragraph S.4.4.2.(c) as written can be interpreted to allow the placement of G-S.1. Identification markings on a door or panel that is removable. Additionally, existing wording allows placement of marking information behind a panel that can be removed through the use of a key (e.g. lower meter access panels) but does not permit the information to be located behind a panel that can be removed using other means such as a removing a screw or moving a lever. The proposed modifications to paragraph S.4.4.2. clarify the original intent, whereby it is acceptable to place G-S.1. information on permanent components located 24 inches to 60 inches above the base of the dispenser within the dispenser cabinet; however, those components can only be accessed by opening a door or panel that requires the use of a key or other tool separate from the device. Scales Code paragraph S.6.2. Location of Marking Information includes similar language that allows for access of required marking information.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) was notified that this item will be considered at the 2003 meeting of the National Type Evaluation Committee (NTETC) Measuring Sector and heard no other comments on this item. The WWMA believes that there is insufficient justification to allow additional tools separate from the device, other than a dispenser key, to be used to access identification information and recommends that this item remain developmental.

At its October 2003 Meeting, the Northeastern Weights and Measures Association (NEWMA) supported the intent of the proposal, but felt that language still needs work. NEWMA agreed to submit alternate language prior to the 2004 NCWM S&T Committee's Interim Meeting.

opportunity to review and discuss Tennessee's proposal. For clarity, the Committee modified Tennessee's proposal to make the last sentence in the original proposal a separate paragraph (c) as shown in the recommendation above.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heardno comments on this item during the open hearing. The WWMA S&T Committee expressed concerned that the proposal does not include a means for compensating for product in a vapor state that returns to the facilities' storage tank. The WWMA agrees with suggestion number 4 of the SWMA that weights and measures officials should require terminals currently unable to load without vapor-return lines to take corrective action to comply with NIST Handbook 44. The WWMA agreed to recommend that the NCWM S&T Committee withdraw this item from its agenda.

At its October 2003 Meeting, the NEWMA recommended that this proposal should remain an information item.

At its October 2003 Meeting, the SWMA did not include this item on its agenda.

At the 2004 NCWM Interim Meeting, the NIST Weights and Measures Division shared a concern with the Committee that allowing terminals to selectively use or not use a vapor return line during tank filling promotes non-uniformity in deliveries from one facility to another. The Committee believes that all parties involved in the loading of tank-trucks at the wholesale level understand the ramifications of using a vapor return line and are willing to accept transactions that require the use of a vapor return line. The Committee agreed to present Item 332-1 for a vote at the 2004 NCWM Annual Meeting in July.

358 MULTIPLE DIMENSION MEASURING DEVICES

358-1 V S.1.6. Customer Indications and Recorded Representations, Table S.1.6. Required Information to be Provided by Multiple Dimension Measuring Systems, UR.5. Customer Information Provided, and Table UR.5. Customer Information to be Provided

Source: Multiple Dimension Measuring Devices Working Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices, paragraph S.1.6.; delete the current Table S.1.6. and replace it with a new Table S.1.6.; and a add new paragraph UR. 5. and new Table UR.5. as follows:

S.1.6. Customer Indications and Recorded Representations. - Multiple dimension measuring **devices or** systems must provide information as specified in Table S.1.6. **As a minimum, all devices or systems must be able to meet either column I or column II in Table S.1.6.** ~~**(See Table Appendix at the end of this code.)**~~
(Amended 2004)

~~Table S.1.6. Information to be Provided on Multiple Dimension Measuring Systems~~

~~Scenarios Ψ~~ ~~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.1.6. Required Information to be Provided by Multiple Dimension Measuring Systems

Information	Column I*	Column II*		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 [1]	D or P	P	P	P or A
2 Error message (when applicable)	D or P	P	N/A	N/A
3 Hexahedron dimensions[2]	D or P	P	P	P or A
4 Hexahedron volume (if used)[2]	D or P	P	P	P or A
5 Actual weight (if used)[2]	D or P	P	P	P or A
6 Tare (if used)[2]	D or P	N/A	N/A	N/A
7 Hexahedron measurement statement [3]	D or P or M	P	P	P or G

D = DISPLAYED, P = PRINTED or RECORDED IN A MEMORY DEVICE and AVAILABLE UPON REQUEST BY CUSTOMER [4], M = MARKED, G = PUBLISHED GUIDELINES OR CONTRACTS, A = AVAILABLE UPON REQUEST BY CUSTOMER [4], N/A = NOT APPLICABLE

Notes:

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

2 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.

3 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.

4 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.

* As a minimum all devices or systems must be able to meet either column I or column II.

Hexahedron = An object with six rectangular, plane surfaces (sides).

(Amended 2004)

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.
(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

D = DISPLAYED, P = PRINTED, M = MARKED, G = PUBLISHED GUIDELINES OR CONTRACTS
A = AVAILABLE UPON REQUEST BY CUSTOMER [2], N/A = NOT APPLICABLE

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.

Hexahedron = An object with six rectangular, plane surfaces (sides).

(Added 2004)

Background/Discussion: This proposal was developed by the NIST Weights and Measures Division at the request of the MDMD Working Group following its meeting in July 2003. The Work Group approved the proposal and agreed to forward it to the NCWM S&T Committee for consideration. The current Table S.1.6. contains specifications for devices or systems and user requirements. The manufacturer of a device or system is responsible for assuring compliance with Handbook 44 specifications. The owner or operator of a device or system is responsible for assuring that the device or system is used in a manner consistent with user requirements of Handbook 44. Separating the requirements into two separate tables will aid manufacturers, users, and weights and measures officials in determining responsibility for complying with a particular requirement. The Work Group supports the proposal. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At their Fall 2003 Meetings, the Central, Western, and Southern Weights and Measures Associations agreed with the proposal as written. In addition the Western Weights and Measures Association commended the MDMD Working Group for its work on this issue.

At the 2004 NCWM Interim Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-2 V S.1.8. Indications Below Minimum and Above Maximum Table S.4.1.b. Notes for Table S.4.1.a.; Note 7

Source: Multiple Dimension Measuring Devices Working (MDMD) Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices paragraph S.1.8. and Note 7 of Table S.4.1.b. as follows:

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 %~~ **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 display or record any usable values, or

(b) identify the displayed or recorded representation with an error indication.
(Amended 2004)

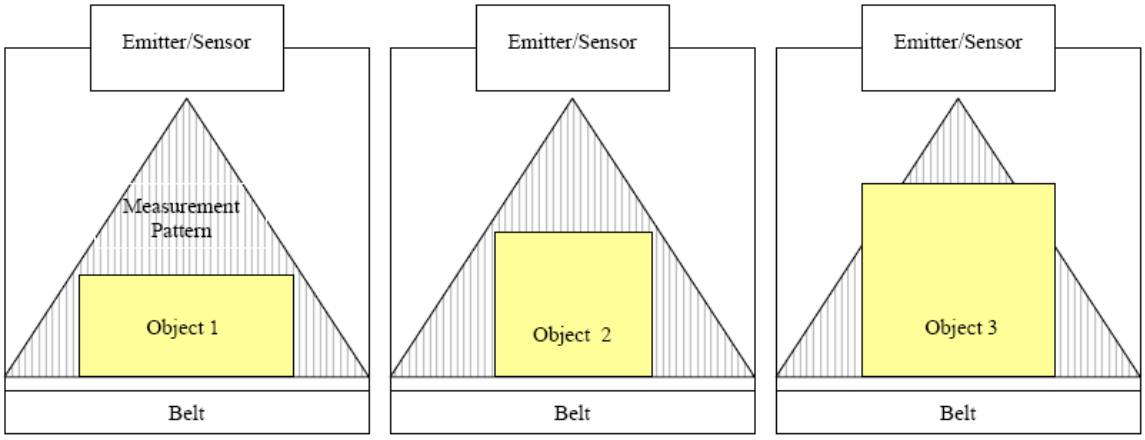
Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems				
	Multiple Dimension Measuring Equipment			
To Be Marked With ↓	Multiple dimension measuring device and indicating element in same housing	Indicating element not permanently attached to multiple dimension measuring element	Multiple dimension measuring element not permanently attached to the indicating element	Other equipment (1)
Manufacturer's ID	x	x	x	x
Model Designation	x	x	x	x
Serial Number and Prefix	x	x	x	x (2)
Certificate of Conformance Number (8)	x	x	x	x (8)
Minimum and Maximum Dimensions for Each 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	

Multiple Dimension Measuring Systems 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 EC to 40 EC (14 EF to 104 EF).
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, **combination of object dimensions,** 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)

Background/Discussion: This proposal was developed by the NIST Weights and Measures Division prior to MDMD Working Group's July 2003 Meeting, to address a request for an agenda item to clarify the requirements in S.1.8 and Note 7 in Table S.4.1.b. Some current device designs utilize a measurement pattern (as shown in example below) that may not allow the device to measure to both the marked maximum height limit and the marked maximum width limit on the same object. The marked maximum height and width are individually correct with respect to the device capability. The minimum and maximum dimension requirements in Handbook 44 do not adequately address this scenario. Handbook 44 states that if an object exceeds the marked measuring limitation for any axis by 105 % it must not display or record a value, or provide an error message. The shape, structure, or orientation of the largest object (object 3) in the example does not exceed the manufacturers marked capacity for height or width individually; however, the system is not capable of providing an accurate measurement for this object because this combination of dimensions is beyond the device's capability. Note 7 in Table S.4.1.b. in Handbook 44, 2004 edition, does not specifically address this situation.

Example:



Correct Measurement **Correct Measurement** **No Measurement**

At its July 2003 Meeting, the MDMD Working Group agreed that the current 105 % limit on overcapacity indication should be changed to the marked maximum plus 9 d for each dimension and/or total volume indicated. This change is consistent with Measurement Canada's requirements and other Handbook 44 Codes that have an overcapacity limit. The Working Group also agreed that the other proposed modifications to paragraph S.1.8. and Note 7 in Table S.4.1.a. are appropriate to recognize new measurement technologies that have been developed since the Tentative Code was adopted. The Work Group agreed to forward the proposals shown above to the S&T Committee for consideration. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At their Fall 2003 Meetings, the Central, Western, and Southern Weights and Measures Associations agreed with the proposal as written. In addition the Western Weights and Measures Association commended the MDMD Working Group for its work on this issue.

At the 2004 NCWM Interim Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-3 V S.3. Systems with Two or More Measuring Elements and Definition of Measurement Field

Source: Multiple Dimension Measuring Devices Working Group

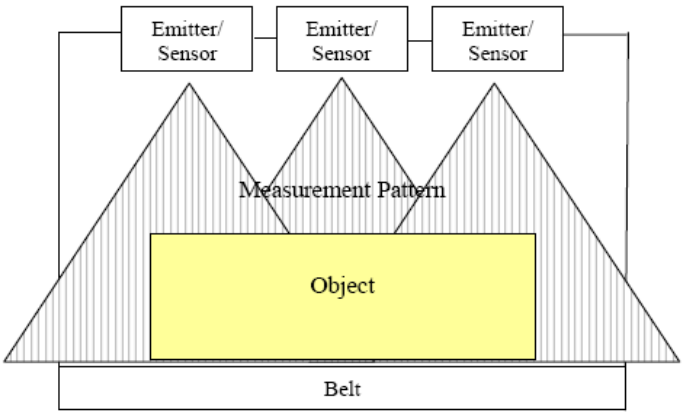
Recommendation: Modify Handbook 44 5.58. Multiple Dimension Measuring Devices, paragraph S.3. as follows, and add a definition for the term "Measurement Field."

S.3. System 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 a 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.

Measurement Field – a region of space or the measurement pattern produced by the measuring instrument in which objects are placed or passed through, either singly or in groups, when being measured by a single device.
(Amended 2004)

Example:



Background/Discussion: This proposal was developed by the NIST Weights and Measures Division prior to MDMD Working Group's July 2003 Meeting, to address a request for an agenda item to clarify the requirements in paragraph S.3. The original intent of this paragraph was to address more than one measuring element in separate locations within a facility that were all coupled to a single indicator. For example, in a shipping hub there may be multiple lines each measuring different objects to increase the shipping capacity of the facility. All the measuring lines may be connected to a single indicator. At least one manufacturer believes that some interpret the term "measuring element" as it applies to a device as shown in the example above. The problem arises if a relatively narrow box is placed on the belt such that only one or two of the measuring elements shown makes measurements. The manufacturer is concerned that some may interpret paragraph S.3. to require the device in the example to identify the measuring element or elements involved in the measurement of a single object. The recommendation is simply to clarify the intent and application of this section. The Work Group supported the proposal as written. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA recommended alternate language for the proposed note to paragraph S.3. to clarify the intent of the proposal and editorially correct the language in the definition of "measurement field."

At its October 2003 Meeting, the Southern Weights and Measures Association (SWMA) supported the proposal as submitted by the MDMD Working Group. The SWMA was not necessarily opposed to the language submitted by WWMA, but did not think it was significantly different.

At the 2004 NCWM Annual Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee received a recommendation from Measurement Canada that the "note" in the original proposal and the WWMA alternate definition for "measurement field" were the most technically correct of the alternate language options proposed. Measurement Canada also recommended that the term "measuring element" in the example drawing be replaced with the term "emitter/sensor." The Committee agreed with Measurement Canada's recommendation and amended the proposal as presented above. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-4 V N.1.4.1. Test Objects and Definition of Test Objects

Source: Multiple Dimension Measuring Devices Working Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices, by adding a new paragraph N.1.4.1. Test Objects and a definition for the term "Test Objects" as follows:

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 meets 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)

Test Object. - An object whose dimensions are verified by appropriate reference standards and intended to verify compliance of the device under test with certain metrological requirements.
(Added 2004)

Background/Discussion: This proposal originated from the July 2003 meeting of the MDMD Working Group. Test standards similar to those developed by Canada for type approval are not currently available in the United States. Without available standards or standards specifications, it is difficult to ensure common test results from field inspections. Some state and local inspectors have conducted tests of multiple dimension measuring devices using packages that were available at the test site. If field officials choose to use on-site packages, great care must be taken in the selection of objects that are in very stable condition and can be compared to a certified length standard with an appropriate degree of uncertainty. Cardboard boxes are particularly subject to damage and deformity. Due to the relative uncertainty of the measurement process, multiple dimension measuring devices with a division size of less than 0.5 inch (1 cm) should only be tested with verified test standards. Uncertainty can be stated as the range of values within which the true value to the "standard" is estimated to lie and defines the limits of error about a measured value between which the true value will lie with the confidence level stated. A coverage factor k = 2 provides a confidence level of 95 %. The Multiple Dimension Measuring Devices Code provides guidance regarding the appropriate size of test objects, but it does not provide any other criteria for what constitutes an appropriate test object. The term "test object" is also not defined in Handbook 44. OIML R 129 Multi-dimensional measuring instruments, provides a definition for a test object and criteria for using test objects to verify the performance of multiple dimension measuring devices. Proposed paragraph N.1.4.1. provides field officials that do not have specifically designed dedicated standards for testing multiple dimension measuring devices with a mechanism for testing these devices, provided care is taken in developing proper reference standards. The mechanism can be compared to the testing of in-motion-monorail scales with carcasses. In both cases, care must be taken to verify that the standards are appropriate at the beginning of a test and remain stable throughout the entire test of the device. The Work Group agreed to submit the proposal as written to the NCWM S&T Committee for consideration at the NCWM Interim Meeting. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA S&T Committee was concerned about an apparent conflict with the language in the first proposed paragraph, stating that the expanded uncertainty of the test object must be known to one-fifth of the applicable device tolerance in field testing, as it relates to language in the second paragraph that states that the test object be verified using standards with an uncertainty less than one-third of the smallest tolerance applied to the device. The WWMA recommends removing the expanded uncertainty language in the first paragraph as shown in the alternate proposal above since the language deleted from the proposal may be more appropriate for standards used for type evaluation tests.

At is October 2003 Meeting, the Southern Weights and Measures Association (SWMA) reviewed and supported the change to N.1.4.1 submitted by the WWMA from it September 2003 Meeting.

After further review of the MDMD Working Group's proposal Measurement Canada submitted alternate language for paragraph N.1.4.1.

At the 2004 NCWM Interim Meeting, the Committee heard support for all Items 358-1 through 7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee agreed with the alternate language proposed by Measurement Canada and modified the proposal as shown above. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-5 V T.3. Tolerance Values

Source: Multiple Dimension Measuring Devices (MDMD) Working Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices, paragraph T.3. Tolerance Values as follows:

> **T.3. Tolerance Values.** - The maintenance and acceptance tolerance values shall be ±1 division. ~~**These tolerances apply regardless of the shape or material of the object being measured unless otherwise marked on the device.**~~
> **(Amended 2004)**

Background/Discussion: This proposal originated from the July 2003 Meeting, of the MDMD Working Group. One member of the group indicated that his company believes that paragraph T.3. should be clarified and that the entire second sentence in the paragraph is unnecessary and could be misleading. The present wording of this section seems to imply that multiple tolerances are permitted on a system if they are marked on the device. Tolerances applicable to devices performing similar or duplicative functions should be equivalent. The Work Group agreed to submit the proposal as written to the NCWM S&T Committee for consideration at the NCWM Interim Meeting. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA supports the proposal as submitted and recommends that the NCWM S&T Committee move the proposal forward as a voting item.

At its October 2003 Meeting, the Southern Weights and Measures Association (SWMA) supported the proposal as written.

At the 2004 NCWM Interim Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-6 V T.5.2. Power Supply Voltage, T.5.2.1. Alternating Current Power Supply, and T.5.2.2. Direct Current Power Supply

Source: Multiple Dimension Measuring Devices (MDMD)Working Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices, paragraph T.5.2. Power Supply Voltage, add new paragraphs T.5.2.1. Alternating Current Power Supply and T.5.2.2. Direct Current Power Supply, as follows and remove paragraph T.7. Electric Power Supply.

T.5.2. Power Supply Voltage. - ~~**Devices shall satisfy the applicable tolerances when subjected to power supply voltage variation of -15 % to +10 % of the voltage rating specified by the manufacturer.**~~

T.5.2.1. Alternating Current Power Supply. - Devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., 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.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)**~~

Background/Discussion: This proposal originated from the July 2003 Meeting, of the MDMD Working Group. The requirements currently in paragraphs T.5.2. and T.7. do not clearly distinguish between alternating current and direct current power supplies. The language is also not consistent with similar requirements in other Handbook 44 Codes, such as paragraph T.N.8.3. Electric Power Supply in the Scales Code or paragraph T.N.7.3. Electric Power Supply in the Automatic Weighing Systems Code. All codes should be consistent and, where possible, should harmonize with international requirements. The Work Group agreed to submit the proposal as written to the NCWM S&T Committee for consideration at the NCWM Interim Meeting. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA supports the proposal as submitted and recommends that the NCWM S&T Committee move the proposal forward as a voting item.

At its October 2003 Meeting, the Southern Weights and Measures Association (SWMA) supported the proposal as written.

At the 2004 NCWM Interim Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-7 V Tentative Status of the Multiple Dimension Measuring Devices Code

Source: Carryover Item 358-1. (This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Change the status of the Multiple Dimension Measuring Devices Code (MDMD) from tentative to permanent.

At its October 2003 Meeting, the SWMA agreed to forward a recommendation to the NCWM S&T Committee that this item be withdrawn from its agenda.

At the 2004 NCWM Interim Meeting, the Meter Manufacturers Association indicated support for this item. A large manufacturer of retail motor-fuel dispensers agreed with the CWMA and SWMA that this item should be withdrawn. The S&T Committee also agreed with the CWMA and SWMA and decided to withdraw Item 330-4 from the S&T Committee Agenda for the 2004 NCWM Annual Meeting in July.

330-5 V Appendix D; Definition of Retail Device

Source: Carryover Item 330-6. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda.)

Recommendation: Modify the definition of retail devices as follows:

retail device. A **measuring** device ~~**used for**~~ **primarily utilized to measure product for the purpose of sale to the end user.**

~~**single deliveries of less than 378 L (100 gal),**~~

~~**retail deliveries of motor fuels to individual highway vehicles, or**~~

~~**single deliveries of liquefied petroleum gas for domestic use and liquefied petroleum gas or liquefied anhydrous ammonia for nonresale use.**~~
(Amended 1987) [**3.30 and** 3.32]

Background/Discussion: During the 2001 NCWM Annual Meeting, the Committee considered several proposals that define retail devices as those that deliver product to the final user. The Committee agreed that these proposals change the classification of some devices, previously classified as wholesale devices, to retail devices that are held to a lesser tolerance.

At the 2002 NCWM Interim Meeting, the Committee agreed that if Items 330-3A Tolerance and Accuracy Classes for Section 3.30, 330-3B Tolerance and Accuracy Classes for Section 3.32. through 3.36. and 3.38., and 331-3 Tolerance and Accuracy Classes for Section 3.31. were adopted at the 2003 Annual Meeting, changes to the definition would be unnecessary and this item could be withdrawn from its agenda.

At the 2002 NCWM Annual Meeting, no comments were received on this item. Items 330-3A and 331-3 were adopted. Item 330-3B was carried over as informational to provide the regional associations the opportunity to identify and discuss any negative impact it would have on the affected codes in NIST Handbook 44.

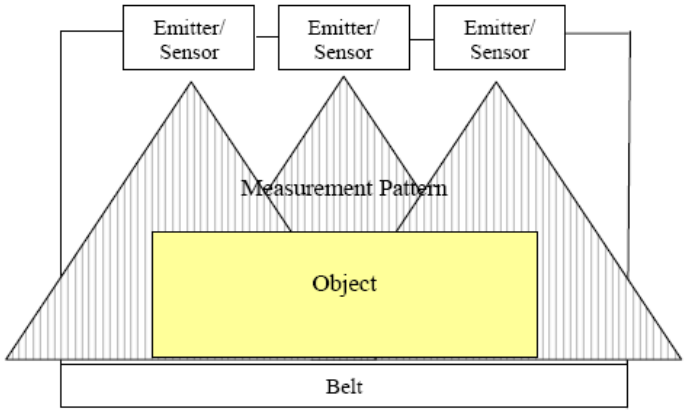
At the Fall 2002 regional meetings, the Central Weights and Measures Association (CWMA) agreed that the word "primarily" is ambiguous and should be removed from the proposal. The WWMA supported the item as proposed in the 2003 Annual Report of the S&T Committee. The Northeastern Weights and Measures Association (NEWMA) agreed that this item is unnecessary if accuracy classes are adopted for Section 3.32. through Section 3.36. and Section 3.38.

At the 2003 NCWM Interim Meeting, the Committee heard that, even with the adoption of the accuracy class tables last year, a definition of "retail device" is still needed because the term retail is referenced in several paragraphs in the Liquid-Measuring Devices code and in other measuring device codes of NIST Handbook 44. The Committee believes that the term "primarily" in the retail device definition is appropriate to provide weights and measures officials some flexibility for determining the applicability of various requirements on a case-by-case basis. The Committee agreed that the item should remain informational to allow further study of all the codes potentially affected by the change.

At the Fall 2003 regional meetings, the CWMA, SWMA, and WWMA all agreed to forward alternate proposed definitions for the term "retail device," as shown in 2004 Interim Meeting S&T Committee Agenda.

Measurement Field – **a region of space or the measurement pattern produced by the measuring instrument in which objects are placed or passed through, either singly or in groups, when being measured by a single device.**
(Amended 2004)

Example:



Background/Discussion: This proposal was developed by the NIST Weights and Measures Division prior to MDMD Working Group's July 2003 Meeting, to address a request for an agenda item to clarify the requirements in paragraph S.3. The original intent of this paragraph was to address more than one measuring element in separate locations within a facility that were all coupled to a single indicator. For example, in a shipping hub there may be multiple lines each measuring different objects to increase the shipping capacity of the facility. All the measuring lines may be connected to a single indicator. At least one manufacturer believes that some interpret the term "measuring element" as it applies to a device as shown in the example above. The problem arises if a relatively narrow box is placed on the belt such that only one or two of the measuring elements shown makes measurements. The manufacturer is concerned that some may interpret paragraph S.3. to require the device in the example to identify the measuring element or elements involved in the measurement of a single object. The recommendation is simply to clarify the intent and application of this section. The Work Group supported the proposal as written. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA recommended alternate language for the proposed note to paragraph S.3. to clarify the intent of the proposal and editorially correct the language in the definition of "measurement field."

At its October 2003 Meeting, the Southern Weights and Measures Association (SWMA) supported the proposal as submitted by the MDMD Working Group. The SWMA was not necessarily opposed to the language submitted by WWMA, but did not think it was significantly different.

At the 2004 NCWM Annual Meeting, the Committee heard support for all Items 358-1 through 358-7 along with the suggestion that the Item 358-1 in the Interim Agenda, recommending that the code section be given permanent status, be moved to the end of the 358 items, as Item 358-7, in order that the status of the code is decided after the other proposed changes to the code have been considered. The Committee received a recommendation from Measurement Canada that the "note" in the original proposal and the WWMA alternate definition for "measurement field" were the most technically correct of the alternate language options proposed. Measurement Canada also recommended that the term "measuring element" in the example drawing be replaced with the term "emitter/sensor." The Committee agreed with Measurement Canada's recommendation and amended the proposal as presented above. The Committee agreed to present the reordered Items 358-1 through 358-7 for a vote at the 2004 NCWM Annual Meeting.

358-4 V N.1.4.1. Test Objects and Definition of Test Objects

Source: Multiple Dimension Measuring Devices Working Group

Recommendation: Modify Handbook 44 Section 5.58. Multiple Dimension Measuring Devices, by adding a new paragraph N.1.4.1. Test Objects and a definition for the term "Test Objects" as follows:

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 meets 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)

Test Object. - An object whose dimensions are verified by appropriate reference standards and intended to verify compliance of the device under test with certain metrological requirements.
(Added 2004)

Background/Discussion: This proposal originated from the July 2003 meeting of the MDMD Working Group. Test standards similar to those developed by Canada for type approval are not currently available in the United States. Without available standards or standards specifications, it is difficult to ensure common test results from field inspections. Some state and local inspectors have conducted tests of multiple dimension measuring devices using packages that were available at the test site. If field officials choose to use on-site packages, great care must be taken in the selection of objects that are in very stable condition and can be compared to a certified length standard with an appropriate degree of uncertainty. Cardboard boxes are particularly subject to damage and deformity. Due to the relative uncertainty of the measurement process, multiple dimension measuring devices with a division size of less than 0.5 inch (1 cm) should only be tested with verified test standards. Uncertainty can be stated as the range of values within which the true value to the "standard" is estimated to lie and defines the limits of error about a measured value between which the true value will lie with the confidence level stated. A coverage factor k = 2 provides a confidence level of 95 %. The Multiple Dimension Measuring Devices Code provides guidance regarding the appropriate size of test objects, but it does not provide any other criteria for what constitutes an appropriate test object. The term "test object" is also not defined in Handbook 44. OIML R 129 Multi-dimensional measuring instruments, provides a definition for a test object and criteria for using test objects to verify the performance of multiple dimension measuring devices. Proposed paragraph N.1.4.1. provides field officials that do not have specifically designed dedicated standards for testing multiple dimension measuring devices with a mechanism for testing these devices, provided care is taken in developing proper reference standards. The mechanism can be compared to the testing of in-motion-monorail scales with carcasses. In both cases, care must be taken to verify that the standards are appropriate at the beginning of a test and remain stable throughout the entire test of the device. The Work Group agreed to submit the proposal as written to the NCWM S&T Committee for consideration at the NCWM Interim Meeting. NCWM adoption of this item will aid in the effort to change the status of the Multiple Dimension Measuring Devices Code from tentative to permanent.

At its September 2003 Meeting, the Central Weights and Measures Association (CWMA) agreed with the proposal as written.

At its September 2003 Meeting, the Western Weights and Measures Association (WWMA) heard comments from a manufacturer supporting the proposal. The WWMA S&T Committee was concerned about an apparent conflict with the language in the first proposed paragraph, stating that the expanded uncertainty of the test object must be known to one-fifth of the applicable device tolerance in field testing, as it relates to language in the second paragraph that states that the test object be verified using standards with an uncertainty less than one-third of the smallest tolerance applied to the device. The WWMA recommends removing the expanded uncertainty language in the first paragraph as shown in the alternate proposal above since the language deleted from the proposal may be more appropriate for standards used for type evaluation tests.