Specifications and Tolerances (S&T) Committee
2024 Interim Meeting Report

Mr. Jason Flint, Committee Chair
New Jersey

INTRODUCTION

The S&T Committee will address the following items in Table A during the Interim Meeting. Table A identifies the agenda items by reference key, title of item, page number and the appendices by appendix designations. The headings and subjects apply to *Handbook 44 Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices, 2020 Edition*. The first three letters of an item's reference key are assigned from the Subject Series List. The next 2 digits represent the year the item was introduced. The acronyms for organizations and technical terms used throughout the agenda are identified in Table B. In some cases, background information will be provided for an item. The fact that an item appears on the agenda does not mean it will be presented to the National Conference on Weights and Measures (NCWM) for a vote. The Committee will review its agenda and may withdraw some items, present some items for information meant for additional study, issue interpretations, or make specific recommendations for change to the publications identified, which will be presented for a vote at the Annual Meeting. The Committee may also take up routine or miscellaneous items brought to its attention after the preparation of this document. The Committee may decide to accept items for discussion that are not listed in this document, providing they meet the criteria for exceptions as presented in *NCWM Policy 3.1.4. Handbooks, Procedures to Modify Handbooks*. The Committee has not determined whether the items presented will be Voting or Informational in nature; these determinations will result from their deliberations at the Interim Meeting.

An "Item Under Consideration" is a statement of proposal and not necessarily a recommendation of the Committee. Suggested revisions are shown in **bold face print** by ~~**striking out**~~ information to be deleted and **underlining** information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***. Additional letters, presentations and data may have been part of the committee's consideration. Please refer to www.ncwm.com/publication-15 to review these documents.

In some cases, there may be proposed changes affecting multiple model laws or regulations that share the same purpose or proposed changes to one model law or regulation may be dependent on the adoption of proposed changes to another. The Committee may group such items into "Blocks" to facilitate efficient handling for open hearings and voting. These blocks are identified in Committee's agenda.

All sessions are open to registered attendees of the conference. If the Committee must discuss any issue that involves proprietary information or other confidential material; that portion of the session dealing with the special issue may be closed if (1) the Chairman or, in their absence, the Chairman-Elect approves; (2) the Executive Director is notified; and (3) an announcement of the closed meeting is posted on or near the door to the meeting session and at the registration table. If possible, the posting will be done at least a day prior to the planned closed session.

Note: It is policy to use metric units of measurement in publications; however, recommendations received by NCWM technical committees and regional weights and measures associations have been printed in this publication as submitted. Therefore, the report may contain references to inch-pound units.

Subject Series List

Table A
Table of Contents

Appendices

Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
ABWS	Automatic Bulk Weighing System	NEWMA	Northeastern Weights and Measures Association
AAR	Association of American Railroads	NIST	National Institute of Standards and Technology
API	American Petroleum Institute	NTEP	National Type Evaluation Program
CNG	Compressed Natural Gas	OIML	International Organization of Legal Metrology
CWMA	Central Weights and Measures Association	OWM	Office of Weights and Measures
EPO	Examination Procedure Outline	RMFD	Retail Motor Fuel Dispenser
EVSE	Electric Vehicle Supply Equipment	S&T	Specifications and Tolerances
FHWA	Federal Highway Administration	SD	Secure Digital
GMM	Grain Moisture Meter	SI	International System of Units
GPS	Global Positioning System	SMA	Scale Manufactures Association
HB	Handbook	SWMA	Southern Weights and Measures Association
LMD	Liquid Measuring Devices	TC	Technical Committee
LNG	Liquefied Natural Gas	USNWG	U.S. National Work Group
LPG	Liquefied Petroleum Gas	VTM	Vehicle Tank Meter
MMA	Meter Manufacturers Association	WIM	Weigh-in-Motion
MDMD	Multiple Dimension Measuring Device	WWMA	Western Weights and Measures Association
NCWM	National Conference on Weights and Measures		

Details of All Items
(In order by Reference Key)

SCL – SCALES

SCL-24.1 W S.1.7. Capacity Indication, Weight Ranges, and Unit Weights.

Source:
Rice Lake Weighing Systems

Purpose:
The term "Electronic computing scales" is not defined and makes S.1.7.(b). a confusing statement. The term should be struck and replaced with retail scale, ECR or POS if that is the intent.

Item under Consideration:
Amend Handbook 44 Scales Code as follows:

S.1.7. Capacity Indication, Weight Ranges, and Unit Weights.

(a) **Gross Capacity.** – An indicating or recording element shall not display nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 % of scale capacity.

(b) ***Capacity Indication*.** – ~~***Electronic computing scales***~~**Retail scales, POS, and ECR** *(excluding postal scales and weight classifiers) shall neither display nor record a gross or net weight in excess of scale capacity plus 9 d.*

[Nonretroactive as of January 1, 1993]

(Amended in 20XX)

The total value of weight ranges and of unit weights in effect or in place at any time shall automatically be accounted for on the reading face and on any recorded representation.

This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically derived totalized values.

(Amended 1990, 1992, and 1995)

Previous Status:
2024: New Proposal

Original Justification:
All digital scales made today are electronic computing scales. They compute weight values for analog signal to digital signal. This is a confusing statement and should be amended for clarification.

The submitter requested Voting status for 2024.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- 2024 Interim: A representative from the State of California commented that the item is confusing, does not meet its intended purpose, and recommended withdrawal.
- 2024 Interim: A representative from the State of New York supported NIST's position, and recommended withdrawal.
- 2024 Interim: A representative from the State of Florida agreed with previous comments supporting withdrawal.
- 2024 Interim: A representative from Los Angeles County in California agreed with the previous comments, stated that a definition for computing scales already exists, and recommended withdrawal.
- 2024 Interim: A representative from the State of Oregon commented that the term electronic has a broader meaning than digital and is not well defined in the proposal. They agreed with previous comments recommending withdrawal.

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST commented that the term computing scale is already defined in the Handbook and differentiates between computing scales that display the indications in a digital electronic form from analog indicating mechanical computing scales. NIST OWM recommended withdrawal of the item.

Neutral Comments:

Regulatory:
- None

Industry:
- 2024 Interim: The Scale Manufacturers Association recommended that the item be made informational by the committee, and that their position is available in writing in NCWM Publication 15.

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: Based upon comments received on the floor, the committee has withdrawn this item.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: Greg VanderPlaats from Minnesota stated that the terms 'Retail Scale', ECR, and POS are not defined in NIST Handbook 44.

Steve Peter from Wisconsin agreed with Greg's Comments. He also suggested adding the word 'Price' to the term Electronic Computing Scales.

The committee recommends that this item is a developing item.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Cory Hainy (Representing the SMA): The SMA has not had the opportunity to assess the item and will meet in November 2023.

Mr. Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program): Expressed confusion regarding terms in the proposed language and questioned whether or not all computing scales are retail scales. He recommended Developing as a status of this item.

Mr. Kevin Schnepp (California, Division of Measurement Standards), Mr. Kurt Floren (Los Angeles County, California), and Ms. Wendy Hahn (Stanislaus County, California) echoed the confusion expressed by Mr. Harrington.

Mr. Kurt Floren (Los Angeles County, California): Commented that there is an existing definition for computing scales and this item may confuse these existing definitions. POS means "Point of Sale" not "Point of Sale System" and ECR means "Electronic Cash Register" which may not be interfaced with a weighing device. He would like more information from Rice Lake and/or SMA regarding this item. Agreed with Oregon on a Developmental status for this item.

During open hearings testimony was received that the SMA has not evaluated this proposal. Comments were heard supporting a developmental status as the item needs further clarification on the terms and definitions in the item. The WWMA S&T Committee recommends that this item be assigned a Developing status. This will allow the submitter the opportunity to address the comments heard during the open hearings. The committee also looks forward to comments from the SMA and NIST OWM regarding this item.

SWMA 2023 Annual Meeting: The committee heard no comments on this item during Open Hearings.

The committee does not agree that the term electronic computing scales is confusing, therefore, making this item unnecessary.

The committee recommends withdrawal of this item.

NEWMA 2023 Interim Meeting: The State of NY opposes this item as computing scales are clearly defined in the definitions and not all electronic retail scales are computing scales. The Commonwealth of Massachusetts recommends to withdraw this item. Upon consensus of the body, the Committee recommends this item be Withdrawn.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

SCL-24.2 D Multiple Sections Regarding Tare

Source:
Ross Andersen, New York, Retired

Purpose:
Reduce confusion regarding net weight and tare issues by defining terms and adds specific requirements for tare operations and for marking and printing of net, gross and tare weight values.

Item under Consideration:
Amend Handbook 44 Scales Code and Appendix D, Definitions as follows:

Appendix D, Definitions:

tare mechanism. – ~~A mechanism (including a tare bar) designed for determining or balancing out the weight of packaging material, containers, vehicles, or other materials that are not intended to be included in net weight determinations.~~ A mechanism for setting the indication to zero when a load is on the load receptor, either without altering the weighing range for net loads (additive tare mechanism); or reducing the weighing range for net loads (subtractive tare mechanism). It may function as a non-automatic mechanism (load balanced by an operator), or a semi-automatic mechanism (load balanced automatically following a single manual command). [2.20] (Amended 20XX)

Add new definitions as follows:

preset tare mechanism. A mechanism for subtracting a numerical value, (representing a weight, that is introduced into the instrument and is intended to be applied to other weighings without determining individual tares) from a gross or net weight value and indicating the result of the calculation. The weighing range for net loads is reduced accordingly. "Introduced" includes procedures such as: keying in, recalling from a data storage device, or inserting via an interface. [2.20] (Added 20XX)

gross indication. The indication of a weighing instrument with no tare mechanism or preset tare mechanism in operation. [2.20] (Added 20XX)

gross load. (1) All materials placed on the load receptor exclusive of the load receptor itself, or (2) the combined commodity and tare materials placed on the load receptor. [2.20] (Added 20XX)

gross weight. A weight value assigned to the combination of commodity and tare in a commercial transaction. [2.20] (Added 20XX)

net indication. The indication of a weighing instrument with a tare mechanism or preset tare mechanism in operation. [2.20] (Added 20XX)

net load. All commodity materials placed on the load receptor. [2.20] (Added 20XX)

net weight. A weight value assigned to the commodity in a commercial transaction. [2.20] (Added 20XX)

tare indication. The indication of a tare weighing mechanism. [2.20] (Added 20XX)

tare weight. A weight value assigned to the tare in a commercial transaction. [2.20] (Added 20XX)

tare load. All tare materials placed on the load receptor. [2.20] (Added 20XX)

Scales Code Changes:

S.1.1.1. Digital Indicating Elements.

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

(b) ***After zero setting the effect of zero deviation on the result of the weighing shall be not more than ± 0.25 e.***

[Nonretroactive as of January 1, 20XX] (Added 20XX)

(c) ~~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 of a scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).~~ A digital indicating device shall have a "center-of-zero" indicator that indicates when the deviation from zero is not more than ± ¼ verification scale division. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s). The "center-of-zero" indicator is not mandatory on a device equipped with an auxiliary indicating device or equipped with a zero-tracking mechanism.

[Nonretroactive as of January 1, 1993]

~~(c)~~(d) *For electronic cash registers (ECRs) and point-of-sale systems (POS systems) the display of measurement units shall be a minimum of 9.5 mm ($^3/_8$ inch) in height.*

[Nonretroactive as of January 1, 2021] (Added 2019)

(Amended 1992, 2008, ~~and~~ 2019, **and 20XX**)

…

S.1.2.1. Digital Indicating Scales, Units. *– Except for postal scales, a digital-indicating scale shall indicate weight values using only a single unit of measure. Weight **~~values~~** **indications** shall be presented in a decimal format with the value of the scale division expressed as 1, 2, or 5, or a decimal multiple or submultiple of 1, 2, or 5.*

*The requirement that the value of the scale division be expressed only as 1, 2, or 5, or a decimal multiple or submultiple of only 1, 2, or 5 does not apply to net weight**s** **~~indications and recorded representations~~** that are calculated from gross and tare weight**s** **(measured without use of a tare or preset tare mechanism)** **~~indications~~** where the scale division of the gross weight is different from the scale division of the tare weight**~~(s)~~** on multi-interval or multiple range scales. For example, a multiple range or multi-interval scale may indicate and record tare weights in a lower weighing range (WR) or weighing segment (WS), gross weights in the higher weighing range or weighing segment, and **calculated** net weights as follows:*

55 kg	*Gross Weight*	*(WR2 d = 5 kg)*	*10.05 lb*	*Gross Weight*	*(WS2 d = 0.05 lb)*
– 4 kg	*Tare Weight*	*(WR1 d = 2 kg)*	*– 0.06 lb*	*Tare Weight*	*(WS1 d = 0.02 lb)*
= 51 kg	*Net Weight*	*(Mathematically Correct)*	*= 9.99 lb*	*Net Weight*	*(Mathematically Correct)*

[Nonretroactive as of January 1, 1989]

(Added 1987) (Amended 2008 **and 20XX**)

…

S.1.7. Capacity Indication, Weight Ranges, and Unit Weights.

(a) **Gross Capacity.** – An indicating or recording element shall not display any values nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 % of scale capacity.

(b) ***Capacity Indication.*** *– Electronic computing scales (excluding postal scales and weight classifiers) shall **~~neither display nor record a gross or net weight values~~** **not display any values nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism)*** **is** *in excess of scale capacity plus 9 d.*

[Nonretroactive as of January 1, 1993]

The total value of weight ranges and of unit weights in effect or in place at any time shall automatically be accounted for on the reading face and on any recorded representation.

This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically derived totalized values.

(Amended 1990, 1992, ~~and~~ 1995, **and 20XX**)

…

S.2.3. Tare Mechanism and Preset Tare Mechanism, General. – *On any scale (except a monorail scale equipped with digital indications and multi-interval scales or multiple range scales when the* ~~*value of*~~ *tare* ***weight*** *is determined in a lower weighing range or weighing segment), the value of the tare division shall be equal to the value of the scale division.** The tare mechanism **or the preset tare mechanism** shall operate only in a backward direction (that is, in a direction of underregistration) with respect to the zero-load balance condition of the scale. *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. **

*[*Nonretroactive as of January 1, 1983]*

(Amended 1985, ~~and~~ 2008**, and 20XX**)

***Note**: On a computing scale, 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.**

*[*Nonretroactive as of January 1, 1983]*

S.2.3.1. Tare Mechanism. – A tare mechanism shall permit setting the indication to zero accurate to ±0.25 e. On a multi-interval device e shall be replaced by e_1.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

S.2.3.2. Preset Tare Mechanism. – Regardless of how a preset tare value is introduced, its scale division shall be equal to or automatically rounded to the scale division of the device. On a multiple range device, a preset tare value may only be transferred from one weighing range to another one with a larger verification scale division but shall then be rounded to the latter. For a multi-interval device, the preset tare value shall be rounded to the smallest verification scale division, e_1, of the device, and the maximum preset tare value shall not be greater than Max_1. The displayed or printed calculated net value shall be rounded to the scale interval of the device for the same net weight value.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

…

S.1.16. Marking of Weight Indications.

(a) A single display used only for gross indications need not be designated. The display may be designated by the term "gross."

(b) A single display used for both gross and net values shall be designated "net" when displaying the net value while a tare mechanism or preset tare mechanism is in operation. The display may be designated "gross" when no tare mechanism is in operation, or when the gross weight is temporarily indicated while a tare mechanism is in operation.

(c) If an instrument simultaneously displays two or more of the net, gross, or tare indications, each display shall be designated by the appropriate term "net," "gross," or "tare."

(d) However, it is permitted to replace the terms net, gross, and tare with the appropriate designations "N" for net, "G" for gross and "T" for tare displayed to the right of the weight values, e.g., 4.48 lb N, 4.52 lb G, or 0.04 lb T.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

S.1.17. Printing of Weighing Results.

(a) Gross weights may be printed without any designation. For a designation by the symbol, only "G" is permitted.

(b) If only net weight is printed without corresponding gross or tare values, it may be printed without any designation. A symbol for designation shall be "N".

(c) Gross, net, or tare weights determined by a multiple range instrument or by a multi-interval instrument need not be marked by a special designation referring to the (partial) weighing range. (see also S.1.2.1.)

(d) If net weights are printed together with the corresponding gross and/or tare weights, the net and tare weights shall at least be identified by the corresponding symbols "N" and "T". If the gross weight is identified, the symbol "G" shall be used.

(e) However, it is permitted to replace "G", "N" and "T" by complete words in English.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

S.1.18. Mathematical Agreement of Net, Gross and Tare Values. When a device simultaneously indicates (or records) net, gross and tare indications, the values shall be in mathematical agreement based on the formula Net Weight = Gross Weight – Tare Weight whenever one of the three values is calculated from two measured weight values, e.g., calculated Net = weighed Gross – weighed Tare. Mathematical agreement is not required due to potential rounding errors when all three values are independently measured.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

Alternative proposal.

S.1.18. Mathematical Agreement of Net, Gross and Tare Values. When a device simultaneously indicates (or records) net, gross and tare indications, the values shall be in mathematical agreement based on the formula Net Weight = Gross Weight – Tare Weight, whenever one of the three values is calculated from two measured weight values, e.g., calculated Net = weighed Gross – weighed Tare. This also applies to calculated net weights when a preset tare mechanism is in operation. Mathematical agreement is not required due to potential rounding errors when a tare mechanism is in operation, as all three values are independently measured.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

…

T.N.2.1. General. – The tolerance values ~~**are positive (+) and negative (−)**~~ **herein prescribed shall be applied to errors of overregistration and underregistration.** ~~**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 (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads.**~~ **The tolerances apply to 1) errors in gross indications (starting at gross load zero), 2) errors in net indications (starting at net load zero) when a tare mechanism is in operation, 3) errors in tare indications on a dedicated tare display when a tare mechanism is in operation, and 4) errors in net indications on a dynamic monorail scale (using a preset tare mechanism). Tolerances do not apply to errors in net indications for scales other than on dynamic monorail scales, when a preset tare mechanism is in operation.**

(Amended 2008 **and 20XX**)

Previous Status:

2024: New Proposal

Original Justification:

This proposal recommends changes to the Scales Code to address:

1. issues of poor terminology that lead to confusion in discussion of net weight (and tare) issues, and

2. absence of specifics in the regulation of net weight that leads to ambiguity in enforcement.

Both of these issues emerged from discussions of the e vs d issues by the Verification Scale Division e Task Group. The Task Group however, decided both were outside the scope of its charge.

Issue 1. – The terminology relating to net weight and tare in the HB44 Scales Code is confusing since the three main terms (net, gross, and tare) may each be used to mean three different things. For example, the term "net" can refer to 1) the weight value on which a commercial transaction is based, 2) the mode of indication of an instrument, or 3) the load placed on the load receptor.

A good example is the use of the common expression "net equals gross minus tare." primarily this is a formula describing the loading of the instrument in the weighing procedure.

Net load	=	Gross load	-	Tare load
Commodity	=	Commodity + Tare	-	Tare

What about the instrument indication? In the terminology of the instrument, a gross indication is the instrument indication when the weighing begins at a no-load zero indication. In the case of a scale with no tare mechanism we find:

Net weight	=	Gross indication	-	Gross indication
Net load	=	Gross load	-	Tare load
Commodity	=	Commodity + Tare	-	Tare

With a tare mechanism or a keyboard tare mechanism, the instrument scale is set to net zero corresponding to the tare load. The Net indication is zero. We find:

Net weight	=	Net indication	-	(Tare indication is zero)
Net load	=	Gross load		
Commodity	=	Commodity + Tare		

The objective of any weighing process is to find the net weight, which might be assigned from one or more instrument indications with different loads on the load receptor and different methods of operating the instrument. We work with these terms every day, but we ignore or struggle with the inherent confusion. Good regulations avoid this kind of confusion using clear terminology.

Issue 2. – There are only a few specifications governing tare operations in the Scales Code. I am not including user requirements that don't apply to the instrument. A word search of the terms "tare" and "net weight" point us to only six Specifications, one Note, and one Tolerance as in the table below.

Section	Subject	# Requirements
S.1.2.1.	Weight Units	2
S.1.7.	Manual Weight Entries	1
S.1.8.	Recording Net Weight POS Scales	2
S.1.12.	Manual Weight	1
S.2.1.6.	Combined Zero/Tare	1
S.2.3.	Tare	2
S.2.3.1.	Tare Digital Monorail Scales	2
N.1.12.	Strain Load Tests	N/A
T.N.2.1.	Tolerance Application to Net Weight	N/A

The number of requirements is an assessment of the number of requirements requiring a distinct test to verify compliance. In total, there are 11 tests required to verify the literal requirements in the Code. Yet the NTEP checklist for an electronic scale has pages of tests governing tare operations. I concede that many of those can also be derived from General Code requirements, but general also comes with a lack of specificity. This is no suggestion that Pub 14 is wrong in any way. There has always been this challenge to ensure NTEP is following HB44, and not the other way around. There is another challenge to not over-regulate. It is generally better to have fewer, but clearer, requirements.

If you believe the current Code is sufficiently unambiguous, try to answer the following questions using only the text in HB44? No peeking in Pub 14.

1. What is meant in T.N.2.1. by "the net weight indication of any possible tare load using certified test weights." If you ask different people, you might get many different answers.

2. Can you point to any guidance in the Notes section to help answer question 1 or conduct the test in order to apply the tolerances?

3. Must keyboard tare, pre-programmed tare, and pushbutton tare all result in the same net weight? If you say yes, on what code requirement do you base your decision? Different weighing procedures can produce different results by one scale division.

4. If the instrument simultaneously indicates the Net, Gross, and Tare weights (or prints them), do the values have to be in mathematical agreement? If you say yes, on what code requirement do you base your decision? Under some circumstances mathematical agreement cannot be mandated due to rounding issues.

5. If an instrument has a dedicated tare weight display, do tolerances apply to that indication?

6. If an instrument records multiple values, e.g., net weight, gross weight, and tare weight, how must the values be identified either on the display or the printed record?

These are just a few questions to highlight a lack of clarity in the current Code. The proposal is intended to help resolve these issues.

Regarding the Proposed Definitions:
Justification: The current definition of tare mechanism does not differentiate between tare alternatives, like pushbutton tare, or keyboard and programmed tare. The amended definition of tare mechanism and the new definition of preset tare mechanism ensure clarity, particularly as they operate differently, and the tolerances should be applied when a tare mechanism is in operation but not when a preset tare mechanism is in operation. (See Revision to T.N.2.1.)

The new definitions relating to net, gross, and tare help clarify that these terms have multiple meanings. By using "loads" for the loading of the instrument, "indications" for the instrument indications, and "weights" for the transaction record, we can keep the meanings specific to the intent. Some key points:

- Weights may be assigned by the operator or by the instrument. Examples: 1) A gross indication when the commodity is the only load on the load receptor is designated the net weight by the operator. 2) A weigh-in/weigh-out system employs two gross indications that are used to calculate a net weight. If the operator calculates the net weight, the operator is also responsible to identify the respective net, gross and tare weights. If the instrument calculates the net weight, it must identify the respective net, gross, and tare weights.

- Requirements applicable to indications are also applicable to recorded representations (values printed or transmitted by the instrument) as per G-S.5.6. Note that some code requirements emphasize the recorded representations (redundantly), and some do not. This does not apply to actions of an operator such as manually computing net values from two measured weight values for gross and tare.

- The term "gross load" unavoidably has two meanings, but this is acceptable since the operator (or the official) clearly knows which applies based on how the scale is used.
  Example 1: a candy store may have a scoop that is sometimes used in the weighing operation. For the purposes of S.1.7. Capacity Indications, the scoop is part of the gross load placed on the load receptor and the weighing range of the scale is reduced by the scoop weight. However, for the purposes of the transaction, the scoop becomes part of the load receptor after a zero operation and is not part of the gross load (commodity and tare). A possible exception is the scale with a combined zero/tare key. However, these are not permitted in direct sale and the net weighing essentially begins at gross zero that is accurate to at least ¼ e.
  Example 2: if the commodity alone is placed on the load receptor, it is a gross load (by the first meaning) and a net load. This is the case when candy in the scoop is weighed for the transaction after including the scoop in the gross zero as in example 1. The net load is introduced into the packaging (tare) after the weighing operation.
  Example 3: if the tare alone is placed on the load receptor it is thus a gross load (by the first meaning) and a tare load. However, there are nuances to the meaning of tare load (next bullet).

- The term "tare load" is used only once in the current Scales Code in T.N.2.1. The proposed revision to that section would remove it. In practice, a tare load results in either a non-zero gross indication, or a zero net indication. Both are consistent with the new definitions of gross and net loads. There is also the possibility that a tare weighing mechanism is in use that displays or prints the tare weight. However, the value displayed on the tare weighing mechanism does not necessarily correspond to the current loading, since the tare weighing mechanism will remain at the tare indication when either the tare is removed from or the gross load (commodity and tare) are placed on the load receptor.

- The term "tare indication" is necessary as tolerances are applicable to a dedicated tare display in the revised T.N.2.1.

To further help explain the terminology, consider four basic weighing procedures. Instrument in all examples is Class III Max 30 lb d = 0.01 lb (Net, gross and tare descriptors in parentheses are optional as per proposed S.1.16.)

1 1. Direct Weighing

Procedure Step	Loading	Internal Value	Indication	Weight (Transaction)
1 zero	No	0.000 lb	(Gross) 0.00 lb	
2 weigh	Net	4.283 lb	(Gross) 4.28 lb	(Net) 4.28 lb

2 2. Difference Weighing

Procedure Step	Loading	Internal Value	Indication	Weight (Transaction)
1 zero	No	0.000 lb	(Gross) 0.00 lb	
2 weigh*	Tare	0.034 lb	(Gross) 0.03 lb	Tare 0.03 lb
3 zero	No	0.000 lb	(Gross) 0.00 lb	
4 weigh*	Gross	4.317 lb	(Gross) 4.32 lb	(Gross) 4.32 lb
5 calculate	N/A	N/A	N/A	Net 4.29 lb

3 * Steps 2 and 4 may be reversed, weighing gross in step 2 and tare in step 4.

4 3. Weighing using Tare Mechanism

Procedure Step	Loading	Internal Value	Indication	Weight (Transaction)
1 zero	No	0.000 lb	(Gross) 0.00 lb	
2 weigh	Tare	0.034 lb	(Gross) 0.03 lb	
3 tare key	Tare	0.000 lb	Net 0.00 lb	
4 weigh	Gross	4.283 lb	Net 4.28 lb	(Net) 4.28 lb

5 4. Weighing using Preset Tare Mechanism – Option (a)

Procedure Step	Loading	Internal Value	Indication	Weight (Transaction)
1 zero	No	0.000 lb	(Gross) 0.00 lb	
2 enter tare	No		0.03 lb	
3 tare key	No	0.000 lb	Net -0.03 lb	
4 weigh	Gross	4.317 lb	Net 4.29 lb	(Net) 4.29 lb

6 4. Weighing using Preset Tare Mechanism – Option (b)

Procedure Step	Loading	Internal Value	Indication	Weight (Transaction)
1 zero	No	0.000 lb	(Gross) 0.00 lb	
2 weigh	Gross	4.317 lb	(Gross) 4.32 lb	
3 enter PLU	Gross	4.32 – 0.03	Net 4.29 lb	(Net) 4.29 lb

7 In the above examples, you can read any row with a transaction weight to describe the weighing process for most
8 cases. The exception is procedure 2 step 5 which is a calculation.

9 Procedure 1 step 2 reads: net weight = gross indication of the net load.

10 Procedure 2 step 2 reads: tare weight = gross indication of the tare load.

11 Procedure 2 step 4 reads: gross weight = gross indication of the gross load.

12 Procedure 3 step 4 reads: net weight = net indication of the gross load.

Regarding S.1.1.1. Digital Indicating Elements.
Justification: The changes mirror those proposed by the Verification Scale Division e Task Group. The current Code has no requirement on the accuracy of zero setting. The new part (b) ensures that zero setting is accurate within ¼ e. The amendments to (c) are further explained in the reports of the Task Group and are not relevant to this proposal. The proposed (b) is nonretroactive since it is a major change.

Regarding *S.1.2.1. Digital Indicating Scales, Units.*
Justification: In the current text it may be unclear that the second paragraph and the examples address multi-interval and multiple range scales weighing by difference, i.e., using two measured gross indications with no tare or preset tare in operation. The changes make this clear. Using the terminology of weights, indications and loads, the 1, 2 or 5 requirement for the scale division applies to 1) the gross indications for the gross and tare loads, and 2) the gross and tare weights recorded for the transaction. The 1, 2, or 5 requirement does not apply to the calculated net weight, which may be displayed and/or printed. More on the mathematical agreement issue can be found in proposed S.1.18. below. As this is only a clarification, it does not alter the nonretroactive status of the section.

This section does not apply to tare operations using tare or preset tare mechanisms. If either a tare mechanism or a preset tare mechanism is in operation, then the net weights in the examples would necessarily be displayed and printed as 50 kg (d = 5 kg) and 10.00 lb (d = 0.05 lb) respectively. Both would be rounded by the device to the d of the upper weighing range before being displayed. It seems highly unlikely that any multi-interval scale would print all three values, if equipped with a tare or preset tare mechanism.

Regarding S.1.7. Capacity Indication, Weights Ranges, and Unit Weights.
Justification: Notice in (a) the current requirement refers to values, but in (b) it refers to weights. This is an instance of multiple meanings colliding in the current Code. The changes are a clean-up since the section uses the terms net, gross and tare. The intent of this section is that no gross or net "indications" are displayed or printed when the "gross load" (meaning all materials exclusive of dead load) exceeds some limit above scale capacity. The current wording in (b) is incorrect since it appears that the net values could also reach capacity plus 9 d even with maximum tare. This doubles the scale capacity and is clearly not the intent of the section. NTEP has always applied this to mean no gross or net indications are permitted when the gross load (all materials other than dead load) exceeds capacity plus 9 d. As this is only a clarification of the original intent, it does not alter the nonretroactive status of the section.

Regarding S.2.3. Tare <u>Mechanism and Preset Tare Mechanism, General.</u>
Justification: The changes to S.2.3. are a cleanup of language consistent with the terms tare mechanism and preset tare mechanism. This backward application of tare has consistently been applied to both tare and preset tare in the past. As this is only a clarification, it does not alter the retroactive status of the affected section.

The new specifications, S.2.3.1. and S.2.3.2., clarify the difference between the two kinds of tare mechanisms. Because these changes may be significant, they are proposed to be nonretroactive. With a tare mechanism, the net zero setting is required to be accurate to ¼ e, parallel to the setting of gross zero in S.1.1.1.(b). With a preset tare mechanism, the net zero value is rounded off to the scale division d. This means net weights are simple calculations of rounded gross weight minus rounded tare weight. For more explanation see justification for changes to T.N.2.1. below.

For a multi-interval scale this means having full access to the entire lower weighing range in net mode. Consider a 0 - 15 lb x 0.005 lb and 15-30 lb x 0.01 lb multi-interval scale. If the tare is 14 lb, the lower weighing range for net weights will coincide with gross loads between 14 lb to 29 lb. The upper range for net weights will coincide with gross loads between 29 lb to 30 lb. Notice also that a maximum preset tare on a multi-interval scale is limited to the Max of the lower weighing range.

Regarding *<u>S.1.16. Marking of Weight Indications</u>* and *<u>S.1.17. Printing of Weighing Results.</u>*
Justification: These new sections provide clear specifications for net weight and the use of tare mechanisms. Because these changes may be significant, they are proposed as nonretroactive. Without these sections, the decisions regarding appropriate markings are arbitrary. Note that NTEP relies heavily on G-S.6. (marking of controls and indications), but Pub 14 has no legal standing. What is clear to one person may not be clear to another when viewing the Scales Code.

In S.1.16. the specifications governing marking of the weight displays are added. In S.1.17. the specifications governing printed records are added. This section comes largely from R76 section 4.6.11.

Regarding *S.1.18. Mathematical Agreement of Net, Gross and Tare Values.*

Justification: Neither the Scales Code nor the General Code clearly addresses mathematical agreement of net, gross, and tare. Mathematical agreement is not an issue for most scales since they only display one or two of the net, gross and tare values. Instruments that display all three values are rare and will now be formally addressed in the Code to prevent confusion. The proposed sections make it clear that values calculated from two measured values must be in mathematical agreement. This is partially explained in the current S.1.2.1. With a preset tare mechanism, only the gross and tare weights are measured, while the net weight is calculated.

With a tare mechanism, the gross and tare weights are measured from gross zero and the net weight is measured from net zero. Mathematical agreement cannot be guaranteed in cases where the instrument measures all three values, since rounding errors may result in disagreement by +1 division 12.5% of the time and -1 division 12.5% of the time. Forcing mathematical agreement would require the manufacturer to fudge the results. Consider the following case:

Load	Internal Value	Rounded Value
Gross	4.317 lb	4.32 lb
Tare	0.034 lb	0.03 lb
Net	4.283 lb	4.28 lb (No agreement as G – T = 4.29 lb)

In this case the gross weight is rounded up and the tare weight is rounded down, resulting in a measured net weight 0.01 lb (1 d) smaller than the calculated net value. Similarly, if the gross weight is rounded up and the tare weight rounded down, the measured net weight is 0.01 lb (1 d) greater than the calculated net weight. Because these changes may be significant, they are proposed as nonretroactive.

There is a disconnect between mathematical agreement and tolerance application to net weight. If the net weight is calculated from measured gross and net weights, then mathematical agreement is required but tolerance is not applied to net weight. If the net, gross and tare weights are all measured, then mathematical agreement is not required but tolerance is applied to the net weight value. See proposed changes to T.N.2.1.

Regarding T.N.2.1. General.

Justification: The changes are clarifications and thus do not affect retroactivity. The addition of language applying the tolerances to errors of overregistration and underregistration insures uniform application of the signs. An instrument with a + error of overregistration also has a – error in deficiency. We should be consistent with G-T.3. and all report errors the same way. The tradition is to apply tolerances to errors of over/underregistration. The last part of the first sentence is deleted since the test may begin at other than zero at no load. For example, tolerance may be applied to net values that begin at zero at tare load with a tare mechanism in operation.

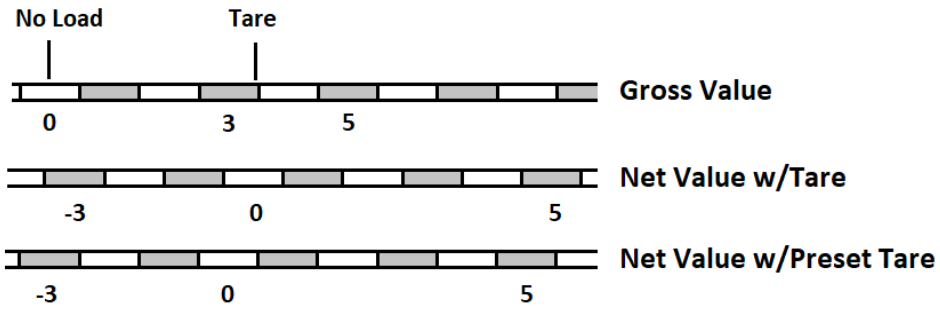
The new text spells out four instances where tolerances are applied. This includes:

1. Errors in gross indications, beginning at gross load zero. – This has always been the case. These weighings begin at dead load zero. Note that the zero setting is covered by proposed S.1.1.1.(b) which requires setting zero accurate to ¼ e.

2. Errors in net indications, beginning at net load zero when using a tare mechanism. – This also has traditionally been the practice even in the Scales Code pre-1984. This net zero setting is also accurate to ¼ e per proposed S.1.1.1.(b). The current wording is ambiguous.

3. Errors in Tare indications displayed on a dedicated tare weighing mechanism when a tare mechanism is in operation. – A good example is a dedicated tare weighbeam with a locking poise. Without this statement, you could not apply tolerances to the indication of the tare weighbeam. With an electronic scale, the dedicated tare display is rare, but the approach is the same as the dedicated weighbeam. A digital value in the tare display will be transferred from the gross weight display when the tare mechanism is activated. We expect the value to match the original gross weight exactly, and thus tolerances should apply. This does not apply to a preset tare since a preset tare is not actually weighed, but introduced externally. Also remember that the tare display will remain at the same value, regardless of the load on the load receptor, until another tare mechanism is activated, or the tare is cleared.

4. Errors in net values recorded on a dynamic monorail scale. – The dynamic monorail is a unique case since these instruments only record net weight. In OIML these devices are not part of R76 on which the Scales Code is based, but rather R51. The text further clarifies that tolerances are not applied to net values on other types of scales when a preset tare is in operation.



The graphic highlights the difference between tare and preset tare devices. The values are in d. In the example, the gross value of the tare is about 3.4 d. When using a tare mechanism, the center of net zero is set at the gross value of 3.4 d. If the tare is removed the no load is at -3.4 d. With a tare mechanism the net divisions may not align with the gross divisions since the tare may not be a whole number of d.

With a preset tare mechanism, the rounded value of the tare entry is subtracted from the gross weight. This results in a net scale that aligns with the gross scale but is offset by the rounded value of the tare. With keyboard tare, the tare is entered at gross zero, resulting in an indication of -3 d. With a programmed tare like a POS system, the rounded gross weight is displayed and the 3 d tare associated with the PLU is subtracted before the net weight is printed. The preset tare may have an inherent rounding error of up to 0.5 d from the actual tare weight. In addition, any error in the instrument gets added to this rounding error. By not applying tolerances you do not penalize the instrument for these two errors. Remember that the user may be cited for misrepresentation of the quantity (UWML §15, if the wrong preset tare is entered. Also, you can use the tare mechanism to test the instrument accuracy in net mode. This is what was intended in the current language of T.N.2.1. referring to “any possible tare load using certified weights.” That is, applying a known weight and using the semi-automatic tare to set the net zero. In the R76 test in net mode, the applied tare load is chosen near the break point between divisions to verify that the net zero is set accurate to ¼ e.

Comments in Favor:

Regulatory:

- None

Industry:

- None

Advisory:
- None

Comments Against:

Regulatory:
- 2024 Interim: A representative from the State of Arkansas agreed with previous comments and stated that the proposal makes it more complicated than it currently is. This representative is against the formation of a task group to develop this item, and suggested the submitter break the item up and develop it individually.
- 2024 Interim: A representative from the State of Oregon agreed with the comments from the Arkansas representative.

Industry:
- 2024 Interim: The Scale Manufacturers Association commented that they do not feel there is enough confusion about the current code to warrant change and recommended the item be withdrawn.

Advisory:
- None

Neutral Comments:

Regulatory:
- 2024 Interim: A representative from the State of California commented that the item should be broken up into separate items and developed individually. This representative also stated that one proposal from S.1.18. should be chosen and the other removed.

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST OWM commented that they do not believe the item is fully developed, but recognizes the issues raised by the submitter. NIST OWM recommended either developing or assigned status.

Item Development:
NCWM 2024 Interim Meeting: The committee made formatting changes to the item to make it consistent with the Form 15. The committee also renumbered paragraphs S.1.15. - S.1.17. to S.1.16. - S.1.18. along with relative references in the justification.

The committee recommends that the submitter develop the item further, possibly breaking it up into separate items and developing them individually. The submitter should also clarify where paragraphs S.2.3.1. Tare Mechanism and S.2.3.2. Preset Tare Mechanism are intended to be inserted.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard. The committee recommends this item as developing and seeks input from industry stakeholders.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Cory Hainy (Representing the SMA): The SMA has not had the opportunity to assess the item and will meet in November 2023.

Mr. Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program): Expressed concerns regarding terminology throughout the item but acknowledged that there is merit to the item. He recommended this item be separated by the appropriate sections that correspond to the handbook and that the items then be blocked together. He also recommended this item be assigned a developing status.

Mr. Kevin Schnepp (California, Division of Measurement Standards): Echoed the comments from Mr. Harrington of Oregon. Mr. Schnepp supported a developing status and looks forward to comments from the SMA.

The WWMA S&T Committee recommended that this item be assigned a Developing status. This will allow the submitter the opportunity to address the comments heard during the open hearings and receive feedback from stakeholders. The WWMA S&T Committee further recommends the items be separated accordingly and then Blocked together, specifically separating the scale code sections into one item and the definitions sections into a second item.

As a point of technical merit to the submitter, proposed items are best presented when they are specific and clear for the body to evaluate the proposal accurately. This specific comment is in reference to the alternative proposals of S.1.17. found on page S&T – 227 of the WWMA 2023 S&T Agenda. The committee recommended that the submitter determine which version of S.1.17. best fits the purpose of this proposal and remove the other version.

SWMA 2023 Annual Meeting: Cory Hainy with SMA stated they have not reviewed the item.

The committee disagrees with the justification and the use of alternate proposals within the item.

The committee recommends the item be withdrawn.

NEWMA 2023 Interim Meeting: A regulator from Holliston, Massachusetts stated the Cannabis Task Group (CTG) is working with the Scale Verification Task Group. A meeting was scheduled for mid-September. The CTG hopes to have something finalized for the Interim meeting. The State of NY supports further development and it is necessary for clarification. There was discussion of assigning this item to the Scale Verification Task Group but it was noted that there would have to be a change of scope. Upon consensus of the body, the Committee recommends this item be Developing.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

SCL-22.3 V UR.3.3. Single-Draft Vehicle Weighing., and UR.3.4. Weighing of Axle Loads and Axle-Group Loads.

Source:
NIST, Office of Weights and Measures

Purpose:
This proposed change is intended to add clarification regarding the implications of using weighing and measuring devices for transactions that may be considered by some as commercial while there is no clear guidance provided.

Item Under Consideration:
Amend Handbook 44, Scales Code as follows:

UR.3.3. Single-Draft Vehicle Weighing. – A vehicle or a coupled-vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each end of such vehicle or individual elements of such coupled combination. However, the weight of:

(a) a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or

(b) a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

~~**Note:**~~ This paragraph does not apply to highway-law-enforcement scales**,** ~~**and**~~ scales used for the collection of statistical data**, or scales used to charge a fee for the service of providing weights of the different axle loads, axle-group loads, and total weight of vehicles and coupled-vehicle combinations when the only use of those values is to determine compliance with established highway weight requirements and safe distribution of the load.**

(Added 1992) **(Amended 20XX)**

And

UR.3.4. Weighing of Axle Loads and Axle-Group Loads. – Establishing weight values for the different individual axle loads and axle-group loads of a vehicle or coupled-vehicle combination is oftentimes necessary to verify compliance with established highway weight requirements and safe distribution of the load. When a fee is charged for this service, the scale's application is considered "commercial" under the provisions of paragraph G-A.1. Commercial and Law Enforcement Equipment and the scale shall comply with all applicable NIST Handbook 44 requirements for commercial weighing systems.

When weight values for axle loads and/or axle-group loads are obtained using multiple-independent platform vehicle scale systems in which all parts of the vehicle or coupled-vehicle combination being weighed are simultaneously positioned on live elements of the scale, the values for the different axle loads and axle-group loads may be summed to establish the legal gross vehicle weight.

In no case, however, shall a summed result of the different axle loads and axle-group loads of a vehicle or coupled vehicle combination weighed in multiple drafts be used as the legal gross vehicle weight unless subpart (a) or (b) of paragraph UR.3.3. Single-Draft Vehicle Weighing is met.

(Added 20XX)

Renumber existing paragraphs UR.3.4 through UR.3.12.

Previous Action:
2023: Developing
2022: Developing

Original Justification:
OWM has noted a number of inquiries submitted to our office for explanation on the many and various issues involved with the use of weighing or measuring devices as commercial devices when there is charge for doing so. Law enforcement devices may be regulated in a different manner than commercial devices (e.g., allows highway weight limit enforcement through multi-draft weighing) when commercial devices are not allowed to be used in that way.

The submitter pointed out that there seems to be a difference in opinions regarding this practice constitutes a commercial transaction.

The submitter requested voting status for these items in 2022.

Comments in Favor:

Regulatory:

- 2024 Interim: A representative from the State of Oregon stated that their previous concerns on this item have been addressed.

Industry:

- None

Advisory:

- 2024 Interim: A representative from NIST OWM recommended this item be made voting with the edits specified in their Executive Summary. The representative stated that the item adds an exemption to UR.3.3. to allow "split weighing" when a fee is charged "for the service of providing weights of the different axle loads, axle-group loads, and total weight of vehicles and couple-vehicles combinations" only when "those values are used to determine compliance with established highway legal load limits and safe distribution of the load." The item also adds UR.3.4. to clarify under which circumstances weight values obtained on a multi-independent platform vehicle scale can be used for commercial transactions. The representative also recommended some minor editorial changes. NIST OWM's full written revision has been provided to the committee in its Executive Summary.

Comments Against:

Regulatory:

- 2024 Interim: A representative from the State of Arkansas stated that they believe it's slippery slope to have law enforcement and commercial applications on the same scale, as it would introduce a risk of fraud. They also asked why "Note" was struck from the item.

Industry:

- 2024 Interim: The Scale Manufacturers Association commented that it does not support adding this verbiage to UR.3.3., and that these changes do not represent the original intent of the item.

Advisory:

- None

Neutral Comments:

Regulatory:

- 2024 Interim: A representative from the State of California commented that they support the item, but the other commenters' concerns should be addressed. This representative recommended developing status.

Industry:

- None

Advisory:

- None

Item Development:
NCWM 2024 Interim Meeting: The committee accepted all the changes recommended by the submitter and has changed the item's title. The committee replaced the word "axle-" with "axle loads" throughout the item, except in the term "axle-group loads." In the last paragraph of UR.3.3., formerly the "Note," the committee added the word "established" between the words "with" and "highway." The committee also removed the last "s" from "subparts" in the last paragraph of UR.3.4. The committee believes this item is fully developed and has assigned it voting status.

NCWM 2023 Annual Meeting: The committee updated the item under consideration using amended language provided by NIST OWM and included in their analysis of the item.

NCWM 2023 Interim Meeting: The committee recommends the submitter work with interested parties to further develop SCL-22.3.

NCWM 2022 Annual Meeting: Tina Butcher, NIST OWM is requesting feedback on the two items in Block 6D. Allow additional time for input. Paragraph numbers have been updated in the proposal and amendments have been made since 2022 Interim meeting and are posted on the website.

NCWM 2022 Interim Meeting: During the S&T Committee work session, the committee agreed to remove item GEN 22.1 from Block 6. The committee recommendations pertain to the remainder of the block only (SCL 22.1 & SCL 22.3). The committee received updated language from the submitter for item SCL 22.1.

This item has been assigned to the submitter for further development. For more information or to provide comment, please contact:

Mr. Loren Minnich
NIST Office of Weights and Measures
loren.minnich@nist.gov

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.
The committee recommends this item as a voting item

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Loren Minnich (NIST OWM): Previous SMA comments have been addressed and recommended this item is ready for a vote.

Mr. Cory Hainy (Representing the SMA): Expressed that the April 2023 analysis represents their position prior to the updates to the item and will reconvene in November 2023 to analyze the item. They support this item with a developing status.

Mr. Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program): Supported development of this item. He raised concerns that the device may potentially be used inappropriately to capture vehicle gross weight and recommends adding a user requirement of posting on a sign or recording on a scale ticket be added to the item to address this concern.

Mr. Kevin Schnepp (California Division of Measurement Standards): Supports a voting status contingent on SMA analysis of the item.

The WWMA S&T Committee recommends that this item be assigned a Developing status to allow the submitter the opportunity to consider the comments heard on the floor and receive feedback from stakeholders.

SWMA 2023 Annual Meeting: Cory Hainy, SMA, stated their position is based on the April version of the item, but they have not had a chance to meet and review the changes to this item. He anticipates the SMA will be in favor of the item with the most recent changes.

The committee feels the item is fully developed and recommends it move forward as a Voting item.

NEWMA 2023 Interim Meeting: The State of NY supports as a developing item but cautions that the change to the Note could allow split weighing. The State of New Hampshire and the Commonwealths of Massachusetts and Pennsylvania concur. Upon consensus of the body, the Committee recommends this item be Developing.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

SCL-23.3 V Verification Scale Division e: Multiple Sections Including, T.N.1.3., Table 6., T.N.3., T.N.4., T.N.6., T.N.8., T.N.9., T.1., T.2., S.1.1.1., T.N.1.2., Table S.6.3.a., Table S.3.6.b., Appendix D, S.1.2.2., Table 3., S.5.4., UR.3., Table 8.

Source:
NCWM Verification Scale Division e Task Group

Purpose:
The mission of the task group, as defined by the S&T Committee, was to review Handbook 44, Section 2.20. Scales and relevant portions of OIML R76, using the items included in S&T Agenda Items: Block 2 as a reference point, and recommend changes as necessary to:

1. Clarify how the error is determined in relation to the verification scale division (e) and the scale division (d)
2. Clarify which is the proper reference; the verification scale division (e) or the scale division (d) throughout this section
3. Ensure proper selection of a scale in reference to the verification scale division (e) and the scale division (d)
4. Clarify the relationship between the verification scale division (e) or the scale division (d)

Item under Consideration:
Amend Handbook 44 Scales Code and Appendix D, Definitions as follows:

Changes proposed to Appendix D. Definitions

auxiliary indication – a means to increase the displayed resolution of a weighing device, such as a rider or vernier on an analog device, or a differentiated least significant digit to the right of the decimal point on a digital device. [2.20]

(Added 20XX)

extended display–mode. – a means to temporarily change the scale division (d) to a value less than the verification scale interval (e), following a manual command. [2.20]

(Added 20XX)

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

(Added 20XX)

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

(Added 1997) **(Amended 20XX)**

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

(Amended 20XX)

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

(Amended 20XX)

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

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

(Added 20XX)

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

(Added 1987) **(Amended 20XX)**

Changes proposed to Section 2.20. Scales Code

S.1.1.1. Digital Indicating Elements.

(a) A digital zero indication shall represent a balance condition that is within ± ½ the value of the scale division **d**.

(b) After zero-setting (gross zero or net zero after a tare operation) the effect of zero deviation on the result of the weighing shall be not more than ± 0.25 e.

[Nonretroactive as of January 1, 20XX]

~~***(b)***~~***(c) ~~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 of a scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).~~ A digital indicating device shall have a "center-of-zero" indicator that indicates a zero-balance condition when the deviation from zero is not more than ± 0.25 e. A "center-of-zero" indicator may operate when zero is indicated for gross and/or net mode(s). The "center-of-zero" indicator is not mandatory on a device equipped with an auxiliary indication or equipped with an enabled zero tracking mechanism that maintains a "center-of-zero" condition to ± 0.25 e.***

[Nonretroactive as of January 1, 1993]

~~(c)~~**(d)** *For electronic cash registers (ECRs) and point-of-sale systems (POS systems) the display of measurement units shall be a minimum of 9.5 mm (3/8 inch) in height.*

[Nonretroactive as of January 1, 2021]

(Added 2019)

(Amended 1992, 2008, ~~and~~ 2019**, and 20XX**)

S.1.2. Value of Scale ~~Division~~ Units. *– Except for batching scales and weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division "d"* ***and the verification scale interval "e"*** *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; or

Examples: scale divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

(c) a binary submultiple of a specific unit of weight.

Examples: scale divisions may be ½, ¼, 1/8, 1/16, etc.

[Nonretroactive as of January 1, 1986]

(Amended 20XX)

S.1.2.1. Digital Indicating Scales, Units. *– Except for postal scales, a digital-indicating scale shall indicate weight values using only a single unit of measure. Weight values shall be presented in a decimal format with the value of the scale division* ***"d"*** *expressed as 1, 2, or 5, or a decimal multiple or submultiple of 1, 2, or 5.*

The requirement that the value of the scale division ***"d"*** *be expressed only as 1, 2, or 5, or a decimal multiple or submultiple of only 1, 2, or 5 does not apply to net weight indications and recorded representations that are calculated from gross and tare weight indications where the scale division* ***"d"*** *of the gross weight is different from the scale division* ***"d"*** *of the tare weight(s) on multi-interval or multiple range scales. For example, a multiple range or multi-interval scale may indicate and record tare weights in a lower weighing range (WR) or weighing segment (WS), gross weights in the higher weighing range or weighing segment, and net weights*

as follows:

55 kg	*Gross Weight (WR2 d = 5 kg)*	*10.05 lb*	*Gross Weight (WS2 d = 0.05 lb)*
– 4 kg	*Tare Weight (WR1 d = 2 kg)*	*– 0.06 lb*	*Tare Weight (WS1 d = 0.02 lb)*
= 51 kg	*Net Weight (Mathematically Correct)*	*= 9.99 lb*	*Net Weight (Mathematically Correct)*

[Nonretroactive as of January 1, 1989]

(Added 1987) (Amended 2008 **and 20XX**)

S.1.2.2. Verification Scale Interval "e".

S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales. ~~**If e ≠ d, the verification scale interval "e" shall be determined by the expression:**~~

~~**d < e ≤ 10 d**~~

~~**If the displayed division (d) is less than the verification division (e), then the verification division shall less than or equal to 10 times the displayed division.**~~

~~The value of e must satisfy the relationship, $e = 10^k$ of the unit of measure, where k is a positive or negative whole number or zero. This requirement does not apply to a Class I device with d < 1 mg where e = 1 mg. If e ≠ d, the value of "d" shall be a decimal submultiple of "e," and the ratio shall not be more than 10:1. If e ≠ d, and both "e" and "d" are continuously displayed during normal operation, then "d" shall be differentiated from "e" by size, shape, color, etc. throughout the range of weights displayed as "d."~~

~~(Added 1999)~~

Scales Equipped with an Auxiliary Indication. – Only a Class I or II scale or a dynamic monorail may be equipped with an auxiliary indication. The auxiliary indication may be either a rider or vernier on an analog device, or a scale division "d" to the right of the decimal point on a digital device that is differentiated, for example by size, shape, or color.

A scale with an auxiliary indication shall not be equipped with an extended display mode.

The verification scale interval "e" on a scale equipped with an auxiliary indication shall be determined as follows:

(a) The value of "e" shall be greater than "d" and less than or equal to 10 "d" (d < e < 10 d), and

(b) The value of "e" must satisfy the relationship, $e = 10^k$ of the unit of measure, where k is a positive or negative whole number or zero.

Examples:

10^{-2}=0.01, 10^{-1}=0.1, 10^0=1, 10^1=10, 10^2=100, etc.

The requirement in subpart (a) does not apply to a Class I devices with e = 1 mg, where d shall be less than "e" (d < e).

Examples:

If e = 1 g for Class I or II, then "d" may only be 0.5 g, 0.2 g, or 0.1 g

If e = 1 mg for Class I, then "d" may be 0.5 mg, 0.2 mg, 0.1 mg, 0.05 mg, 0.02 mg, etc.

(Added 1999) (Amended 20XX)

S.1.2.2.2. Class III, III L, and IIII Scales. – The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales **and weight classifiers**, "e" must be ~~less than or~~ equal to "d."

(Added 1999) **(Amended 20XX)**

S.1.2.2.2.1. Dynamic Monorail Scales. – On a dynamic monorail scale the value of "e" shall be equal to or greater than "d".

S.1.2.2.2.2. Weight Classifiers. – On a weight classifier, such as a postal or shipping scale that rounds up and is marked for special use, the value of "e" shall be equal to or less than "d".

(Added 20XX)

S.1.2.2.3. Extended Display Mode. – A scale with an auxiliary indication shall not be equipped with an extended display mode. When a scale is equipped with an extended display mode, displaying an indication with a scale division "d" smaller than "e" shall be possible only:

(a) while pressing a key; or

(b) for a period not exceeding 5 seconds after a manual command.

Printing or transferring data via interface shall not be possible while the extended display mode is in operation.

(Added 20XX)

(Amended 2021 **and 20XX)**

S.5.4. Relationship of Minimum Load Cell Verification Interval Value to the Verification Scale ~~Division~~Interval. *– The relationship of the value for the minimum load cell verification scale interval, v_{min}, to the **verification** scale **~~division~~interval** **~~d~~ e**, for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent[1] weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):*

(a) $v_{min} \leq \frac{d*e}{\sqrt{N}}$ *for scales without lever systems; and*

(b) $v_{min} \leq \frac{d*e}{\sqrt{N} \times (\textbf{scale multiple})}$ *for scales with lever system*

[1]"Independent" means with a weighing/load-receiving element not attached to adjacent elements and with its own A/D conversion circuitry and displayed weight.

~~[*When the value of the scale division, d, is different from the verification scale division, e, for the scale, the value of e must be used in the formulae above.]~~

This requirement does not apply to complete weighing/load-receiving elements or scales, which satisfy all the following criteria:

- *the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;*
- *the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and*
- *the complete weighing/load-receiving element or scale is equipped with an automatic zero-tracking mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.*

[Nonretroactive as of January 1, 1994]

(Added 1993) (Amended 1996**,** 2016 **and 20XX**)

Table 3.
Parameters for Accuracy Classes

Class	*Value of the Verification Scale* ~~*Division*~~*Interval* (~~*d or*~~ *e*[1])	*Number of Verification Scale*[43] ~~*Divisions*~~*Intervals (n)*	
		Minimum	*Maximum*
	SI Units		
I	*equal to or greater than 1 mg*	*50 000*	*--*
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[21,54]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[32]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*

~~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.*~~

[21] *A Class III scale marked "For prescription weighing only" may have a verification scale* ~~*division*~~***interval*** *(e) not less than 0.01 g.*

(Added 1986) (Amended 2003)

[32] *The value of a* ***verification*** *scale* ~~*division*~~***interval (e)*** *for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of* ***verification*** *scale* ~~*divisions*~~***intervals (n)*** *shall be not less than 1000.*

(Amended 20XX)

[43] *On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of* ***verification*** *scale* ~~*divisions*~~***intervals****, (n), for each weighing range is determined by dividing the scale capacity for each range by the verification scale* ~~*division*~~***interval****, (e), for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the* n_{max} *for the summed indication shall not exceed the maximum specified for the accuracy class.*

(Added 1997)**(Amended 20XX)**

[54] *The minimum number of* ***verification*** *scale* ~~*divisions*~~***intervals (n)*** *for a Class III Hopper Scale used for weighing grain shall be 2000.*~~)~~

(Amended 20XX)

1 [*Nonretroactive as of January 1, 1986*]

(Amended 1986, 1987, 1997, 1998, 1999, 2003, ~~and~~ 2004**, and 20XX**)

Table S.6.3.a.
Marking Requirements

To Be Marked With ⇓	**Weighing Equipment**				
	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
Model Designation and Prefix (1)	X	X	X	X	X
Serial Number and Prefix (2)	X	X	X	X	X (16)
Certificate of Conformance Number (CC) (23)	X	X	X	X	X (23)
Accuracy Class (17)	X	X (8)	X (19)	X	
Nominal Capacity (3)(18)(20)	X	X	X		
Value of Scale Division, "d" (3)**(4)**	X	X			
Value of **Verification Scale Interval,** "e" **(3)**(4)	X	X			
Temperature Limits (5)	X	X	X	X	
Concentrated Load Capacity (CLC) (12)(20)(22)					
Special Application (13)	X	X	X		
Maximum Number of **Verification** Scale ~~**Divisions**~~**Intervals** (n_{max}) (6)		X (8)	X (19)	X	

Many rows of the table are not included in this proposal for brevity.

(Added 1990) (Amended 1992, 1999, 2000, 2001, 2002, ~~and~~ 2004**, and 20XX**)

Table S.6.3.b.
Notes for Table S.6.3.a. Marking Requirements

3. The device shall be marked with the nominal capacity. **The nominal capacity may be prefaced by the terms "capacity" or "Max."** ***For any scale where the value of "e" is equal to the value of "d" (see S.1.2.2.),*** ~~***T***~~***the*** *nominal capacity shall be shown together with the value of the scale division* ***"d" or the verification scale interval "e"*** *(e.g., 15 × 0.005 kg,* ~~***30 × 0.01 lb,***~~ *or capacity = 15 kg*~~***,***~~ *d = 0.005 kg****, or Max 15 kg e = 0.005 kg****) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device.* ***On multiple range or multi-interval scales the value of the***~~***Each***~~ *scale division* ~~*value*~~ ***"d" or verification scale interval "e"*** ~~*or weight unit*~~ *shall be marked* ***together with its associated nominal capacity***~~***on multiple range or multi-interval scales***~~***.*** ***For any scale that has no "d" or any scale where "e" does not equal "d" refer to Note 4.***
[Nonretroactive as of January 1, 1983]
(Amended 2005 **and 20XX**)

4. ~~***Required only if different from "d."***~~ ***Exceptions to Note 3 regarding marking of "e" and "d.".***

(a) For an ungraduated scale such as an equal arm scale where the scale graduations do not represent a fixed weight quantity, the nominal capacity shall be shown together with the verification scale interval "e" (e.g. capacity 1,000 g e = 0.1 g, or Max 1,000 g e = 01 g). These devices have no "d."

(b) For a scale where e does not equal d, such as a scale equipped with an auxiliary indication or a weight classifier marked for special use, the nominal capacity shall be shown together with the scale division "d" and the verification scale interval "e," (e.g., capacity 1,000 g e = 0.1 g d = 0.01 g, or Max 1,000 g e = 0.1 g d = 0.01 g).
[Nonretroactive as of January 1, 1986]
(Amended 20XX)

5. *Required only on Class III, III L, and IIII devices if the temperature range on the NTEP CC is narrower than and within − 10 °C to 40 °C (14 °F to 104 °F).*
[Nonretroactive as of January 1, 1986]
(Amended 1999)

6. *This value may be stated on load cells in units of 1000; e.g., n: 10 is 10 000 divisions.*
[Nonretroactive as of January 1, 1988]

7. *Denotes compliance for single or multiple load cell applications. It is acceptable to use a load cell with the "S" or Single Cell designation in multiple load cell applications as long as all other parameters meet applicable requirements. A load cell with the "M" or Multiple Cell designation can be used only in multiple load cell applications.*
[Nonretroactive as of January 1, 1988]
(Amended 1999)

8. *An indicating element not permanently attached to a weighing element shall be clearly and permanently marked with the accuracy Class of I, II, III, III L, or IIII, as appropriate, and the maximum number of* ***verification*** *scale* ~~***divisions***~~***intervals****,* n_{max}*, for which the indicator complies with the applicable requirement. Indicating elements that qualify for use in both Class III and III L applications may be marked III/III L and shall be marked with the* ~~***maximum number of scale divisions***~~***n_{max}*** *for which the device complies with the applicable requirements for each accuracy class.*
[Nonretroactive as of January 1, 1988]

Table S.6.3.b. Notes for Table S.6.3.a. Marking Requirements
(Amended 20XX)

Remainder of the table is omitted for brevity with this proposal.

T.1. Tolerance Values.

T.1.1. General. – The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table T.1.1. Tolerances for Unmarked Scales.

Note: When Table T.1.1. refers to T.N. sections it shall be accepted that the scale division d on the unmarked scale always equals the verification scale interval e.

(Amended 1990 **and 20XX**)

T.2. Sensitivity Requirement (SR).

T.2.2. General. – Except for scales specified in paragraphs T.2.3. Prescription Scales through T.2.8. Railway Track Scales: 2 **(e)** ~~d~~, 0.2 % of the scale capacity, or 40 lb, whichever is least.

(Amended 20XX)

T.2.4. Jewelers' Scales.

T.2.4.2. With More Than One-Half Ounce Capacity. – 1 **(e)** ~~d~~ or 0.05 % of the scale capacity, whichever is less.

(Amended 20XX)

T.2.7. Vehicle, Axle-Load, Livestock, and Animal Scales.

T.2.7.1. Equipped With Balance Indicators. – 1 **(e)** ~~d~~.

(Amended 20XX)

T.2.7.2. Not Equipped With Balance Indicators. – 2 **(e)** ~~d~~ or 0.2 % of the scale capacity, whichever is less.

(Amended 20XX)

T.2.8. Railway Track Scales. – 3 **(e)** ~~d~~ or 100 lb, whichever is less.

(Amended 20XX)

T.N.1. Principles.

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

T.N.1.2. Accuracy Classes. – Weighing devices are divided into accuracy classes according to the number of **verification** scale ~~**divisions**~~**intervals** (n) and the value of the **verification** scale ~~**division**~~**interval** ~~**(d)**~~**(e)**.

(Amended 20XX)

T.N.1.3. Verification Scale ~~Division~~Interval. – The tolerance for a weighing device is related to the value of ~~the scale division (d) or the value of~~ the verification scale ~~division~~**interval** (e) and is ~~generally~~ expressed in terms of ~~d or~~ e.

(Amended 20XX)

T.N.3. Tolerance Values.

T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales. – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 **e** ~~**d**~~ or 0.1 % of the scale capacity, whichever is less.

(Amended 1986 **and 20XX**)

Table 6.
Maintenance Tolerances
(All values in this table are in verification scale ~~divisions~~intervals (e))

Tolerance ~~in Scale Divisions~~								
	1		**2**		**3**		**5**	
Class	**Test Load Applied**							
I	0 -	50 000	50 001 -	200 000	200 001 +			
II	0 -	5 000	5 001 -	20 000	20 001 +			
III	0 -	500	501 -	2 000	2 001 -	4 000	4 001 +	
IIII	0 -	50	51 -	200	201 -	400	401 +	
III L	0 -	500	501 -	1 000	(Add 1 ~~d~~ **e** for each additional 500 ~~d~~ **e** or fraction thereof)			

(Amended 20XX)

T.N.4. Agreement of Indications.

…

T.N.4.3. Single Indicating Element/Multiple Indications. – In the case of an analog indicating element equipped with two or more indicating means within the same element, the difference in the weight indications for any load other than zero shall not be greater than one-half the value of the **verification** scale ~~division~~**interval (e)** ~~**(d)**~~ and be within tolerance limits.

(Amended 1986 **and 20XX**)

T.N.6. Sensitivity. – This section is applicable to all nonautomatic-indicating scales marked I, II, III, III L, or IIII.

T.N.6.1. Test Load.

(a) The test load for sensitivity for nonautomatic-indicating vehicle, axle-load, livestock, and animal scales shall be 1 ~~**d**~~**e** for scales equipped with balance indicator, and 2 ~~**d**~~**e** or 0.2 % of the scale capacity, whichever is less, for scales not equipped with balance indicators.

(b) For all other nonautomatic-indicating scales, the test load for sensitivity shall be 1 ~~d~~e at zero and 2 ~~d~~e at maximum test load.

(Amended 20XX)

T.N.8. Influence Factors.

…

T.N.8.1.3. Temperature Effect on Zero-Load Balance. – The zero-load indication shall not vary by more than:

(a) three ~~divisions~~e per 5 °C (9 °F) change in temperature for Class III L devices; or

(b) one ~~division~~e per 5 °C (9 °F) change in temperature for all other devices.

(Amended 1990 **and 20XX**)

T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed one ~~c~~**scale division (d)**; or the equipment shall:

(a) blank the indication; or

(b) provide an error message; or

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

The tolerance in T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility is to be applied independently of other tolerances. For example, if indications are at allowable basic tolerance error limits when the disturbance occurs, then it is acceptable for the indication to exceed the applicable basic tolerances during the disturbance.

(Amended 1997 **and 20XX**)

UR.3. Use Requirements.

UR.3.1. Recommended Minimum Load. – A recommended minimum load is specified in Table 8 since the use of a device to weigh light loads is likely to result in relatively large errors.

Table 8. Recommended Minimum Load

Class	Value of Verification Scale ~~Division~~Interval e ~~(d or e*)~~	Recommended Minimum Load in Verification Scale Interval e ~~(d or e*)~~
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
	equal to or greater than 0.1 g	50
III	All**	20*
III L	All	50
IIII	All	10

~~***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. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."****~~A minimum load of ~~**10 d**~~**5 e** is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

(Amended 1990 **and 20XX**)

Previous Action:
2023: Assigned to the Verification Scale Division (e) Task Group

Background:
This proposal is being brought forward because the HB44 Scales Code is confusing and contradictory in several respects. This is particularly related to e and d and this has been true since the code was created as a translation of OIML R76 into HB44 format and adopted in 1984. In the creation process, the translators made a few translation errors that changed meanings or simply left important things out. Even small changes can have significant effects. We have been struggling with the contradictions ever since. In some cases, we continue to apply the code in ways that do not follow the written text.

The original submitter (Ross Andersen, NY retired) compared each paragraph referring to d or e in HB44 to the corresponding sections of R76 and identified a number of translation errors that either changed the meaning or left out something important from R76. He also proposed fixes. The Task Group continued the work and has prepared this final proposal. The sheer number of changes makes the proposal appear complicated. The changes all flow from the initial translation errors. The Task Group believes the changes are absolutely necessary, and the changes will eliminate the known conflicts and contradictions in the Code. This will subsequently reduce confusion in enforcing it.

Proposed changes to Appendix D. Definitions are presented first. The proposed changes and additions to the Scales Code will be presented in order of appearance. For each change or group of changes there will be a brief justification. The translators made key errors in the translation of two paragraphs dealing with basic principles. The repair of each of these paragraphs has ripple effects requiring corresponding changes in multiple related paragraphs throughout the code.

Other Issues Discussed by the Task Group:

1. Based on input from the Scale Manufacturers Association and discussion within the task group the decision was made to replace all references to the "verification scale division" with the term "verification scale interval". The intent of this change is to clearly differentiate between the verification scale interval (e) and the scale division (d)

2. For reference, the following specifications, tolerances, and user requirements are specific to the scale division (d).

Code Section	Applies to	Justification
G-S.5.2.2.(c)	d	Rounding is a function of instrument operation not accuracy
G-S.5.2.2.(d)	d	Requires "d" to be an indicated zero and all digits to the left of "d" to be zero when d<1. Requires "d" to be an indicated zero and all digits to the right of "d" to be zero when d>5.
S.1.1.1.(a)	d	Describes width of the zero division, also sets up the normal rounding half-up/half-down
S.1.2.1	d	Refers to rounded values of d.
S.1.7.(b)	e	This is a classification issue addressing maximum indication above capacity.
S.2.1.2.	d	They must be in terms of d since stability of zero setting applies to d.
S.2.1.3.(all)	d	These limit the window for action of AZT. They must be in terms of d since zero setting applies to d.
S.2.3.	d	Tare division must equal smallest increment displayed.
T.N.7.	d	Discrimination requires an instrument to discriminate to the displayed scale division (zone of uncertainty). This relates to the rounding of the smallest increment.

3. The following specifications, tolerances, and user requirements are specific to the verification scale interval (e). No changes are proposed for these sections.

Code Section	Applies to	Justification
S.1.2.3.	e	This is a classification issue. It ensures accuracy of the piece counts.
N.1.10.	e	Refers to test loads verifying piece count and must be e.
N.4.5.	e	Refers to tolerances in time dependence tests and must be e.
T.N.9.	e	This is a tolerance for reaction to a disturbance.
UR.3.10.	e	As written, this is clearly e. (See item 4 as this may need additional study)

4. The Task Group also observed that method of referencing the scale division and verification scale interval is inconsistent throughout the Code. In some cases, the paragraph only uses the abbreviation d or e, in other cases the name is stated without the abbreviation and in other cases the name is included with the abbreviation d or e in quotes or parentheses. Because the proposal only considers sections that needed change, this issue is not addressed formally in the proposal. The Task Group believes the change to a consistent method could be made editorially by OWM.

Request from the Task Group to the NCWM S&T Committee

The Task Group asks the S&T committee to replace the current S&T Block 2 items (B2) with our recommended changes to NIST HB44. We further ask the committee to make the new "Block 2" an assigned item and return it to the task group so we can consider comments and make changes as needed.

Comments in Favor:

Regulatory:

- 2024 Interim: A representative from the State of Oregon commented that they support the item as voting.

- 2024 Interim: A representative from the State of California commented that they support the item as voting in accordance with the task group's recommendation.

Industry:

- 2024 Interim: The Scale Manufacturers Association commented that it supports the item as voting.

Advisory:

- 2024 Interim: A representative from the Scale Verification Division Task Group, the submitter, commented that incorrect use of d and e leads to confusion, and that this will correct the terminology in the handbook. They stated that the group believes the item is ready for a vote.
- 2024 Interim: A representative from NIST OWM stressed the importance of this item, and that the current code contains contradictions and inconsistencies which lead to confusion. NIST OWM recommends voting on this item.

Comments Against:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Item Development:

NCWM 2024 Interim Meeting: The committee made no changes to this item, believes this item is fully developed, and has assigned it voting status.

NCWM 2023 Annual Meeting: The Chair of the Specifications and Tolerances Committee asked for a volunteer for chair of the task group.

NCWM 2023 Interim Meeting: The committee updated the item under consideration with the language the task group forwarded to the committee on January 9, 2023. The committee looks forward to further development from the task group this item is assigned to.

Regional Associations' Comments:

This item was submitted by an NCWM Task Group following the fall regional meetings in 2022.

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item remain as assigned.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Loren Minnich (NIST OWM): Stated that the NCWM Verification Scale Division e Task Group now has a chairman and has met to begin cleaning up the language in the item. The task group will make changes to Table 8 so that it only references "verification scale division" (e). Mr. Minnich requested that this item be assigned an Informational status to receive feedback from the body of the NCWM.

Mr. Cory Hainy (Representing the SMA): Supported further development of this item with the recommendation that all references to "verification scale division" be changed to "verification interval". Mr. Hainy stated that the SMA will reconvene in November 2023, and requested that this item continue to be further developed.

Mr. Kevin Schnepp (California Division of Measurement Standards): Echoed the SMA with the request that this item be assigned an Informational status.

The WWMA 2023 S&T Committee recommends that this item be assigned an Informational status to allow the body of the NCWM to provide feedback.

SWMA 2023 Annual Meeting: The committee heard no comments on this item during Open Hearings.

The committee recommends this item remain an Assigned item.

NEWMA 2023 Interim Meeting: Steve Timar, NY, a member of the Scale Verification Task Group stated the TG has met a few times and there has been much progress, including cleaning up some definitions and other language. The TG has changed all references of "verification scale division" to "verification scale interval" throughout the item, as requested by SMA. A regulator Holliston, Massachusetts recommended a voting. A regulator from New Hampshire stated that the change to Table 6 in this proposal is different than New Hampshire's new proposal. Upon consensus of the body, the Committee recommends this item be Voting.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

SCL-24.3 V Table 6. Maintenance Tolerances

NOTE: This item was introduced through the Northeastern Weights and Measures Association.

Source:
New Hampshire Department of Agriculture, Markets, and Food

Purpose:
Provide clarity to NIST HB 44, 2.20. Scales, Table 6. Maintenance Tolerances.

Item under Consideration:
Amend Handbook 44 Scales Code as follows:

Table 6. Maintenance Tolerances (All values in this table are in scale divisions)				
Tolerance in Scale Divisions				
Class	1	2	3	5
	Test Load			
I	0 - 50 000	50 001 - 200 000	200 001 +	
II	0 - 5 000	5 001 - 20 000	20 001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	~~(~~Add 1 d for each additional 500 d or fraction thereof~~)~~ **(Only applies to Class III L)**	

Previous Status:
2024: New Proposal

Original Justification:
Table 6. will be easier to read if the vertical and horizontal grid lines are included, as seen in other tables within Handbook 44. The additional remarks added to Class III L will clarify the tolerance requirement for both regulators and other users of the handbook. Understanding Table 6. can be resolved through more thorough training.

The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:
- 2024 Interim: A representative from the state of New Hampshire, the submitter, commented that they originally thought of this as a housekeeping item. They support either option in the item at the discretion of the committee and recommend voting status.
- 2024 Interim: A representative from the State of Oregon recommended voting on this item after the committee chooses one of the options.
- 2024 Interim: A representative from the State of New Jersey recommended voting on this item with no preference for either option.
- 2024 Interim: A representative from the State of Arkansas commented that they support either option.

Industry:
- 2024 Interim: The Scale Manufacturers Association commented that it supports option 1.

Advisory:
- 2024 Interim: A representative from NIST OWM commented that the item should be informational until one of the options is chosen to vote on, but that NIST OWM supports the effort to provide clarity to Table 6, especially for Class IIIL.

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- 2024 Interim: A representative from the State of California recommended the committee pick one of the options in the item and further develop it. They also stated that the item does not currently provide clarity.

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: The committee removed the entirety of Option 2, and the phrase "OPTION 1" from the item. The committee believes this item is fully developed and has assigned it voting status.

Regional Associations' Comments:
This item was introduced only to NEWMA in Fall 2023.

NEWMA 2023 Interim Meeting: A presentation was provided by a regulator from the State of New Hampshire. The basis for the changes is to modify the appearance of table to be easier to read by adding horizontal and vertical lines and to add clarification for Class IIIL scales. Two options for modification of the table have been provided. The regulator believes this could be a simple editorial change. The State of New York and Commonwealth of Pennsylvania believe the proposed modifications add value and clarity. Upon consensus of the body, the Committee recommends a Developing status, with both options presented to the membership for further discussion.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

SCL-22.2 A UR.1. Selection Requirements, UR.3.1.X. Required Minimum for Cannabis Products.

Source:
NCWM Cannabis Task Group

NOTE: The Scales Focus Group of the NCWM Cannabis Task Group modified the proposal in the fall of 2022 as represented below.

The Scales Subgroup recognizes that, in addition to the proposed modifications of Table 7a, guidance is needed to assist businesses and inspectors in identifying suitable devices for use in various applications used to weigh Cannabis.

The Scales Subgroup plans to continue discussions on the best method(s) for developing that guidance. This may include one or more of the following:

- *Developing a guidance document to assist users, scale service companies, and inspectors in identifying appropriate scales for Cannabis weighing applications.*
- *Revisiting proposed modifications to paragraph UR.1. to either include:*
  - *Proposing minimum requirements for Class II all weighing applications (non- product specific) as is already in place in some states; or*
  - *Proposing minimum requirements for Class II weighing applications used specifically for Cannabis.*

Purpose:
Establish uniform scale suitability requirements among the states for sales of cannabis.

Item Under Consideration:
Amend Handbook 44, Scales Code as follows:

UR.1.1. General.

(a) For devices marked with a class designation, the typical class or type of device for particular weighing applications is shown in Table 7a. Typical Class or Type of Device for Weighing Applications.

(b) For devices not marked with a class designation, Table 7b. Applicable to Devices not Marked with a Class Designation applies.

Table 7a.
Typical Class or Type of Device for Weighing Applications (Also see Table 8)

Class	Weighing Application or Scale Type
I	Precision laboratory weighing **and weighing of all *Cannabis* products**
II	Laboratory weighing, precious metals and gem weighing, grain test scales**, and weighing of all *Cannabis* products**
III	All commercial weighing not otherwise specified, grain test scales, retail precious metals and semi-precious gem weighing, grain-hopper scales, animal scales, postal scales, vehicle on-board weighing systems with a capacity less than or equal to 30 000 lb, and scales used to determine laundry charges**, and weighing of all *Cannabis* products**
III L	Vehicle scales (including weigh-in-motion vehicle scales), vehicle on-board weighing systems with a capacity greater than 30 000 lb, axle-load scales, livestock scales, railway track scales, crane scales, and hopper (other than grain hopper) scales
IIII	Wheel-load weighers and portable axle-load weighers used for highway weight enforcement

Notes:
A scale with a higher accuracy class than that specified as "typical" may be used.
The use of italicized text in the references to "*Cannabis*" in this table is only to denote its proper taxonomic term; the italicized font does not designate a "nonretroactive" status as is the convention used throughout NIST Handbook 44.

(Amended 1985, 1986, 1987, 1988, 1992, 1995, 2012, ~~and~~ 2021**, and 20XX**)

Table 8. Recommended Minimum Load		
Class	**Value of Scale Division (d or e*)**	**Recommended Minimum Load (d or e*)**
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
	equal to or greater than 0.1 g	50
III	All**	20
III L	All	50
IIII	All	10

*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. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."

**A minimum load of 10 d is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

Notes:
Scales used for commercial purposes to buy or sell commodities that have a total weight of 3 ounces or less shall be class II, National Type Evaluation Program compliant and have a scale division of not greater than 0.01 gram.

(Amended 1990 **and 20XX**)

UR.3.1.X. Required Minimum Loads for Cannabis Products. - The recommended minimum loads specified in Table 8 shall be considered required minimum loads for scales used to weigh Cannabis and Cannabis-containing products.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

Previous Action:
2023: Assigned to the Cannabis Task Group
2022: Assigned to the Cannabis Task Group.

Original Justification:
As states legalize sales of cannabis in its various forms, the need has arisen for uniform standards for scale suitability. Uniform requirements from one state to the next, will strengthen each jurisdiction's ability to effectively regulate the industry in a fair and equitable manner. Uniform standards also provide industry with expectations regardless of the jurisdiction, reducing potential conflict or confusion.

Some states may already have scale suitability requirements differing for those proposed here. The task group is hopeful that differences can be resolved so that the standards are the same in every jurisdiction:

The proposed suitability requirements are based on existing standards as set forth by the California Division of Standards, Division of Measurement Standards.

The submitter requested that this item be a Developing Item.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: A representative of the task group commented that the item is fully developed and ready for a vote.

Comments Against:

Regulatory:
- 2024 Interim: A representative from California commented that they do not support this version but supported a previous version of the item.
- 2024 Interim: A representative from LA County, CA commented that there is a lack of clarity in Table 7a and that minimum load parameters should be retained. Also, the mention of non-retail cannabis contradicts California law as the track and trace system does not recognize non-retail designations.

Industry:
- 2024 Interim: A representative from the Scale Manufacturers Association supported further development and noted that the SMA's position is based on a previous version.

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST OWM commented that the proposed changes to Table 7a are ambiguous and recommended assigned status.

Item Development:
NCWM 2024 Interim Meeting: The Committee updated the item to the latest version from the task group and the title to reflect the current item under consideration. The Committee has some concerns with the language "National Type Evaluation Program compliant" in the note being added to Table 8. The Committee also heard support during open hearings for a previous version of the item and concerns about the use of the terms "all cannabis" and "non-retail cannabis". The Committee has given this item an assigned status and requests the task group address the concerns that have been raised.

NCWM 2023 Annual Meeting: The committee heard from Charles Rutherford (Co-Chair of the task group) that they were waiting on the outcome of item SCL-23.3 before moving forward with this item.

NCWM 2023 Interim Meeting: The committee updated the item to include UR-3.1.2., as recommended by NEWMA. The committee has designated this item as assigned per recommendations from the submitters.

NCWM 2022 Annual Meeting: The Committee was given an update from Mr. Charles Rutherford, NCWM Cannabis Task Group Co-Chair. In his update, Mr. Rutherford requested that this item remain Assigned to the Task Group for further discussion. The Scales Focus Group will be regrouping, with Mr. Lou Sakin (Hopkinton, MA) as the Chair, for further development of the item. The Committee has agreed that this item will retain an Assigned status.

NCWM 2022 Interim Meeting: After hearing comments from the floor and referencing submitted supporting documents, the Committee has assigned this item back to the NCWM Cannabis Task Group for further development. The Task Group should consider the several proposals for alternate language that were provided by the regional associations. For more information or to provide comment, please contact:

Vince Wolpert	Charles Rutherford
NCWM Cannabis Task Group	NCWM Cannabis Task Group
vwolpert@azda.gov	charlie@cprsquaredinc.com

Regional Associations' Comments:

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item remain as assigned.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Vince Wolpert (NCWM Cannabis Task Group Co-Chair): This item is still being developed by the task group and requested the item remain assigned to the task group.

Mr. Kevin Schnepp (California, Division of Measurement Standards): Questioned basing the suitability of a scale on the type of product. Recommended this item remain assigned to the task group.

Mr. Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program): Echoed Mr. Schnepp.

Mr. Kurt Floren (Los Angeles County, California): Referred to previous language of the item which stated weight ranges for the suitability of the device and the current language now references a product type. Recommended referring to the previous language of weight ranges. Commented Table 7a. is not enforceable and the item should remain assigned to the task group.

Mr. Cory Hainy (Representing the SMA): Recommended a change of language in Table 7a. class III devices, replace the words "All Cannabis" with "non-retail Cannabis". Recommend adding a comment in Table 7a. for reference to Table 8. for scale selection.

Ms. Wendy Hahn (Stanislaus County, California): Echoed Mr. Harrington with an additional concern that the table is confusing and someone may select a class of device that may not be suitable.

Mr. Aaron Yanker (Colorado Dept. of Agriculture Weights and Measures): Supports this item with the proposed changes heard on the floor.

The WWMA 2023 S&T Committee recommends this item remain Assigned to the NCWM Cannabis Task Group and recommends the task group consider the comments heard during the open hearing.

SWMA 2023 Annual Meeting: The committee heard no comments on this item during Open Hearings.

The committee recommends this item remain an Assigned item.

NEWMA 2023 Interim Meeting: A regulator from Holliston, Massachusetts, and a Cannabis Task Group member, recommends this item remain as assigned pending the Verification Scale Division Task Group item, as it impacts this item. Upon consensus of the body, the Committee recommends this item be Assigned.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

AWS – AUTOMATIC WEIGHING SYSTEMS CODE

AWS-24.1 V N.1.5. Test Loads.

Source:
Marel Ltd.

Purpose:
Re-word AWS test loads section for clarity and consistency across rest of handbook.

Item under Consideration:
Amend Handbook 44 Automatic Weighing Systems Code as follows:

N.1.5. Test loads. - A performance test shall ~~**consist of four separate test runs**~~**be** conducted ~~**at**~~**with a minimum of four** different test loads according to Table N.1.5. Test Loads.

(Amended 20XX)

Previous Status:
2024: New Proposal

Original Justification:
Existing wording could be interpreted a number of different ways. This uncertainty bad for NTEP labs, W&M inspectors, and manufacturers. The original intention can be seen in HB 44 AWS N.2.2.2 and in Publication 14, AWS 35.1.7 (copied below for convenience). I have spoken to NCWM staff and had it confirmed that the widely understood interpretation and understanding of note N.1.5. is as my replacement wording describes.

HB 44 AWS, N.2.2.2. 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., near the lowest and highest ranges in which the device is typically operated.) Each test load should be run a minimum of ten consecutive times.

Pub 14 AWS, 35.1.7. 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.

Checkweighers have similar requirements but must be run the number of times as described in N.4.2 (copied below). All those numbers are 10 or greater so “minimum of 10 consecutive times” still works fine for checkweighers.

Pub 14 AWS, Table N.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*

The submitter acknowledged the following potential arguments: The intention is for only four consecutive test runs per test loads. The openness of the wording allows laboratories and inspectors leeway to vary testing as they see fit for that application.

The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:
- None

Industry:
- 2024 Interim: A representative from the Scale Manufacturers Association supported voting status for the item.

Advisory:
- 2024 Interim: A representative from NIST OWM supported voting status with changes recommended in the NIST OWM Analysis.

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: The Committee revised the proposal per NIST OWM recommendations agreed to by the submitter. The changes included striking the phrase "consist of at least four", unstriking the word "conducted", adding the phrase "with a minimum of four" after "conducted at" and removing the phrase ", each load being run a minimum of ten consecutive times". The committee believes the item is fully developed and assigned it a voting status.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as developing and seeks input from industry stakeholders.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

A question was raised by the WWMA S&T Committee directed to the submitter - the proposed language would seem to bring in repeatability tolerance requirements as at a minimum each test load is to be performed 10 times consecutively, is this the intention? The committee did not receive a response during open hearings.

Mr. Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program): Supports this item for a Voting status.

Mr. Cory Hainy (Representing the SMA): The association has not met on this item and intends to review it in the November 2023 SMA meeting.

Mr. Aaron Yanker (Colorado Dept of Agriculture Weights and Measures): Questioned the language of the types of tests, the definitions per the item, and the reference in Table N.4.2 referring only to the type evaluation and not the entire table. Recommended this item for Developing status.

Mr. Loren Minnich (NIST OWM): The current language as written in existing code is causing confusion on testing the devices and this item is an attempt to clarify that language.

Mr. Kevin Schnepp (California Division of Measurement Standards): Recommends this item be assigned a Developing status with pending review and position from the SMA.

The WWMA 2023 S&T Committee recommends this item be assigned a Developing status to allow the submitter the opportunity to receive input from stakeholders and address comments heard during open hearings. The committee further recommends that these items, AWS-24.2, and AWS-24.3 be Blocked.

SWMA 2023 Annual Meeting: Cory Hainy, SMA, stated they have not met to develop a position on this item.

The committee believes this item has merit regarding clarifying the required number of tests with new language.

The committee recommends this item move forward as a Developing item to allow additional feedback from other stakeholders.

NEWMA 2023 Interim Meeting: No comments were heard on this item and the Committee does not have a recommendation.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

AWS-24.2 V ~~N.1.6. Influence Factor Testing.~~

Source:
Marel Ltd.

Purpose:
Remove [influence factor testing conducted statically] section for clarity and consistency across rest of handbook.

Item under Consideration:
Amend Handbook 44 Automatic Weighing Systems Code as follows:

~~**N.1.6. Influence Factor Testing. – Influence factor testing shall be conducted statically.**~~

Previous Status:
2024: New Proposal

Original Justification:
It looks like HB44 was amended in 2004 to mandate automatic testing for automatic machines but this contradicting clause was accidentally left in? See HB 44 AWS N.2 Note, N.2.2.1, and Pub 14 AWS 36 (copied below for convenience).

HB 44 AWS N.2

Note: *If the device is designed for only automatic weighing, it shall only be tested in the automatic weighing mode.*

(Amended 2004)

HB 44 AWS

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

Pub 14 AWS 36

Influence factor testing shall be conducted:

- *If the device is designed for use in static weighing, it shall be tested statically using mass standards.*
- *If the device is designed for only dynamic weighing, it shall only be tested dynamically.*
- *If the device is designed for static and dynamic weighing, it shall be tested statically and dynamically*

The submitter acknowledged the following potential arguments: Influence factors should be tested statically (more repeatable results not dependent on vibrations, conveyor belt transfers, etc.) and the other sections, for example HB 44 AWS N.2. and Pub 14 AWS 36, should be changed or removed.

The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:
- None

Industry:

- 2024 Interim: A representative from the Scale Manufacturers Association supported voting status for the item.

Advisory:

- 2024 Interim: The Chairperson of the NTEP Weighing/Belt-Conveyor Sector commented that they do not oppose removing N.1.6.
- 2024 Interim: Comments were heard from NIST OWM supporting the removal of N.1.6. and recommending a voting status.

Comments Against:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Item Development:
NCWM 2024 Interim Meeting: The Committee agrees with the comments heard during open hearings and has assigned a voting status to the item.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as developing and seeks input from industry stakeholders.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Cory Hainy (Representing the SMA): The association has not met on this item and intends to review it in the November 2023 SMA meeting.

Mr. Kevin Schnepp (California Division of Measurement Standards): Recommends this item be assigned a Developing status with pending review and position from the SMA.

The WWMA 2023 S&T Committee recommends this item be assigned a Developing status to allow the submitter time to receive input from stakeholders. The committee further recommends that these items, AWS-24.1, and AWS-24.3 be Blocked.

SWMA 2023 Annual Meeting: Cory Hainy, SMA, state they have not met to develop a position on this item.

The committee feels that this item has merit.

The committee recommends this item move forward as a Developing item to allow for additional feedback regarding the use of static influence factor testing for automatic weighing systems.

NEWMA 2023 Interim Meeting: No comments were heard on this item and the Committee does not have a recommendation.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

AWS-24.3 V N.2.2.3. Shift Test (Dynamic).

Source:
Marel Ltd.

Purpose:
Introduce dynamic shift test for automatic weigh labelers.

Item under Consideration:
Amend Handbook 44 Automatic Weighing Systems Code as follows:

N.2.2.3. Shift Test (Dynamic). - The device shall be tested at the normal operating speed. 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 a minimum of 10 consecutive times, and (2) halfway between the center and back edge a minimum of 10 consecutive times.

Note: The shift test is not applicable if the device has a means to align packages.

(Added 20XX)

Previous Status:
2024: New Proposal

Original Justification:
HB 44 currently only recognizes static shift tests but since automatic weighing systems that are designed to weigh only automatically should only be tested automatically, there should be a method to test the ability of an automatic only machine to cope with off-center loads.

Publication 14 AWS §35.1.8. (copied below for convenience) already describes an automatic/dynamic shift test that has been used many times and is clearly understood by laboratories, inspectors, and manufacturers. By copying this over to HB 44 and adapting the wording slightly, we can better align HB 44 and Pub 14 and reduce confusion and misunderstandings.

Pub 14 AWS

35.1. Static Tests
35.1.1. Increasing-load test…

35.1.2. Decreasing-load test…

35.1.3. Shift test…

35.1.4. Discrimination test…

35.1.5. Zero-load balance change…

35.1.6. Influence factor testing…

35.1.7. 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.

35.1.8. 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.

(1)
(2)

The submitter acknowledged the following potential arguments: Testing shift dynamically is available for NTEP laboratories but is intentionally not made a requirement in Handbook 44. Dynamic shift testing is not expected to be carried out during field tests or subsequent evaluations.

The passage is fine but the name should be "Shift Test (Automatic)" as 'automatic' is frequently used in HB 44 where 'dynamic' is used in Pub 14.

The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:
- None

Industry:
- 2024 Interim: A representative from the Scale Manufacturers Association supported voting status for the item.

Advisory:
- 2024 Interim: Comments were heard from a NIST OWM representative recommending voting status. The representative noted that Handbook 44 currently has no shift test requirement, and this proposal would align Handbook 44 more closely with OIML.

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Item Development:
NCWM 2024 Interim Meeting: The Committee agrees with the comments heard during open hearings and has assigned a voting status to the item.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as developing and seeks input from industry stakeholders.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Cory Hainy (Representing the SMA): The association has not met on this item and intends to review it in the November 2023 SMA meeting.

Mr. Kevin Schnepp (California, Division of Measurement Standards): Recommends this item be assigned a Developing status with pending review and position from the SMA.

Mr. Kurt Floren (Los Angeles County, California): Recommend this item be assigned a Developing status. He raised a concern that the existing requirement for a shift test load is 50% of the total scale capacity, he proceeded to question the reasoning behind the change in the shift test load to 1/3 of the total scale capacity.

The WWMA 2023 S&T Committee recommends this item be assigned a Developing status to allow the submitter time to receive input from stakeholders. The committee further recommends that these items, AWS-24.1, and AWS-24.2 be Blocked.

SWMA 2023 Annual Meeting: Cory Hainy, SMA, stated they have not met to develop a position on this item.

The committee feels a separate shift test may not be practical for routine field testing and suggests incorporating the shift test into the existing test procedure.

The committee recommends the item move forward as a Developing item.

NEWMA 2023 Interim Meeting: No comments were heard on this item and the Committee does not have a recommendation.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

WIM – WEIGH-IN-MOTION SYSTEMS

WIM-23.1 V 2.26 Weigh-in-Motion Systems Used for Vehicle Direct Enforcement

Source:
New York City DOT, C2SMART, and Kistler

Purpose:
Provide a legal document that can be used by local and State agencies to certify Weigh-In-Motion (WIM) systems used for automated weight enforcement.

Item under Consideration:
Add Handbook 44 Weigh-In-Motions Systems Used for Vehicle Direct Enforcement Code as follows:

Table of Contents

Section 2.26 Weigh-In-Motion Systems Used for Vehicle Direct Enforcement

A. Application

A.1. General. – This code applies to systems installed in a fixed location used to weigh vehicles, while in motion, for the purpose of direct enforcement of legal weight limits.

A.2. Exception. – This code does not apply to weighing systems intended for the collection of statistical traffic data and weighing systems used for vehicle enforcement screening.

A.3. Additional Code Requirements. – In addition to the requirements of this code, weigh-in-motion systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

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

S.1.1. Ready Indication. – The system shall provide a means of verifying that the system is operational and ready for use.

S.1.2. Value of System Division Units. – The value of a system 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.

Examples: divisions may be 10, 20, 50, 100; or 0.01, 0.02, 0.05; or 0.1, 0.2, 0.5, etc.

S.1.2.1. Units of Measure. – The system shall indicate weight values using only a single unit of measure.

S.1.3. Maximum Value of Division. – The value of the system division "d" weigh-in-motion (WIM) system shall not be greater than 200 kg or 500 lb.

S.1.3.1. Number of System Divisions. – The number of system divisions shall be a minimum of 50 and a maximum of 1,000.

S.1.3.2. Minimum Capacity. – The minimum capacity in system divisions shall be 10.

S.1.4. Value of Other Units of Measure.

S.1.4.1. Speed. – Vehicle speeds shall be measured in miles per hour or kilometers per hour.

S.1.4.2. Axle-Spacing (Length). – The center-to-center distance between any two successive axles shall be measured in:

(a) meters and decimal submultiples of a meter;

(b) feet and inches; or

(c) feet and decimal submultiples of a foot.

S.1.4.3. Vehicle Length. – If the system is capable of measuring the overall length of the vehicle, the length of the vehicle shall be measured in feet and/or inches, or meters.

S.1.5. Capacity Indication. – An indicating or recording element shall not display nor record any values greater than 105 % of the specified capacity of the load receiving element.

S.1.6. Identification of a Fault. – Fault conditions affecting accuracy as specified in Table T.2.3. Maintenance Tolerances for Accuracy shall be presented to the operator in a clear and unambiguous means. No weight values shall be indicated or recorded when a fault condition is detected. The following fault conditions shall be identified:

(a) Vehicle speed is below the minimum or above the maximum system specified speed.

(b) The maximum number of vehicle axles as specified has been exceeded.

(c) A change in vehicle speed greater than that specified has been detected.

(d) Imbalanced weight between the left and right wheels has exceeded the specified values.

(e) Vehicle has changed lanes between or in the proximity of the first and the last sensors.

(f) Any axle or wheel, or part of each is not on the load-receiving element of the sensors.

(g) Vehicle direction of travel is not valid for the installation.

S.1.7. Recorded Representations.

S.1.7.1. Values to be Recorded. – At a minimum, the following values shall be printed and/or stored electronically for each vehicle weighment:

(a) transaction identification number;

(b) station ID;

(c) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in motion);

(d) vehicle speed;

(e) number of axles;

(f) weight of each axle;

(g) identification and weight of axle groups;

(h) axle spacing;

(i) gross vehicle weight;

(j) total vehicle length;

(k) all fault conditions that occurred during the weighing of the vehicle, as identified in paragraph S.1.6. Identification of a Fault;

(l) violations, as identified in paragraph S.2.1. Violation Parameters, which occurred during the weighing of the vehicle; and

(m) time and date.

Note: Consult the specific jurisdictional legislation for additional values that may be required to issue enforcement violations. All gross vehicle, axle, and axle group weights must be printed and/or stored with the corrected values that include any necessary reductions due to the system tolerance and adopted violation thresholds. Violation thresholds may be dependent on additional items, not specified in this code.

S.1.8. Value of the Indicated and Recorded System Division. – The value of the system's division "(d)," as recorded, shall be the same as the division value indicated.

S.2. System Design Requirements.

S.2.1. Violation Parameters. – The instrument shall be capable of accepting user-entered violation parameters for the following items:

(a) single axle weight limit;

(b) axle group weight limit;

(c) gross vehicle weight limit; and

(d) bridge formula maximum.

The instrument shall display and/or record violation conditions when these parameters have been exceeded.

Note: Jurisdiction-defined weight limits for S.2.1 Violation Parameters (a) through (d) can be used to determine the violation.

S.3. Design of Weighing Elements.

S.3.1. Multiple Load-Receiving Elements. – An instrument with a single indicating or recording element, or a combination indicating-recording element, that is coupled to two or more load-receiving elements with independent weighing systems, shall be provided with means to prohibit the activation of any load-receiving element (or elements) not in use, and shall be provided with automatic means to indicate clearly and definitely which load receiving element (or elements) is in use.

S.4. Design of Weighing Devices. – WIM systems for direct enforcement of legal weight limits shall meet the requirements of this code.

S.5. Design of Balance

S.5.1. Zero-Tracking Device. – A zero-tracking device shall have a range of 4% of the system capacity and operate only when:

(a) the system is in a no-load condition;

(b) is in stable equilibrium; and

(c) the corrections are not more than 0.5 d per second

S.5.2. Totalizing Device. – A WIM system may be provided with a totalizing device for determining gross vehicle weight which operates:

(a) automatically, in which case the instrument shall be provided with a vehicle recognition device defined in S.5.4. Vehicle Recognition/Presence Device; or

(b) semi-automatically (e.g., it operates automatically following a manual command).

S.5.3. Vehicle Recognition/Presence Device. – WIM systems which are able to operate without the intervention of an operator shall be provided with a vehicle recognition device. The device shall detect the presence of a vehicle in the weigh zone and shall detect when the whole vehicle has been weighed. WIM system shall not indicate or print the vehicle mass unless all wheel loads of the vehicle have been weighed.

S.6. Accidental Breakdown and Maladjustment. – WIM system shall be so constructed that an accidental breakdown or maladjustment of control elements likely to disturb its correct functioning cannot take place without its effect being evident.

S.7. Marking Requirements. – In addition to the marking requirements in G-S.1. Identification, the system shall be marked with the following information:

(a) value of the system division "d";

(b) operational temperature limits;

(c) number of instrumented lanes (not required if only one lane is instrumented);

(d) minimum and maximum vehicle speed;

(e) maximum number of axles per vehicle;

(f) maximum change in vehicle speed during weighment;

(g) minimum and maximum load; and

(h) any restrictions specified in the NTEP Certificate of Conformance.

S.7.1. Location of Marking Information. – The marking information required in Section 1.10. General Code, G-S.1. Identification and S.7. Marking Requirements shall be visible after installation. The information shall be marked on the system or recalled from an information screen.

N. Notes

N.1. Test Procedures.

N.1.1. Selection of Test Vehicles. – All dynamic testing associated with the procedures described in each of the subparagraphs of N.1.6 Test Procedures shall be performed with vehicles of these three types, at a minimum.

(a) a two-axle, six-tire, single-unit truck or Federal Highway Administration (FHWA) Class 5; that is, a vehicle with two axles with the rear axle having dual wheels;

(b) a three-axle, single-unit truck or FHWA Class 6; and

(c) a five-axle, single-trailer truck or FHWA Class 9 (3S2 Type).

(d) The gross vehicle weights shall be as stated in N.1.2.2. Dynamic Test Loads.

Note 1: Consideration should be made for testing the system using vehicles which are typical to the roadway in which the system is installed if different than the types listed in (a) through (c) above.

Note 2: If the WIM system will be used to enforce the weight limit for vehicles with liquid loads, a vehicle with a liquid load shall be included in the selection of test vehicles.

N.1.1.1. Weighing of Test Vehicles. – All test vehicles shall be weighed statically on a reference scale, meeting the requirements of Appendix A, before being used to conduct dynamic tests.

N.1.1.2. Determining Reference Weights for Axles, Axle Groups, and Gross Vehicle Weight. – The reference weights shall be the average weight value of a minimum of three static weighments of all single axles, axle groups, and gross vehicle weight on a reference scale before being used to conduct the dynamic tests.

Note: The axles within an axle group are not considered single axles.

N.1.2. Test Loads.

N.1.2.1. Static Test Loads. – All static test loads shall use certified test weights.

N.1.2.2. Dynamic Test Loads. – Test vehicles used for dynamic testing shall be loaded as specified below. Except when testing for liquid loads, the "load" shall be non-shifting and shall be positioned to present as close as possible, an equal side-to-side load.

(a) a half load condition (60-80% of the legal load limit of the test vehicle) for a minimum of 10 runs per test vehicle type;

(b) a full load condition (> 85% of the legal load limit for the test vehicle) for a minimum of 20 runs per test vehicle type; and

(c) When it is anticipated that a system will be used to enforce weight limits for vehicles that may be unloaded, e.g., an unloaded Class 9 vehicle crossing a bridge with a 20 TN maximum capacity, tests shall include unloaded vehicles as part of the test load.

N.1.3. Reference Scale. – Each reference vehicle shall be weighed statically on a multiple platform vehicle scale, an axle-load scale, portable axle-load weighers, or wheel-load weighers.

The scale shall be tested prior to use to establish reference test loads and shall meet the applicable NIST Handbook 44 tolerances. The official with statutory authority has the discretion to establish the location of the reference scale and timeframe in which it shall be tested.

N.1.3.1. Multi-Independent Platform Vehicle Scale System. – When using a multi-independent platform vehicle scale system, the three individual weighing/load receiving elements shall be of such dimension and spacing to facilitate the single-draft weighing of all reference test vehicles;

(a) the simultaneous weighing of each single axle and axle group of the reference test vehicles on different individual elements of the scale; and

(b) gross vehicle weight determined by summing the values of the different reference axle and reference axle groups of a test vehicle.

N.1.3.2. Axle-Load Scale. – When using an axle-load scale, each individual axle or axle group of the reference test vehicle shall be measured on the axle-load scale. Only one single axle or axle group for measurement shall be on the single platform, while other single axles or axle groups shall be off the platform. The gross vehicle weight shall be determined by summing all the single axles and axle groups.

N.1.3.3. Portable Axle-Load Weighers.

(a) When using a single portable axle-load weigher, each individual axle or axle group of the reference test vehicle shall be measured on the portable axle-load weigher. Only one single axle or axle group for measurement shall be on the weighing element of the device. The other single axles or axle groups shall not be in contact with the weighing element. The gross vehicle weight shall be determined by summing all the single axles and axle groups.

(b) When using more than a single portable axle-load weigher, each individual axle or axle group of the reference test vehicle shall be on the weighing element of a device. The gross vehicle weight shall be determined by summing all the single axles and axle groups.

N.1.3.4. Wheel-Load Weighers. – When using wheel-load weighers, each individual axle load of the reference test vehicles shall be measured on wheel-load weighers. The gross vehicle weight shall be determined by summing all axle loads.

When utilizing portable axle-load weighers or wheel-load weighers to determine the value of individual axles or axle-group loads, the reference vehicle shall be in a reasonably level position not to exceed 3 degrees or 5 % at the time of such determination.

N.1.4. Test Speeds. – All dynamic tests shall be conducted at two designated speeds.

(a) at a high speed – posted speed limit (Vmax); and

(b) at a low speed – site-specific minimum speed, not below manufacturer's requirement (Vmin).

N.1.5. Reference Axle Spacings. – To establish reference axle spacing, before measuring the axle spacing, the test vehicle shall be positioned straight, and the driving axle shall also be straight. A steel tape measure shall be used for measurement. Both left and right axle spacing shall be measured, and the average of two measurements shall be recorded by the nearest cm (inches). Each axle spacing shall be made by a single measurement.

N.1.6. Test Procedures.

N.1.6.1. Dynamic Load Test. – The dynamic test shall be conducted using the test vehicles defined in N.1.1. Selection of Test Vehicles and at the load condition as stated in N.1.2. Test Loads and at the speed as stated in N.1.4. Test Speeds. The number of runs shall be per Table N.1.6.

At the conclusion of the dynamic test, there shall be a minimum of 20 weight readings for each single axle, axle group, and gross vehicle weight of each test vehicle. The tolerance for each weight reading shall be based on the percentage values specified in Table T.2.3. Maintenance Tolerances.

Note. Any vehicle records identified as fault conditions listed in S.1.6. Identification of a Fault or jurisdiction defined fault conditions shall be excluded from the minimum weight readings in N.1.6.1. Dynamic Load Test.

See Table N.1.6 below to summarize the minimum number of test runs.

Table N.1.6
Minimum Number of Test Runs per Each Test Vehicle

Load Condition	Speed
Half Load (10 runs)	High Speed Vmax (5 runs)
	Low Speed Vmin (5 runs)
Full Load (20 runs)	High Speed Vmax (10 runs)
	Low Speed Vmin (10 runs)

N.1.6.2. Axle Spacing Test. – The axle spacing test is a review of the displayed and/or recorded axle spacing distance of the test vehicles. The tolerance value for each distance shall be based on the tolerance value specified in T.2.4. Tolerance Value for Axle Spacing.

T. Tolerances

T.1. Principles.

T.1.1. Design. – The tolerance for a weigh-in-motion system is a performance requirement independent of the design principle used.

T.2. Tolerance Values for Accuracy.

T.2.1. Acceptance Tolerance. – Acceptance tolerance shall be 50% of tolerances in Table T.2.3. Maintenance Tolerances for Accuracy. The acceptance tolerance shall apply to a new installation, within 30 days of a new installation being placed in service, when an existing system undergoes major reconditioning or overhaul, or during type evaluation.

T.2.2 Tests Involving Digital Indications or Representations. – To the tolerances that would otherwise be applied in paragraphs T.2.3. Tolerance Value for Dynamic Load Test, there shall be added an amount equal to one-half the value of the system division to account for the uncertainty of digital rounding.

T.2.3. Maintenance Tolerance Values for Dynamic Load Test. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.3. for direct enforcement purposes.

Table T.2.3.
Maintenance Tolerances

Load Description	Tolerance as a Percentage of Applied Test Load
Axle Load	± 20 %
Axle Group Load (including bridge formula)	± 15 %
Gross Vehicle Weight	± 10 %

T.2.4. Tolerance Value for Axle Spacing. – The tolerance value applied to each axle spacing measurement shall be ± 0.15 m (6 inches) at 100% compliance.

T.3. Influence Factors. – The following factors are applicable to tests conducted under controlled conditions only.

T.3.1. Temperature. –The instrument shall operate within tolerance throughout the specified operational temperature range.

T.3.2. 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.3.3. Power Supply. – System shall satisfy the tolerance requirements in Table T.2.3. Maintenance Tolerance for Accuracy under voltage ranges of -15% to +10% of the marked nominal line voltage(s) at 60 Hz or the voltage range marked by the manufacturer at 60 Hz. The battery-operated systems shall satisfy the tolerance requirements in Table T.2.3. Maintenance Tolerance for Accuracy when the battery power output is not excessive or deficient.

T.4. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed the tolerance value as stated in Table T.2.3. Maintenance Tolerances for Accuracy.

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 system divisions, value of the system division, or verification system division, and minimum capacity.

UR.2. Installation and Maintenance.

UR.2.1. System Modification. – The dimensions (e.g., length, width, thickness, etc.) of the load receiving element of a system shall not be changed beyond the manufacturer's specifications, nor shall the capacity of a sensor 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 a competent engineering authority, preferably that of the engineering department of the manufacturer of the system, and by the weights and measures authority having jurisdiction over the system.

UR.2.2. Foundation, Supports, and Clearance. – The foundation and supports shall be such as to provide strength, rigidity, and permanence of all components.

On load-receiving elements, which use moving parts for determining the load value, 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 system.

UR.2.3. Access to Weighing Elements. – If necessary, adequate provision shall be made for inspection and maintenance of the weighing elements.

UR.3. Maximum Load. – A system shall not be used to weigh a load of more than the marked maximum load of the system.

UR.4. Enforcement Guidance. – Prior to the issuance of an enforcement violation, the user shall ensure compliance with specific jurisdictional legislation and/or protocols. All gross vehicle, axle, and axle group weights must be printed and/or stored with the corrected values that include any necessary reductions due to the system tolerance and adopted violation thresholds.

UR.5. Notification of Violation. – If a violation occurs, there shall be an audible or visual notification provided to the vehicle operator. The method used to provide notification of a violation shall be determined by the jurisdiction with authority.

Add the following definitions to Appendix D:

axle. – The axis oriented transversely to the nominal direction of vehicle motion, and extending the full width of the vehicle, about which the wheel(s) at both ends rotate. [2.26]

axle-group load. – The sum of all tire loads of the wheels on a group of adjacent axles; a portion of the gross-vehicle weight. [2.26]

axle load. – The sum of all tire loads of the wheels on an axle; a portion of the gross-vehicle weight. [2.26]

axle spacing. – The distance between the centers of any two axles. When specifying axle spacing, the axels used also need to be identified. [2.26]

weigh-in-motion (WIM). – A process of estimating a moving vehicle's gross weight and the portion of that weight that is carried by each wheel, axle, or axle group, or combination thereof, by measurement and analysis of dynamic vehicle tire forces. [2.26]

WIM System. – A set of load receptors and supporting instruments that measure the presence of a moving vehicle and the related dynamic tire forces at specified locations with respect to time; estimate tire loads; calculate speed, axle spacing, vehicle class according to axle arrangement, and other parameters concerning the vehicle; and process, display, store, and transmit this information. This standard applies only to highway vehicles. [2.26]

Previous Action:
2023: Informational

Original Justification:
1. INTRODUCTION
The Brooklyn-Queens Expressway (BQE) is an aging and deteriorating 6-lane highway which comprises a critical link of I-278 - the sole Interstate highway in Brooklyn, connecting it to Manhattan, Staten Island, and Queens in New York. Constructed in 1954 and comprised of varying and complex structure types, the segment of the BQE between Atlantic Ave. Interchange to the South and Sands St. to the North is nearing the end of its design life. Urgent repairs are underway, while roughly 110 spans may be in need of intervention by 2028, and another 75 spans may be in need of intervention within the next decade. Weigh in Motion (WIM) sensors, installed in October 2019, have revealed overweight vehicles, excessively exceeding FHWA legal load limits, with gross vehicle weights (GVW) that range from just over 80,000 lbs to as high as 200,000. The continued presence of overweight vehicles on the BQE contributes to the continued structural deterioration of this aging piece of infrastructure. The New York State legislature recently authorized the New York City Department of Transportation to conduct automated overweight vehicle enforcement through a WIM demonstration program;

however, a universal standard has not yet been established that specifically defines a protocol for calibration and certification by the New York State local Division of Weights and Measures.

In response to this challenge, this proposal seeks an amendment of Section 2.25 of NIST Handbook 44 to allow for Weigh-In-Motion Systems Used for Automated Vehicle Weight Enforcement. The remainder of this proposal lays out the justification for the amendment, using the BQE as an example to establish the urgent need for the amendment, supported by data received from other State programs, including New Jersey, Maryland, and Indiana. The City of New York is not alone in its struggle to maintain the safety and the structural integrity of its infrastructure. Guarding against violations of vehicle weight restrictions that are enacted to protect critical infrastructure is an issue of national concern.

The combined interstate data presented here stresses the national importance of establishing protocols for automated vehicle weight enforcement using WIM, citing:

- the deleterious effects of overweight vehicles and axles on primary structural components and pavements;
- the difficulty associated with the use of screening combined with stationary weighing stations to enforce vehicle weight regulations;
- the percentages of overweight vehicles on major interstates across the nation; and
- the proven accuracy of WIM equipment used in several states across the nation.

2. THE BROOKLYN-QUEENS EXPRESSWAY: THE NEED FOR URGENT INTERVENTION

Constructed in 1954, the BQE is a network of varying and complex structure types, including multi-girder steel bridges, concrete arch bridges, and double and triple concrete cantilever structures. The triple-cantilever section possesses unusual engineering characteristics. Its three levels of cantilevered structure (comprised of two levels of vehicular roadway and a top-level pedestrian Brooklyn Heights Promenade) are supported by a vertical wall that also serves to hold back the earth, and, in turn, the neighborhood of Brooklyn Heights behind it. Thus, there is a complex system of forces acting to hold up the cantilevered decks and soil, and moving one of its parts affects the others. With major structural components nearly 70 years old, this segment of the BQE is rapidly approaching the end of its design life. Due to its complex nature and its historic integration with the surrounding communities, repair and replacement of this segment of the BQE requires careful and strategic planning, exhausting every avenue to maintain the safety of its operations and the integrity of its structural condition.

Its aging characteristics are evidenced by a number of factors, including:

- Visible signs of deterioration, including scaling, efflorescence, transverse cracking, map cracking, and spalling, with exposed and corroded rebar at the underdeck, walls, and substructure components;
- Poor freeze-thaw results in the concrete cores;
- High chloride levels in the deck, leading to the onset and propagation of steel rebar corrosion in the structural decks and substructure components;
- Deteriorated concrete beneath the surface, as detected by Non-Destructive Test and Evaluations (NDT/E) and verified by probe samples; and
- Projected decreases in structural load ratings to below standard limits, with isolated segments projected to fall below standard limits by 2026, and large segments of this portion of the corridor projected to fall below standard limits by 2028.

Numerous traffic studies have been completed for this segment of the corridor, revealing average daily traffic (ADT) of approximately 153,000 vehicles, including a substantial average daily truck traffic (ADTT, up to 13 percent of the total ADT). In addition, the installation of WIM sensors in October 2019 has revealed that a considerable number of the vehicles traversing the BQE are classified as overweight, when compared with FHWA legal load limits. WIM data shows Gross Vehicle Weights ranging from just over 80,000 lbs to as high as 200,000 lbs, with roughly 20% of North-bound traffic classified as overweight, and roughly 8% of South-bound traffic classified as overweight.

The New York City Mayoral Executive Order 51, executed in January 2020, mandated the formation of the New York City Police Department (NYPD) BQE Truck Enforcement Task Force, whose purpose is to ensure that all existing weight restrictions on the BQE are strictly enforced. However, the lack of roadway shoulders on this stretch of the BQE means that there is insufficient space for the New York City Department of Transportation (NYCDOT) to introduce stationary weighing stations, or for NYPD enforcement officers to pull over overweight vehicles and use portable scales to screen and enforce legal weight limits.

Urgent repairs are currently underway for two spans within this complex network, while structural assessments show that roughly 110 spans may be in need of intervention by 2028, and roughly 75 spans may be in need of intervention within the next decade.

In response to this challenge, NYCDOT has initiated aggressive efforts to develop and implement a plan that maintains the operational safety of the BQE, as well as protects its structural integrity, including the pursuit of automated weight enforcement using WIM on this segment of corridor. It has combined its efforts with other local and State agencies in order to demonstrate that this is not an isolated local problem, but a national need.

3. AUTOMATED TRUCK ENFORCEMENT USING WIM: THE NATIONAL NEED

The national roadway infrastructure, including bridges and pavement, has handled substantial daily truck traffic. While trucks have been an integral part of the freight movement network in distributing goods and services to various communities, many trucks are often found to be overweight beyond the FHWA legal load limits. Illegally overweight vehicles have been shown to be one of the primary causes of the deterioration of aging pavement and bridges. Accordingly, the infrastructure suffers from significant deterioration because of the existing environmental conditions exacerbated by the frequently increasing and substantial number of overweight vehicles.

Vehicles on Interstate highways must conform to the Federal Bridge Formula (FBF), designed to protect bridges from vehicle overloads beyond the legal limits. To date, the enforcement regulations have been executed at stationary weighing stations across the nation, especially at the borders between states. However, the stationary stations have limited resources for effective enforcement because: (1) the number of stationary weighing stations is not spatially well distributed across the nation; (2) the operation hours are limited; and (3) the number of enforcement officers is insufficient.

Though each state allows a certain number of permitted vehicles to exceed the FHWA weight limits on Interstate Highways, the number of permit overweight vehicles is typically a small fraction of the total. According to a previous study (Nassif et al., 2016)[1], the number of permit overweight vehicles is only 4% of the total overweight vehicles observed at NJ WIM stations. In New Jersey, it was also noticed that the overweight vehicles cited at the stationary weighing stations were only a small fraction (6.4%) of the *actual* overweight populations recorded by the WIM sensors on the main lanes, and this is, in turn, 0.142% of the total number of vehicles (Nassif et al., 2021)[2]. In New York City, enforcement officers have been able to cite only 14.7% of the *actual* number of overweight vehicles on and near Interstate Highway I-278 between February and December of

[1] Nassif, H., K. Ozbay, H. Wang, R. Noland, P. Lou, S. Demiroluk, D. Su, C.K. Na, J. Zhao, and M. Beltran. Impact of freight on highway infrastructure in New Jersey. Final Report FHWA-2016-004, NJDOT, 2016

[2] Nassif, H., K. Ozbay, C.K. Na, and P. Lou. Feasibility of Autonomous Enforcement using A-WIM system to Reduce Rehabilitation Cost of Infrastructure, C2SMART Tier 1 University Transportation Center, Year 3 Final Report, 2021

2021. Therefore, the overweight enforcement practices at the stationary weighing stations, combined with using mobile enforcement units, are ineffective in substantially reducing the percentage of overweight vehicles.

The figure below summarizes the percent of overweight vehicles, relative to the ADTT for each US State. The overall overweight percentage out of ADTT is 13.2%, based on the data in the figure below.

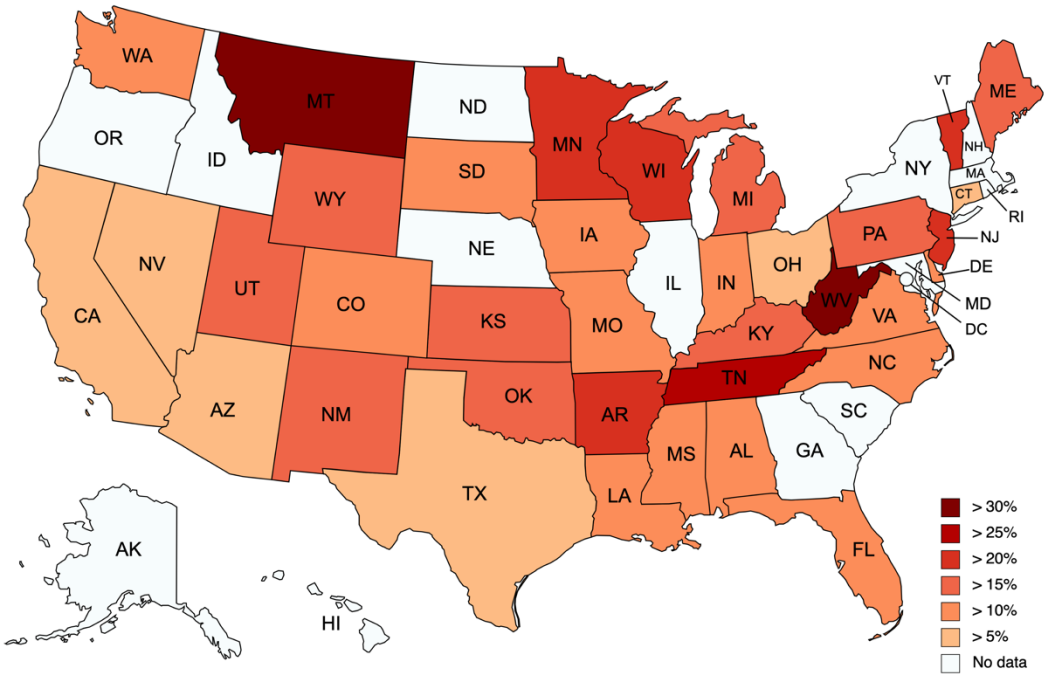


Figure 1. Overweight percentage per State

Going beyond weight enforcement, officers in most States are responsible for checking Commercial Motor Vehicles (CMV's) for safety. This includes different levels of truck inspection, including the driver credentials, hours of service, key systems on the truck, load securement, and many more. The highest level of inspection, Level 1, has 20+ safety criteria that an officer checks on a CMV. There is an opportunity with automated weight enforcement to, not only deter overweight vehicles on the nation's infrastructure, but to automate the inspection tasks of officers, freeing them up so they can do more inspections for other safety issues related to CMV's. Currently, with most sites running with a single officer, as they are focused on weighing, doing an inspection, or interviewing a driver, other unsafe vehicles behind the current one go by without scrutiny until an officer can complete their task.

4. AUTOMATED TRUCK ENFORCEMENT USING WIM: PROVEN ACCURACY OF WIM TECHNOLOGY

ASTM E1318-09 Type III accuracy requirements have been used by many States in their fixed and virtual weigh stations to screen CMV's for over a decade. In New York, three calibration tests were performed using various trucks (Class 9, Class 7, Class 6, and Class 5), and it was found that the WIM system could provide 100% compliance for GVW within 6%, single axle weight within 15%, tandem axle weight within 10%, and even wheel weight within 20%. In Indiana, the Indiana DOT and Purdue University studied the accuracy of the virtual WIM sensors on the main lanes compared to the stationary weighing station. They found that 98% of the virtual WIM weights were within 5% of the static weights.

Attachment A includes data from New York, Indiana, and Maryland, proving the accuracy of their WIM technology. Additionally, Wisconsin, and two other States have expressed interest in sharing data from their

sites which meet these accuracy requirements.

Given the consistent accuracy of WIM measurements, compared with measurements obtained from the stationary scales, the amendment of Handbook 44 to expand its provisions for screening to include automated vehicle weight enforcement using WIM is both prudent and justified.

5. CONCLUSIONS

Across the nation, the deterioration of aging infrastructure is exacerbated by the presence of overweight vehicles in excess of the Federal Bridge Formula (FBF). Though several states have implemented vehicle weight enforcement measures using a screening protocol that includes the use of mobile enforcement officers and stationary scales, these measures have been insufficient in significantly reducing the volumes of overweight vehicles on the nation's infrastructure. The use of WIM for the purposes of automated vehicle weight enforcement would both alleviate this problem and free up local and state resources to address other safety concerns. However, to date, no unified national standard specifically paves the way for the certification of WIM technology to be used for the purposes of automated vehicle weight enforcement. The amendment of Section 2.25 of NIST Handbook 44 will provide such a standard. With several states evidencing the proven accuracy of current WIM technology, the amendment of Section 2.25 to expand its screening provisions to include automated vehicle weight enforcement using WIM is both prudent and justified.

This request is not to introduce new regulations to the trucking industries but to guide the trucking industries to comply with the applicable laws to protect our infrastructure, provide safe corridors to the nation's taxpayers, and improve the resilience of our built environment. Moreover, this request would allow the United States to catch up with other countries globally that have successfully implemented and proved automated weight enforcement, including China (2004), the Czech Republic (2010), Russia (2013), Hungary (2016), France (in process) and Brazil (in process).

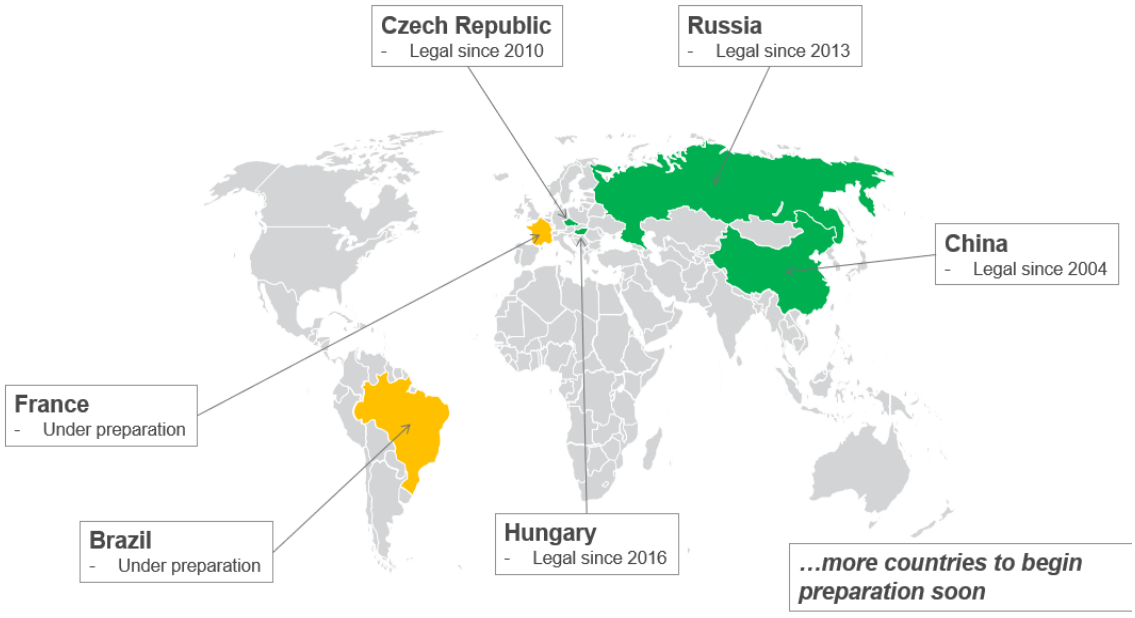


Figure 2. Automated enforcement around the world

The submitters requested that this be a Voting item in 2023.

Comments in Favor:

Regulatory:

- 2024 Interim: A regulator from the State of New Jersey made comments in support of the language and recommended a voting status.
- 2024 Interim: A regulator from New York commented that this system is still prevalently confused with a scale, which it is not and is not capable of scale accuracy. The accuracy of 10% is appropriate for enforcement when the issuing entity takes the tolerance into account.

Industry:

- 2024 Interim: Tanvi Pandya with NYC DOT (submitter) introduced a presentation outlining the WIM system and the differences between screening and direct enforcement. She clarified that the tolerances are from OIML and commented that the reference scale should be tested on the day of the test and may be located more conveniently than previously thought.

Advisory:

- None

Comments Against:

Regulatory:

- 2024 Interim: Comments were heard from a regulator from Arkansas that direct overweight enforcement is a leap from a screening tool. Questions were raised about class E, the 500-pound division, and the 4% zero tracking in a 200,000-pound system. The concern was also raised about the test vehicles and the high number of runs required for the test. They recommended the item be withdrawn.
- 2024 Interim: Comments from a regulator representing the State of Maryland were heard in opposition to the item. Issues involved getting a violation from more than one location on the same day with the same load, e.g., double jeopardy. Questions were also raised involving the static scale certification timeframe, that is it should be on the day of the test, and that liquid loads are an issue with this type of system. The representative recommended the item be withdrawn.
- 2024 Interim: A regulator from Colorado made comments in opposition to this proposal. The difference between estimates (screening) and enforcement is great. The representative recommended informational status.
- 2024 Interim: Comments were heard from a representative of Arizona recommending informational status, as the weighments are estimates and the driver should have a scoreboard to inform of the possible infraction.
- 2024 Interim: A regulator from Delaware commented that they would be required to test the systems in their jurisdiction twice per year and they would lead to consumer complaints that would have to be investigated. The representative stated the mileage required to test a system in their jurisdiction would be 631 miles for all the runs.
- 2024 Interim: A regulator from West Virginia commented in opposition to the item, stating there are numerous questions to be addressed.
- 2024 Interim: A representative from Pennsylvania opposed the current version as submitted.
- 2024 Interim: A regulator from Louisiana commented that there are concerns about the large tolerances, lengthy test procedures, and lack of a customer indicator.

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- 2024 Interim: A regulator from Massachusetts commented that the proposal is not ready and recommended informational status.
- 2024 Interim: A regulator from Florida commented that the proposal is needed but expressed concerns about the numerous sections in the handbook for WIM scales. They recommended developmental or informational status.
- 2024 Interim: A Los Angeles County regulator pointed out the difference between screening and direct enforcement and the WIM systems will address a problem with overweight vehicles. They also pointed out that the Weights & Measures entity will not be issuing weight infractions, it will be the law enforcement arm that faces the defensibility of the violation.

Industry:

- None

Advisory:

- 2024 Interim: Comments from a NIST OWM representative were heard recommending informational status. They voiced concerns that it is impractical to weigh axles in isolation as the current proposal requires.

Item Development:

NCWM 2024 Interim Meeting: The Committee updated the item to address the technical comments heard during open hearings. Updates include removing Class E, changes to N.1.3. Reference Scale and subsequent paragraphs, the addition of UR.5 Notification of Violation, paragraph renumbering, and other editorial changes. The committee feels the item is fully developed and has assigned it a voting status.

NCWM 2023 Annual Meeting: The committee used the updated (7/11/23) proposal from the submitters as a basis for the current item under consideration, but with changes in the following sections: S.1.6, N.1.1.2 Note 1, N.1.2.3 (a), N.1.3., N.1.4., Table N.1.5., N.1.6.1., T.2.4., and UR.4., and removed N.1.5.4.. The committee also believes that N.1.3 needs to better clarify the use of "single platform vehicle scale". As written, it currently promotes split weighing, or could be confused with the use of axle-load scales. The committee encourages the submitters to continue to work with the committee, NIST OWM and other stakeholders to further develop this item.

NCWM 2023 Interim Meeting: The committee has updated this item to the latest version received from the submitter. In the most recent version of the proposal, the submitters changed N.1.3. to require the reference scale be tested no more than 2 weeks prior to the test of the WIM scale, instead of 24 hours. The committee does not agree with this change and has decided to leave it as currently written in Handbook 44. The committee continues to work on this item, including User Requirements, to address concerns it heard during the Interim. The submitters intend to provide a demonstration of a WIM scale in use in the near future. The committee has decided to leave the item as informational and encourages the submitters to continue to work with the committee, NIST OWM, and stakeholders for further development.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: Tanvi Pandya and Chaekuk Na presented on behalf of the submitters outlining the changes that have been made to address previous concerns.

Mike Harrington from Iowa supports this item and recommends it moving forward as voting.

Greg VanderPlaats from Minnesota commented that the submitters have done a lot of work and have made changes per the feedback received at the National Conference. He supports this item as voting.

The committee recommends this item moving forward as a voting item with the proposed changes by the submitter which are attached to the end of this report. [APPENDIX B]

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

A presentation was given from the submitters of this item regarding updated language provided for consideration and posted on the WWMA website {Events – Meeting Documents – WIM.23-1} Proposed Language. The submitters spoke to:

- This device is not a scale in the traditional application and intended for use dynamically of overweight vehicle enforcement.
- The intent is to remove the "Tentative" status for Class E devices. The "Tentative" status would remain for Class A devices.
- A demonstration was conducted on a similar device in April 2023.
- This application would exclude all liquid tank trucks.
- It is difficult to be consistent with vehicle positioning. The submitter clarified that if the vehicle is not in the correct position the system will default to "Error". This "Error" is an appropriate performance function.

Mr. Cory Hainy (Representing the SMA): The association formed a position in April 2023 of opposition to this item prior to the updated language being proposed and will meet in November 2023 to reassess the item. It was reemphasized that the proposed tolerances were a point of contention with the association. The association would like to see revisions that address dynamic weighing should not be allowed a greater tolerance, acceptance and maintenance tolerances should be applied, and harmonizing existing tolerances with the scale code.

Mr. Loren Minnich (NIST OWM): OWM reached out to the submitter to clarify the intention regarding tentative and permanent status for "Class A" and "Class E" devices subject to this code. Examples were provided in open hearing of existing code such as Grain Analyzers as an example of separating this code for enforcement and screening purposes.

The WWMA S&T Committee posed the following questions:

- Can the submitter clarify the intent of all weights for 100% compliance regarding the applicable tolerances?

  The submitter response clarified the device should perform within the applicable tolerances at all test loads and that a fault qualifies towards the 100% compliance.

- Can the submitter clarify what is meant by 100% compliance regarding T.2.4?

  The submitter clarified that the axle spacing must be predetermined by the inspector and must match the device. The system will identify a bridge formula violation and the inspector has to accurately measure the axle spacing and then verify the system measurement within the tolerance specified with T.2.4

- Can the submitter provide data to support the +/- 10% to 20% tolerance range?

  The submitter response clarified the intent of the use of the device is for dynamic and not static weighment. Scales currently function at a lower range of 6% but the addition of the 100% compliance is to justify the tolerance. It was expressed that the intention of the proposed code is to enforce grossly overweight vehicles.

The submitter clarified that the 100% compliance came from the original proposed 95% compliance. The submitter clarified 100% of the total number of runs would need to be within tolerance.

- Can the body please clarify how or if 2.20 scale code regarding WIM systems and the proposed WIM system code will impact each other?

  Mr. Loren Minnich (NIST OWM) clarified each section of the existing code has an application section to identify what devices are covered by that code. The application section for each code should be reviewed to verify that there is no overlap.

Mr. Cory Hainy (Representing the SMA): Raised concern regarding tolerances specifically whether OIML R 134-1 standards where considered.

Mr. Chaekuk Na (Rutgers University): OIML 134-1 standards were considered and further clarified there are different levels of accuracy. The tolerances selected are currently being used in other countries, the F-10 for 10% gross meet the proposed tolerances.

Mr. Cory Hainy (Representing the SMA): Reinforced the concern regarding the large tolerances and spoke to already existing tolerances. Existing scales are held to certain standards even if used for law enforcement purposes.

Ms. Tanvi Pandya (New York City DOT): Clarified this is a dynamic test and supports the tolerances as written.

Mr. Aaron Yanker (Colorado Dept. Ag Weights and Measures): Questioned the note in Table 1 regarding the comment of additional accuracy classes. The submitter responded that the language in the note of Table 1 is carry over language of the item from its original draft.

The WWMA S&T Committee recommends that the NCWM S&T Committee consider incorporation of the updated language as provided by the submitter and that this item remain Informational. This will allow stakeholders to provide comments on the updated language. We further recommend that NCWM S&T Committee consider the comments and questions which came up in the WWMA S&T open hearing session while further developing the item with special attention to the comments from NIST OWM.

The proposed updated language will be included in the WWMA S&T Committee 2023 Final Report as an Appendix to the item.

SWMA 2023 Annual Meeting: Tanvi Pandya, NYCDOT, co-submitter, gave a presentation on the item. She has had some edits since the July report. She stated these systems are used internationally, and it isn't realistic to statically weigh the 10% of all trucks that are overweight on the road. She feels the tolerance is acceptable for enforcement purposes. She stated that this device is to be used for law enforcement and screening purposes only and not commercial applications. She noted some jurisdictions have raised concerns to her about removing the tentative status. She also stated that she hasn't had a chance to resolve some issues with NIST, and that the New York Department of Agriculture is requiring a corresponding code in Handbook 44 before they will certify the weighing system.

Chaekuk Na, Rutgers University, co-submitter, stated they are trying to harmonize the language in the item with the OIML code. Mr. Na stated fuel consumption of the test vehicle is not relevant due to the large tolerances allowed in their current code.

Cory Hainy, SMA, stated they are opposed to the item and have not had a chance to review the latest revision. SMA stated that they are concerned that enforcement scales are already defined, acceptance and maintenance tolerances have not already been established, and that adding it to the WIM code will create two conflicting law enforcement codes. The specifics of their concerns are in their April positions from SMA.

Tim Chesser, Arkansas, echoed Mr. Hainy's position and asked what other states besides New York and Maryland plan to use this code? He also raised a concern that once this code is in the handbook some states would be forced to enforce it. He also stated the tolerances were too wide for enforcement. He also expressed concern about the axle spacing measurement being confusing.

Alison Wilkinson, Maryland, raised concerns about the lack of standards, the use of the word "may", and stated the reference scale code is vague in regard to testing logistics such as how far or near the reference scale should be to the system being tested. She also raised concerns about the fuel consumption of the test vehicles. She stated the state of Maryland is opposed to this item, and that she agrees with Tim Chesser's comments. She believes this code should only be used for screening.

Mauricio Mejia, Florida, agreed with the concerns raised by other commenters, questioned whether this is the proper channel for this type of code, and that it should only be used for gross vehicle weight.

Juana Williams, NIST OWM, has concerns about combining tentative and non-tentative codes. She stated NIST OWM is of the opinion that acceptance tolerance should be 50% of the maintenance tolerance. She also stated that this code should cover all vehicles, including those carrying liquids and empty vehicles.

John Stokes, South Carolina, agreed with Arkansas in opposition to the item.

Robert Huff, Delaware, stated this item will result in numerous complaints that they will not be able to handle.

The committee heard no comments in support of this item from the SWMA membership and suggests that the NCWM S&T committee work with the submitters and NIST to address the issues raised.

The committee recommends the item remain as an Informational item.

NEWMA 2023 Interim Meeting: A presentation was made by submitters with updates to the item, including having 2.25 remain tentative for screening and creating 2.26 for enforcement. The submitters are working with NIST to finalize language and the updated proposal after taking feedback from the regions. The State of NY recommends voting. The Commonwealth of PA questions if it should be in the handbook. The States of New Hampshire, New Jersey, and the Commonwealth of Massachusetts supports as voting. Upon consensus of the body, the Committee recommends this item be Voting with the upcoming changes to the item.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

LMD – LIQUID MEASURING DEVICES

LMD-24.1 D N.4.1. Normal Tests.

NOTE: This item was introduced through the Northeastern Weights and Measures Association.

Source:
New Hampshire Department of Agriculture, Markets, and Food

Purpose:
Provide clarity to 3.30. Liquid—Measuring Devices, N.4.1. Normal Tests.

Item under Consideration:
Amend Handbook 44 Liquid Measuring Devices Code as follows:

N.4. Testing Procedures.

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

(Amended 1991)

Example:

- **Maximum rated flow rate is 12 gpm / Minimum rated flow rate is 0.5 gpm.**
- **Maximum discharge flow rate developed under conditions of installation is 9 gpm = normal test**
- **Additional normal tests are determined using the following formula:**

$$\frac{Max\ discharge\ flow\ rate + rated\ min\ discharge\ flow\ rate}{2} = minimum\ discharge\ flow\ rate$$

- **In this example $\frac{9\ gpm + 0.5\ gpm}{2} = 4.75\ gpm$. Therefore, flow rates of 9 gpm down to and including 4.75 gpm are considered normal tests.**

Previous Status:

2024: New Proposal

Original Justification:

The existing code requirement is very wordy and difficult to understand without an example and a formula. This proposal adds an example and formula that will give clarity to N.4.1. Normal Tests.

The additional language will be one of several other NIST HB 44 codes that give clarifying examples.

NIST has indicated that in the near future the handbooks will not be printed but will be digitally produced. Therefore, we are no longer constrained by the size of the handbook if the information adds value.

The problem can be resolved through more thorough training. We were informed that a formula can be added, however, an example will make the handbook longer and it sets a precedence for adding examples in the future.

The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:

- 2024 Interim: A representative from the New Hampshire Department of Agriculture Markets & Food commented in agreement with the NIST analysis/comments and that there is now clarity. This representative recommends a voting status for this item.
- 2024 Interim: A representative from the California Division of Measurement Standards commented that they will support it as voting if the body agrees with the example provided. They also provided edits to clarify what the minimum flow rate is based on.
- 2024 Interim: A representative from New Jersey Weights & Measures commented that the examples are helpful and that they would support voting.

Industry:

- None

Advisory:

- 2024 Interim: A representative from NIST OWM commented that with recommended additions and some editorial wording, they would support voting.

Comments Against:

Regulatory:

- None

Industry:

- 2024 Interim: A representative from Endress+Hauser commented that the formula goes beyond an editorial change and that the change should have followed NCWM processes. This commenter also questioned the formula as well as the minimum flow rate. The representative recommended a developing status.

Advisory:

- None

Neutral Comments:

Regulatory:

- 2024 Interim: A representative from the Florida Department of Agriculture and Consumer Services commented in support of the example if it is helpful to inspectors. However, the example is suggested to be moved to a guidance document or an EPO.

Industry:

- 2024 Interim: A representative from Liquid Controls Inc. expressed concerns that the confusion about the minimum discharge rate marked on these devices will carry over into other codes.
- 2024 Interim: A representative from Gilbarco commented that the added paragraph is ambiguous and suggests better wording be used in place of examples. This commenter supports further development of this item.
- 2024 Interim: A representative from Murray Equipment Inc. encouraged keeping the example in the book and supports further development of this item.

Advisory:

- None

Item Development:

NCWM 2024 Interim Meeting: The committee notes that the item under consideration is inconsistent with 2024 edition of Handbook 44 language and encourages the submitter to work with NIST OWM to harmonize the differences and address the concerns raised during open hearings. The committee has assigned a developing status for this item.

Regional Associations' Comments:

This item was only introduced to NEWMA in Fall 2023.

NEWMA 2023 Interim Meeting: A regulator from New Hampshire commented that the test procedure, as currently written, is difficult to understand, specifically in the second sentence. The purpose of the proposal is to add an equation and give an example of the equation, adding a value and clarity to the handbook. The State of New York commented that other codes, such as LPG, has the same language and may also need to be updated in the future but agrees the proposal has merit. The Commonwealth of Pennsylvania commented that clarity is an added advantage in the field and makes a difference to help regulators and industry understand the testing methods. It was also suggested that if this does not appear in the handbook, then it could possibly be worked into the NCWM field testing manual. The State of New Jersey concurs. Upon consensus of the body, the Committee recommends this item as a voting item.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

LPG – LIQUIFIED PETROLEUM GAS AND ANHYDROUS AMMONIA LIQUID-MEASURING DEVICES

LPG-23.1 W S.2.5. Zero-Set-Back Interlock.

Source:
National Propane Gas Association and U-Haul International

Purpose:
Address practical issues that propane retailers encounter when trying to comply with the zero setback requirements for propane stationary meters in Handbook 44.

Item under Consideration:
Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

S.2.5. Zero-Set-Back Interlock.

S.2.5.1. Zero-Set-Back Interlock, Electronic Stationary Meters (Other than Devices used Exclusively as Stationary Retail Motor- Fuel Dispensers) and Electronic Vehicle-Mounted Meters. *– A device shall be constructed so that after an individual delivery or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating element and, if equipped, recording element have been returned to their zero positions.*

[Nonretroactive as January 1, 2021]

(Added 2019) (Amended 2021)

Note: Devices used exclusively for Stationary Retail Motor-Fuel dispensing are those only utilizing a K15 connection on the hose-end valve, as required in NFPA 58 "Liquefied Petroleum Gas Code".

(Added 20XX)

S.2.5.2. Zero-Set-Back Interlock for Devices Used Exclusively as Stationary Retail Motor-Fuel Devices. *– A device shall be constructed so that:*

(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;

(b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and

(c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

[Nonretroactive as of January 1, 2017]

(Added 2016)

Previous Action:
2023: Informational

Original Justification:
This proposal reflects the intent of U-Haul International, Inc. and the National Propane Gas Association's Technology, Standards and Safety Committee, a volunteer organization comprised of 2500+ members, including propane retail marketers and others providing products or services to the propane industry.

The intent behind enacting the current version of S.2.5.2 was to create consistency among motor-fuel devices used for all products. This proposal strikes a balance between a consistent standard for retail motor-fuel devices and the diverse applications and industry standard for dispensing LP-Gas. To that end, this proposal addresses only those devices used exclusively for retail motor-fuel transfer. Multi-use LP-Gas devices that are used for the filling motor-fuel and other containers, including grill cylinders, forklift cylinders, cylinders used on recreational vehicles and even motor fuel containers, are covered by S.2.5.1.

Most LP-Gas dispensed is for purposes other than motor-fuel. (Less than 3% of all LP-Gas used in the United States is used for transportation. *See* U.S. Department of Energy, Alternative Fuels Data Center afdc.energy.gov/fuels/propane_basics.html.) Pursuant to NFPA 58, this is accomplished by a trained and certified employee dispensing LP-Gas, typically using analog (mechanical) meters, into cylinders and tanks. The analog (mechanical) meters are safe and effective, and most notably exempt from the zero-set-back requirement because S.2.5.1 only applies to electronic devices. Clearly, Handbook 44 recognizes this reality as S.2.5.1 does not require that all LP-Gas dispensers have zero-set-back interlocks, only electronic devices. S2.5.1 is most appropriate because currently there is no readily available technology that can be used to retrofit an analog device. When looked at from a cost/benefit perspective, one has to question the expense of replacing an analog device with an electronic device at a location that mostly serves portable cylinders and not motor vehicle tanks when LP-Gas's use is so limited in transportation.

Furthermore, NFPA 58 currently does not allow the public to refuel its LP-Gas powered motor vehicles. All motor vehicles or other containers must be filled by a specially trained employee. A proposed change has been introduced for consideration in the 2023 edition of NFPA 58 that would permit public refueling of motor vehicles as long as the dispensing system meets very specific safety requirements, including a specialized nozzle, and is furnished with visible instructions. Upon the acceptance of this new public refueling allowance, the LP-Gas industry agrees that Zero-Setback-interlocks are needed. These public, self-service motor vehicle dispensing systems will be listed to Underwriters Laboratories Standard 495 and will be dedicated to the filling of motor vehicles.

For the minimal amount of retail motor fuel customers that a typical LP-Gas dispenser serves, both U-Haul and NPGA feel that this proposal represents the most equitable approach to date for balancing the need to ensure fair transactions and consistent standards with how the LP-Gas industry currently dispenses LP-Gas and LP-Gas's future transportation applications as envisioned by the proposed changes to NFPA 58 without conducting costly industry-wide retrofits of existing, functioning multi-use equipment. Handbook 44 needs to work with industry to make technical standards economically feasible lest it risk the advancement of LP-Gas as a viable and clean motor-fuel.

One continually occurring objection is that there would be no protection for the consumer without a zero-set-back feature on retail motor fuel devices. That really isn't the case, however, as the customer always has the option to check the dispenser and meter before the filling process begins to verify that it is starting at zero.

The submitter requested that this be a Voting item.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- 2024 Interim: A representative from the California Division of Measurement Standards commented that the item should be withdrawn.

Industry:
- 2024 Interim: A representative from the National Propane Gas Association commented that the item should be withdrawn.

Advisory:
- 2024 Interim: A representative from NIST OWM commented that the item should be withdrawn.

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: Based on comments heard on the floor, the committee has withdrawn this item.

NCWM 2023 Annual Meeting: The committee heard comments from the floor and replaced the note under S.2.5.1. so that it reads:

Note: Devices used exclusively for Stationary Retail Motor-Fuel dispensing are those only utilizing a K15 connection on the hose-end valve, as required in NFPA 58 "Liquefied Petroleum Gas Code".

After hearing comments during the voting session, expressing concerns regarding how the modified language is to be interpreted, the Committee conferred and downgraded the item to Informational before it went to a vote.

NCWM 2023 Interim Meeting: The committee heard comments from the floor in support of the changes submitted by Mr. Strawn (Red Seal) and has modified the item by adding the following note to S.2.5.1.:

> **Note: Analog (Mechanical) devices used for multiple purposes other than exclusively for Retail Motor Fuel Dispensing are exempt. Any devices used exclusively for Stationary Retail Motor-Fuel dispensing are subject to S.2.5.2.**

The committee did not agree with striking "(Other than Stationary Retail Motor Fuel Dispensers)" from the title of S.2.5.1. and the title remains unchanged. With the modifications, the committee believes this item is fully developed and has assigned it a voting status.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as withdrawn as we believe the attempted revision of this item was actually a resubmission listed under item LPG 24.2. The committee recommends that the discussion history for this item be moved to LPG 24.2. These recommendations are intended to clean up what we perceive to be an administrative error in that LPG 24.2 should not have been created, but should have been an update to this item (LPG 23.1).

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting comments were heard from Mr. Kevin Schnepp (California, Division of Measurement Standards), Mr. Scott Simmons (Colorado, Division of Oil and Public Safety), and Mr. Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program) supporting a Withdraw of this item in lieu of LPG-24.1, LPG-24.2, and OTH 24.1.

The WWMA 2023 S&T Committee recommends this item be Withdrawn.

SWMA 2023 Annual Meeting: Steve Benjamin, North Carolina, stated he opposed this item.

The committee recommends this item be Withdrawn.

NEWMA 2023 Interim Meeting: This item be informational. Upon consensus of the body, the Committee recommends this item be Informational.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

HGM – HYDROGEN GAS-MEASURING DEVICES

HGM-23.1 D UR.3.8. Safety Requirement.

Source:
Quong and Associates, Inc.

Purpose:
Add safety requirement for hydrogen gas measuring devices.

Item under Consideration:
Amend Handbook 44 Hydrogen Gas-Metering Devices Code as follows:

> ***UR 3.8 Safety Requirement. – All hydrogen gas-measuring devices subject to this code shall maintain verification of testing demonstrating conformance with the latest version of SAE J2601 Fuel Protocols for***

Light Duty Gaseous Hydrogen Surface Vehicles, as determined by the latest version of ANSI/CSA HGV 4.3 "Test Methods for Hydrogen Fueling Parameter Evaluation.

[Nonretroactive as of January 1, 10XX]

(Added 20XX)

Previous Action:
2023: Developing

Original Justification:
The proper fueling of hydrogen vehicles is critical to ensure that the vehicle and high pressure tank is not damaged. Unlike other gases, such as compressed natural gas, hydrogen heats as a vehicle is fueled due to the reverse Joule-Thompson effect. This means that the fueling rate and temperature of the hydrogen must be carefully controlled, or damage can occur to the vehicle hydrogen tanks. The hydrogen industry has done considerable work in developing standard fueling protocols in SAE J2601 (https://www.sae.org/standards/content/j2601_202005/) and validation methods in ANSI/CSA HGV 4.3 (https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/) to ensure that the vehicles are fueled correctly and safely.

The validation of SAE J2601 using ANSI/CSA HGV 4.3 has been performed on the 50+ hydrogen stations in California by the Air Resources Board (ARB) (https://ww2.arb.ca.gov/resources/documents/annual-hydrogen-evaluation). The proposed requirement provides assurances that dispensers have been verified to the proper fueling protocol which will protect the dispenser, vehicle, and consumer.

While the California Department of Food and Agriculture is discussing submitting the same language for the California Code of Regulations, adding the same language of Handbook 44 would allow other states to understand and adopt the key hydrogen fueling protocol standards, thereby expanding the use of hydrogen throughout the United States.

The submitter acknowledged that some may argue that the equipment to validate stations is not available except in California.

The submitter's response would be that, first, there are other private companies who have the equipment to test dispensers outside of California, including stations in the northeast US. Second, HGV 4.3 allows for factory acceptance testing of dispensers prior to installation and an abbreviated Site Acceptance Test. This approach shortens the time and equipment necessary to verify a station meets SAE J2601. Third, the design and software of the Hydrogen Station Equipment Performance (HyStEP) Device used by ARB is publicly available. (https://h2tools.org/hystep-hydrogen-station-equipment-performance-device).

The submitter provided the following links:

SAE J2601: https://www.sae.org/standards/content/j2601_202005/ (copyrighted)

ANSI/CSA HGV 4.3 (https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/) (copyrighted)

California Air Resources Board: Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel StationNetwork Development

https://ww2.arb.ca.gov/resources/documents/annual-hydrogen-evaluation (many reports available, latest is too large to attach)

EVSE Pre_Rule Wkshop Shared Deck.pdf

The submitter requested that this be a Voting item in 2023.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- 2024 Interim: A representative from New Jersey Weights & Measures commented that safety requirements are not appropriate for NIST Handbook 44 and that his item should be withdrawn.

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- 2024 Interim: A representative from the California Division of Measurement Standards commented that this is required in California and that a survey to gather additional data is underway. There will be additional comments when the results of the survey are known.

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST OWM commented that standards for safety have not been a part of NIST Handbook 44, dispensers of other fuel types have mechanisms in place to ensure safety, and that it is unclear how compliance will be verified.

Item Development:
NCWM 2024 Interim Meeting: The committee decided to leave this item as developing to allow for data submission of the ongoing survey.

NCWM 2023 Annual Meeting: The committee heard no comments on this item.

NCWM 2023 Interim Meeting: The committee would like to see the metrological effect this has on the device. The committee decided to keep this as developing.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item be withdrawn. The committee questions the merit of this information being provided in Handbook 44, and have not received answers to questions outlined in the historical comments for this item.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Kevin Schnepp (California, Division of Measurement Standards): Stated that data is being collected by CDFA-DMS and the California Air Resources Board. Mr. Schnepp requested that this item remain developing until the data can be provided.

The WWMA 2023 S&T Committee recommends this item remain Developing based on comments heard to allow the submitter the ability to provide data and address the concerns of the 2023 WWMA S&T and 2023 NCWM S&T comments. This Committee considered the comments recorded in the 2023 NCWM S&T Committee Interim Report in our analysis and echoes the concerns raised in the report on how this protocol affects performance in addition to safety.

SWMA 2023 Annual Meeting: Dr. Matt Curran, Florida, questioned if this is the proper venue for the safety requirements but supports safety concerns in the item.

The committee recommends this item remains as a Developing item to allow time for the data to be collected.

NEWMA 2023 Interim Meeting: Comments were heard that no additional data has been provided as to what the effects on the metrological parameters are. The States of New York and New Jersey, and Holliston, Massachusetts recommends withdrawal.

Upon consensus of the body, the Committee recommends this item be Withdrawn.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

EVF – ELECTRIC VEHICLE FUELING SYSTEMS

EVF-24.1 W S.1.3. Mobile Device as Indicating Element for AC Chargers.

Source:
Siemens Industry Inc., Smart Infrastructure eMobility

Purpose:
Clarify that use of a hand-held mobile device such as a mobile phone to provide the Indicating Elements for an EVSE is an acceptable alternative to having the Indicating Elements built into the EVSE. This option is already accepted by the National Type Evaluation Program for certification.

Item under Consideration:
Amend Handbook 44 Electric Vehicle Fueling Systems as follows:

S.1.3. Mobile Device as Indicating Element for AC Chargers. – the indication requirements and elements specified in Section 3.40, sub-sections S.1.1., S.1.2., S.2.4.1, S.2.6, S.2.7, UR.1.1., and UR.3.1. may be fulfilled through either a display built into the EVSE or a display available via an application on a hand-held device such as a smart phone or in the purchaser's vehicle receiving the electrical energy, such device or vehicle being in the immediate vicinity of the EVSE.

Previous Status:
2024: New Proposal

Original Justification:
Most AC chargers installed today for public charging do not have electronic displays. The requirements for showing prices, quantity delivered, cost of delivery, and other required data elements of Section 3.40 are fulfilled by displaying the data on a mobile phone or within the vehicle receiving the electrical energy. This alternative to having a display on the charger itself reduces the cost of the charger, as well as maintenance required when displays fail due to harsh outdoor conditions, including direct sunlight and wind, rain, and snow exposure. These conditions often make the built-in displays difficult to read. Having the option of providing the display on a mobile device or in the vehicle reduces costs, improves EVSE longevity, and, most importantly, improves the consumer experience. Moreover, EV drivers usually utilize their mobile phones to carry out charging transactions already, so the drivers are accustomed to receiving the information on their device or in their vehicle. Finally, the industry is moving toward Plug and Charge, based on the ISO 15118 standard. With Plug and Charge, the vehicle communicates with the charger to authenticate as well as initiate and end charging, with the fees processed automatically. With Plug and Charge, there is no interaction between the driver and the charger. ISO 15118 is a requirement for federal funding under the NEVI and FCI programs, as well as for some state funding, including in California.

The opposing arguments would be that there are, in fact, some AC chargers that have the Indication of Delivery on their face – but these are limited and much more expensive.

The submitter requested that this have Voting status in 2024 as a retroactive specification.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- 2024 Interim: A representative from the California Division of Measurement Standards commented that this item fails to meet the device display requirements and creates inequities for users without a smartphone. There was also a comment that the app should be submitted to NTEP by the developer and referenced upon approval.
- 2024 Interim: A representative from New Jersey Weights & Measures commented that not all users have smartphones.
- 2024 Interim: A representative from the Massachusetts Division of Standards supported the withdrawal of this item.
- 2024 Interim: A representative from the U.S. Department of Energy (DOE) commented that this item contradicts the DOE objectives for customer experience.
- 2024 Interim: A representative from the Florida Department of Agriculture and Consumer Services commented that using a phone as an indicating element introduces issues with investigations, with gaining access to the interface, and other legal problems. They recommended withdrawing this item.
- 2024 Interim: A representative from the New York Department of Agriculture & Markets Weights & Measures commented in support of withdrawing this item.

- 2024 Interim: A representative from the Maryland Department of Agriculture recommended withdrawal.

Industry:

- 2024 Interim: A representative from Gilbarco commented that using a phone as an indicating element could set unwanted precedence. They recommended withdrawal.

Advisory:

- 2024 Interim: A representative from NIST OWM recommended withdrawal. NIST OWM submitted comments against this item which are summarized as they do not believe the proposed exceptions are appropriate without more detailed work to fully vet the permissible metrological features and functions for the wide range of software-based remote devices to be recognized as the primary indicating elements for these commercial electrical energy measuring systems.

Neutral Comments:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Item Development:

NCWM 2024 Interim Meeting: Because of concerns with privacy issues related to accessing information on a personal device, the committee has withdrawn this item.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as developing and seeks input from industry stakeholders.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

General comments were heard from Mr. Chris King (Siemens), Ms. Francesca Wahl (Tesla), Mr. Kevin Schnepp (California, Division of Measurement Standards), Mr. Jose Arriaga (Orange County, CA), Mr. Mike Brooks (Arizona Department of Ag: Weights and Measures), Mr. Brent Ricks (Montana Weights and Measures Program) supporting a developing status of this item.

Mr. Chris King (Siemens) spoke to why this is needed, acceptable, and more affordable. He also claimed that there are already devices nationally type evaluated in this manner. The committee questioned what NTEP approval number Mr. King was referring to. Mr. King stated that he would provide a type evaluation number. He requested that members review his presentation which is posted on the WWMA website and requested a developing status for this item.

Ms. Francesca Wahl (Tesla): Claimed that Tesla chargers are already using a display in vehicles not on the chargers and that there is a CTEP (California Type Evaluation Program) for these chargers.

Mr. Kevin Schnepp (California, Division of Measurement Standards): Commented that there are no NTEP approved systems with a remote device as an indicator and that Tesla's (CTEP) is for a charger and car as a system. Mr. Schnepp also asked if we want the first ever device where the indication is the responsibility of the consumer? Stated that the item requires further development.

Comments were also heard on the floor from Mr. Jose Arriaga (Orange County, CA), Mr. Mike Brooks (Arizona), and Mr. Brent Ricks (Montana) regarding concern with this item, in particular:

- Accessibility of the mobile device by the consumer (credit card payment vs. mobile payment app).
- Use and responsibility of the device indication by consumer.
- Code should apply to DC as well as AC chargers.
- Code should only apply to those devices which require a mobile app to activate.
- Addressing potential wireless connection issues that may occur.

Mr. Brent Ricks (Montana Weights and Measures): Asked how the indication is connected to the charger (Bluetooth, cell service, etc.). Mr. Chris King (Siemens) responded that an RFID is used to identify the user and also uses Bluetooth on some devices. Ms. Francesca Wahl (Tesla) responded that per European regulation, it must be encrypted on back-end with a key to tie them together.

The WWMA S&T Committee recommends that this item be assigned a Developing status to allow the submitter the opportunity to consider the comments heard on the floor and receive feedback from stakeholders.

SWMA 2023 Annual Meeting: Tim Chesser, Arkansas, recommended the item be withdrawn because he was not going to enforce indicating element requirements on cell phones of customers.

Dr. Matt Curran, Florida, echoed Mr. Chesser's comments and raised concern of privacy with customer cell phones.

Patrick Bean, Tesla, stated their devices rely on customer phones and vehicle indicators for customer user interface. He also stated DC Chargers should be included with the item.

John Stokes, North Carolina, was not in support of this item.

The committee has reservations about having the customer cell phone as the sole indicating element for these devices.

The committee recommends the item be Withdrawn.

NEWMA 2023 Interim Meeting: A written statement from Siemens was provided and read during the comment period, which is included on the NCWM website. A regulator from Holliston, Massachusetts commented that when the MOS was approved for EV, it was specified that there be physical displays on the devices and what is being recommended is highly appropriate. A regulator from the Commonwealth of Pennsylvania questioned what ramifications would this cause for other display requirements across the board eg: gasoline. Other devices have proved they can have markings on displays in all kinds of weather and doesn't agree with the proposal. The States of Vermont, New Hampshire, New Jersey, New York, and the Commonwealth of Massachusetts agree with Pennsylvania that the display must appear on the device. Upon consensus of the body, the Committee recommends this item be Developing.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

EVF-24.2 V S.2.7. Indication of Delivery, N.3.2. Accuracy Testing., and T.2.1. EVSE Load Test Tolerances.

Source:
California Department of Food and Agriculture, Division of Measurement Standards

Purpose:
Change the exemption period for DC EVFS from 2028 to 2025.

Item under Consideration:
Amend Handbook 44 Electric Vehicle Fueling Systems Code as follows:

S.2.7. Indication of Delivery. – ***Except for DC systems*,*** ~~**The**~~ EVSE shall automatically show on its face the initial zero condition and the quantity delivered (up to the capacity of the indicating elements).

~~**All DC EVSE are exempt from this requirement until January 1, 2028.**~~
[*Nonretroactive as of January 1, 2025]
(Amended 2022 **and 202X**)

And

N.3.2. Accuracy Testing. – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

(a) For AC systems:

(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.

(2) Accuracy test of the EVSE system at a load of not greater than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least the minimum measured quantity (MMQ).

(b) For DC systems (see note):

(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes current (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard for a total energy delivered of at least twice the minimum measured quantity (MMQ).

(2) Accuracy test of the EVSE system at a load of not more than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard for a total energy delivered of at least the minimum measured quantity (MMQ).

~~**All DC EVSE are exempt from this requirement until January 1, 2028**~~.
[Nonretroactive as of January 1, 2025]
(Amended 2022 **and 202X**)

Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient.

And

T.2.1. EVSE Load Test Tolerances. – ***Except for DC systems*,*** ~~**T**~~**t**he tolerances for EVSE load tests are:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

~~**All DC EVSE are exempt from this requirement until January 1, 2028.**~~

[*Nonretroactive as of January 1, 2025]

(Amended 2022 **and 202X**)

Previous Status:

2024: New Proposal

Original Justification:

The 2028 exemption was provided for DC EVFS due to the lack of available field test equipment that could accurately test and verify conformance of DC EVFS to established tolerances. Testing equipment capable of testing DC EVFS at the higher power levels of modern DC EVFS is now available and new manufactures of test equipment are entering the market now. The justification for the exemption for DC EVFS is no longer valid as regulating jurisdictions have access to test equipment that can properly evaluate installations of DC EVFS for conformance to the adopted specifications and tolerances. The availability of DC EVFS test equipment has been verified by two test equipment manufacturers and by research conducted by Argonne National Lab. With fully capable test equipment available in 2023 and 2024, establishing a 2025 effective is reasonable and provides a uniform, transparent, and equitable marketplace for both consumers and competing businesses.

T.2.1. Does not have any separate specifications for either AC or DC EVFS. It is intended to be applicable to all EVFS.

EVFS manufacturers and regulators agreed to a 2028 date due to lack of available testing equipment. During open hearings prior to adoption of the 2028 exemption date, industry representatives agreed that the 2028 could be amended once test equipment was available.

The submitter requested that this have Voting status in 2024 as nonretroactive provisions.

Comments in Favor:

Regulatory:

- 2024 Interim: The submitter of this item commented that the 2025 date would be made nonretroactive and that this item is ready for a vote.
- 2024 Interim: Representatives from the Massachusetts Division of Standards, New Jersey Weights & Measures, Westchester County New York, the Pennsylvania Department of Agriculture Bureau of Weights & Measures, and the New York Department of Agriculture & Markets Weights & Measures commented in support of this item as voting with the changes by the submitter.

Industry:

- 2024 Interim: A member of the NCWM who is retired from the industry commented that there is an expectation that testing equipment will be available by 2025. He supports this item as voting.
- 2024 Interim: A representative of EVgo commented that equipment is available, and this item is ready for voting.

Advisory:

- 2024 Interim: A representative from NIST OWM supports this item as voting with the nonretroactive edit. They commented that allowing an exemption from these requirements could prove to be a barrier to placing these DC systems into commercial service as there would be no specific performance standard to apply and that jurisdictions may have no alternative but to utilize paragraph G-A.3. Special and Unclassified Equipment, which may result in application of tolerances present in other metering devices codes which would result in non-uniform regulation of these devices.

Comments Against:

Regulatory:

- 2024 Interim: A representative from the U.S. Department of Energy (DOE) opposed the 2025 date change as supply issues will prohibit equipment from being available. They stated that moving up the date from 2028 will not be uniform, smooth, fair, or just.

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- None

Industry:

- 2024 Interim: A representative from ChargePoint has no position on this item. They stated that the supply chain is not there today.
- 2024 Interim: A representative from Tesla commented in appreciation of the nonretroactive edit by the submitter and is not opposed to moving up the date. Testing procedures and implementation will still need consideration.
- 2024 Interim: A representative from EV Test Solutions LLC commented that RSA personnel are waiting for the regulation to be put into place to force the acquisition of testing equipment.

Advisory:

- None

Item Development:

NCWM 2024 Interim Meeting: The committee recommends this item as a voting item with the edit of striking the line "All DC EVSE are exempt from this requirement until January 1, 2028" in its entirety and making this requirement nonretroactive as of January 1, 2025. The Committee wants to clarify that should this item be adopted DC devices placed in service before 2025 will be exempt from paragraphs S.2.7., N.3.2., and T.2.1.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: Perry Lawton from TESCO spoke in support of the change of the date stating that the equipment will be available at the end of this year.

Theo Brillhart from Fluke support this modification in anticipating the equipment will be sufficiently available to inspectors using this timeline.

Scheleese Goudy from Electrify America is concerned that there is nothing beyond a prototype available at this time. Items should not be added to the Handbook in hopes we might be able to have equipment in the future because we might be creating a law that cannot be complied with. This item does not address legacy equipment. Electrify America recommends making this a developing item so that the submitter can address these concerns.

Mike Harrington from Iowa stated that he can be swayed either way and he believes the test equipment will be ready. He would not mind leaving the 2028 date in place. Recommend developing or informational while we await feedback from other regional meetings. Does not support voting status.

The committee recommends this item as a voting item.

WWMA 2023 Annual Meeting: Due to the WWMA S&T Committee Chairman being a submitter of this item, Matt Douglas (California Department of Food and Agriculture, Division of Measurement Standards) abstained from the committee during open hearing, committee work sessions, voting session, and subsequent deliberations.

During the WWMA 2023 annual meeting the following comments were received:

General comments from representatives of California and manufacturers of the test equipment were heard on the floor in support of this item being moved forward as a Voting item.

Scheleese Goudy (Electrify America): Questioned the meaning of the availability and lead time of the test equipment. Expressed the concern of how to address legacy devices that are already installed and being used.

Francesca Wahl (Tesla): Echoed, Electrify America regarding the legacy device issue. Recommend this item be given a Developing status.

Perry Lawton (TESCO): Clarified the availability of test equipment, it will be available in the first quarter of 2024.

Kevin Schnepp (California, Division of Measurement Standards): Legacy devices can be addressed by adding “Non-Retroactive”.

Chris King (Siemens): Agreed with Electrify America and Tesla regarding concerns about the availability of the test equipment, legacy equipment and recommended this item be given a Developing status.

The WWMA S&T Committee recommended that this item be assigned a Developing status to allow the submitter the opportunity to consider the comments made on the floor and receive feedback from stakeholders.

During the voting session comments were received from Mr. Schnepp (CA DMS) requesting that the committee reconsider the recommended developing status and change the item to a voting status.

Mr. Schnepp (CA. DMS) commented that the item is fully developed as there is nothing in this proposal that requires any further explanation or data. He also commented that the item had majority support from membership during open hearings for a voting status.

The WWMA S&T committee entered deliberations to discuss the request from the floor to amend the status of the item from developing to voting. During deliberations, the committee reviewed the item and determined that the item did have merit, was fully developed as presented in the agenda, and agreed with the motion to amend the status of the item.

The WWMA S&T committee agreed with the motion to change the recommendation from a Developing status to a Voting status for the item. It was moved, seconded, and voted on by the body. Furthermore, this committee recommends the NCWM S&T Committee consider comments heard during open hearings, specifically the concerns from industry regarding legacy devices and the potential addition of a nonretroactive date.

SWMA 2023 Annual Meeting: Perry Lawton, Tesco, was in support of this item.

Tim Chesser, Arkansas, was in support of this item.

Mauricio Mejia, Florida, was in support of this item.

Gene Robertson, Mississippi, supports this item.

ScheLeese Goudy, Electrify America, raised concerns what would happen with legacy equipment.

Alex Beaton, EVgo, echoed the statements of ScheLeese.

Patrick Bean, Tesla, agreed with Alex and ScheLeese's comments and suggested waiting for test equipment to change the date.

The committee recommends this item move forward as a Voting item.

NEWMA 2023 Interim Meeting: A representative from Tesco commented in support of the date change to 2025 as equipment is readily available to allow testing. A representative from Electrify America expressed concerns on how the date change would affect legacy devices. The States of New Hampshire, Vermont, New York, New Jersey and the Commonwealth of Massachusetts supports as voting. Upon consensus of the body, the Committee recommends this item be Voting.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

EVF-23.4 V S.5.2. EVSE Identification and Marking Requirements, S.5.3. Abbreviations and Symbols, and N.3. Test of an EVSE System.

Source:
Power Measurements LLC

Purpose:
Update the details of the recommended tests in HB44 3.40 to better conform to current practice and Pub 14 instructions.

Item under Consideration:
Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

Add the following definitions to Appendix D:

Maximum current deliverable - The maximum current that the EVSE can deliver as installed under optimum conditions. [3.40]

(Added 202X)

Maximum deliverable amperage - The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE and EV or test equipment. [3.40]

(Added 202X)

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and ~~**indelibly**~~**permanently** marked:

(a) voltage rating;

(b) maximum **current** deliverable ~~**amperes**~~;
(Amended 2023 **and 202X**)

(c) type of current (AC or DC or, if capable of both, both shall be listed);

(d) minimum measured quantity (MMQ); and

(e) temperature limits, if narrower than and within – 40 °C to + 85 °C (− 40 °F to + 185 °F).
(Amended 2021)

S.5.3. Abbreviations and Symbols. – The following abbreviations or symbols may appear on an EVSE system.

(a) VAC = volts alternating current;

(b) VDC = volts direct current;

(c) MDA = maximum deliverable amperes;

(d) kWh = kilowatt hour~~.~~**;**

(Amended 2023)

(e) MCD = Maximum current deliverable.

(Added 202X)

N.3. Test of an EVSE System. - The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard. Each test shall be performed for at least the minimum measured quantity (MMQ).

~~**N.3.1. Performance Verification in the Field. Testing in the field is intended to validate the transactional accuracy of the EVSE system. The following testing is deemed sufficient for a field validation.**~~

~~**N.3.2. Accuracy Testing. The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.**~~

~~**(a) For AC systems:**~~

~~**(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.**~~

~~**(2) Accuracy test of the EVSE system at a load of not greater than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least the minimum measured quantity (MMQ).**~~

~~**(b) For DC systems (see note):**~~

~~**(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes current (expressed as MDA) as determined from the digital communication message**~~

~~from the DC EVSE to the test standard for a total energy delivered of at least twice the minimum measured quantity (MMQ).~~

~~(2) Accuracy test of the EVSE system at a load of not more than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard for a total energy delivered of at least the minimum measured quantity (MMQ).~~

N.3.1. Testing of an AC EVSE - Accuracy tests shall be performed at the following current levels:

(a) A point between 4 A and 10 A; and

(b) A point between 40 % and 60 % of the MDA; and

(c) A point between 70 % and 100 % of the MDA.

N.3.2. Type Evaluation Testing of a DC EVSE - Tests shall be performed at the following voltage points one between 350 VDC and 450 VDC and if supported by the EVSE a second at between 700 VDC and 900 VDC:

Accuracy tests shall be performed at the following current levels:

(a) A point between 10 % and 20 % of the MDA, but not less than 30 A;

(b) A point between 40 % and 60 % of the MDA; and

(c) A point between 70 % and 100 % of the MDA.

N.3.3. Performance Verification in the Field of a DC EVSE - Accuracy tests shall be performed at any voltage and the following current levels:

(a) A point between 10 % and 20 % of the MDA, but not less than 30 A; and

(b) A point between 25 % and 100 % of the MDA, with the recommendation to test at the maximum power level within that range that is possible using the test equipment available.

Note: The test points (a) and (b) above must not be at the same current level. It is recommended that the current levels should be separated to the extent that the test equipment will allow.

For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient for field verification provided that it is greater than 40 % of the MDA and no less than 30 A.

All DC EVSE are exempt from this requirement until January 1, 2028.

(Amended 2022 **and 202X**)

~~**Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient.**~~

Previous Action:

2023: Developing

Original Justification:
S.5.2:
Change (b) to maximum deliverable amperes because that is the term to be used throughout the document. Previously both terms had been used interchangeably.

S.5.3:
Joule is no longer used in the document. Replace with the abbreviation for kilowatt hours.

N.5:
When the HB44 code was originally written there had been no real experience in EVSE testing. Additionally, DC EVSE were quite new and power levels were low (typically 50kW) by today's standards where 350 kW systems are already deployed and megawatt systems are in discussion. The test points chosen at that time have been proven to be less than optimum to verify performance of the EVSE. Publication 14, which was developed later than HB44 adopted a set of test points similar to those proposed here. The tests proposed here have been extensively discussed in the NIST EVSE Working Group. However, that Work Group ran out of time for a formal vote to approve these proposals.

As background, the NIST WG is submitting Form 15s to start the restructuring of the test process. In those Form 15s the No Load and Starting load tests are removed from section 3.4. This proposal completes the restructuring of the EVSE testing.

Detailed review of proposed changes:
Logically section 5.2.1 should follow section 5.2.2 so both sections have been renumbered.

New 5.2.1:
In the new 5.2.1 (formerly 5.2.2) the word Laboratory was added to the title. As the power of both AC and DC EVSE has grown rapidly the equipment to test them at full power has become both large and expensive. It is perfectly reasonable for NTEP or a manufacturer to have this type of equipment but not reasonable for the average Weights and Measures inspector to have it available in the field. For that reason, this proposal breaks testing into two types: (1) testing for type verification done in a laboratory or at a manufacturer and (2) testing in the field for verification.

For testing AC systems in the laboratory three test points are proposed:

(i) A point between 10 % and 20 % of the maximum deliverable amperes, but not exceeding 8A,
(ii) A point between 45 % and 55 % of the maximum deliverable amperes,
(ii) A point between 70 % and 100 % of the maximum deliverable amperes.

All test points are expressed in terms of a percent of the maximum deliverable amperes of the EVSE. For point (i) of the test a restriction has been added to ensure that high current chargers are tested near the nominal 6 A load that is the minimum charging current for most vehicles.

Today AC Level 2 chargers typically have maximum currents of 30 A to 80 A. Chargers with currents above 32 A were generally unavailable at the time HB44 3.4 was written. Several vehicles have recently been introduced that charge at 48 A. There is only one vehicle currently available that charges at 80 A. This test regime can be performed quickly. It can be performed on any AC Level 2 EVSE with test equipment commercially available and in the hands of multiple Weights and Measures authorities.

New 5.2.2:
Since HB44 3.40 was initially written a whole new generation of DC chargers have been developed. At that time the maximum power delivery was approximately 100 kW at 400 VDC. Today we have 350 kW systems operating at both 400 VDC and 800 VDC. The CCS EVSE standards have already been updated to allow chargers up to 1000 VDC and 800 A (800 kW). Because there are now two broad classes of DC EVSE; 400 VDC and 800VDC two voltage test points are included. Both voltage classes are capable of charging at 400V so a point between 350 VDC and 400VDC is required for both. For systems that can also operate at 800VDC a second point between 700 VDC and 800 VDC is required. Current points are to be tested at both voltages if they are appropriate for the EVSE.

For DC systems three test points are proposed:

(i) A point at less than 30 A
(ii) A point between 45 % and 55 % of the maximum deliverable amperes
(iii) A point between 70 % and 100 % of the maximum deliverable amperes

This approach provides a test point at the lower end of the power transfer range where older vehicles may charge or where more modern EVs charge when topping off. The other two points are intended to bracket the power levels where most EV transfer most of their energy.

The power levels of DC EVSE are rapidly evolving to ever higher levels. For that reason, this change provides for flexibility in field testing of DC EVSE at the high power point. The high current point is revised to 20% to 100% of the maximum deliverable current **with guidance to test at the maximum power level that is possible using the test equipment available. The new code also provides for using a vehicle as the test load providing it meets the 20% of** maximum deliverable current requirement.

One objection might be the creation of a field testing regime for DC EVSE that is less rigorous than that applied in the laboratory. For many decades ANSI C12 meter testing has applied testing over the full range of voltage and current for meters during type testing but only done validation testing at two current values. For example, class 320 meters (320 A maximum current) are tested for accuracy at 11 points between 3 A and 320 A during type evaluation. However, for verification typically only two current points are used 5 A and 50 A.

Another objection might be the requirement to test 800 VDC EVSE at both 400 VDC and 800 VDC. Only a very few electric vehicles (three at this time) are capable of using 800 VDC charging. Therefore, even though an EVSE may be capable of 800 VDC operation because mose EV operate at 400 VDC testing at 400 VDC on an 800 VDC capable system is appropriate.

The submitter requested that this be a Voting item in 2023.

Comments in Favor:

Regulatory:

- 2024 Interim: A representative from the Department of Energy supports a voting status in order to begin the implementation of test procedures.
- 2024 Interim: A regulator from the State of California supports a voting status of the item with recommended edits. Those edits were submitted to the committee for consideration.

Industry:

- 2024 Interim: A member of industry representing Tesco spoke in support of a voting status and commented it would allow for the longevity of testing equipment.
- 2024 Interim: A member of industry, retired from Tesco (Power Measurement), commented he felt the 2025 date is more appropriate. He also mentioned the USNWG reached a consensus, but not an official position. He supports a voting status, adding the language is needed and is essential for current technology.
- 2024 Interim: A member of industry representing Electrify America commented he felt the 2025 date is more appropriate. He also mentioned the USNWG reached a consensus, but not an official position. He supports a voting status, adding the language is needed and the date of 2028 should be kept as a separate issue.
- 2024 Interim: A member of industry representing Fluke Electronics spoke in support of a voting status, adding that it is a consensus proposal and is needed for regulators and the industry.

Advisory:
- None

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- 2024 Interim: A member of industry representing EV Test Solutions questioned the need for the mid-level test. He commented the test would add additional time and cost to the inspection process. He questioned if the tests are supported by data.
- 2024 Interim: A member of industry retired from Tesco (Power Measurement) commented that the three tests are aligned with Publication 14 and with OIML. He also commented that the new tests would take a fraction of the time of the old tests, taking less time than before for testing.

Advisory:
- 2024 Interim: A representative of NIST OWM recommended a developing status and mentioned there were recent edits in August 2023 by the submitters. NIST OWM is aware of additional revisions that will be proposed on the work by the test procedure subcommittee and recommends further review and consideration of the edits. These are described in the NIST OWM executive analysis.

Item Development:
NCWM 2024 Interim Meeting: The Committee considered the comments heard during open hearings and assigned a voting status to the item. The Committee updated the item to reflect changes agreed upon by the submitter. These include updates to paragraph S.5.2., changing the word "indelibly "to "permanent" and removing the word "convenient" from paragraph N.3.3. to add clarity.

NCWM 2023 Annual Meeting: The Committee heard from Bill Hardy, Power Measurements, LLC-NIST USNWG SG is working on updated language.

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and assigned a Developing status to the item. The Committee recommends the submitter work with the NIST USNWG EVFE Subgroup for item development. The Committee discussed and changed the title to clarify the intent of the proposal.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: The committee heard comments on this item and item EVF 23.7 concurrently. Comments made about this item will also be found in the comments section on item EVF 23.7.

Theo Brillhart from Fluke presented material regarding the merge of EVF 23.4 and EVF 23.7 by the submitters as well as the passing of item EVF 23.1 at the 2023 Annual NCWM Meeting. The passing of item EVF 23.1 has forced a renumbering of sections within this current proposal. The submitters of EVF 23.4 and EVF 23.7 have reflected those changes in their proposal. With these changes (letter submitted), the submitter recommends this item as voting.

Scheleese Goudy from Electrify America agrees with the proposal because it makes testing easier. Language regarding '10 amps or above' fixes the concerns between item EVF 23.4 and item EVF 23.7.

Perry Lawton from TESCO applauds the work achieved between EVF 23.4 and EVF 23.7.

Steve Peter from Wisconsin supported this item.

The committee recommends this item moving forward as a voting item with the proposed changes by the submitter which are attached to the bottom of this report. [APPENDIX C]

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting:

The Committee heard comments regarding item EVF-23.7 and this item. The WWMA S&T Committee received a letter with updated proposed language for this item and EVF-23.7. The letter has been posted to the WWMA website {Events – Meeting Documents – Letter from the Submitters EVF-23.4 and EVF-23.7}. This letter has also been provided to the NCWM S&T Committee.

Comments were heard from Theodore Brillhart (Fluke), Scheleese Goudy (Electrify America), Perry Lawton (Tesco), Francesca Wahl (Tesla), and Chris King (Siemens) supporting the proposed language in the Joint Letter dated August 22, 2023.

Mr. Kevin Schnepp (California Division of Measurement Standards): Supported this item with an additional proposed revision of changing the Exemption Date from 2028 to 2025.

The WWMA 2023 S&T Committee recommends this item be revised to reflect all proposed language in the Joint Letter dated August 22, 2023, and that the item remain Developing to allow all stakeholders the ability to review all proposed changes. This Committee recommends the withdrawal of item EVF-23.7 in favor of this item with the revisions per the letter.

The letter will be posted on the NCWM website.

SWMA 2023 Annual Meeting: ScheLeese Goudy, Electrify America, stated this was a joint proposal and will take the place of EVF-23.7.

Perry Lawton, Tesco, supported this item.

Juana Williams, NIST, the Test Procedures Sub-committee was asked to provide feedback on earlier combined proposal as well as an earlier proposal. They came back with 10 items they would like addressed and terms like optimal test load, convenient voltage, and optimal conditions.

The committee considered the proposed joint language from a letter dated August 22, 2023 from both submitters. The item itself still needs to be updated with this new language.

The committee recommends this item move forward as a Voting item.

NEWMA 2023 Interim Meeting: A representative from Electrify America provided a presentation on updates with this proposal. Comments were heard that the submitters of EVF-23.4 and 23.7 worked together on a joint proposal to come to a consensus on low end testing and specify minimum loads on DC meters. A representative from Tesco commented that the new proposal provides realistic testing constraints that will last and establishes minimums and parameters for "man in the middle" testing. Upon consensus of the body, the Committee recommends this item be Voting with the following changes:

Strike the entirety of N.3 and replace with:

N.3. Test of an EVSE System.
The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard. Each test shall be performed for at least the minimum measured quantity (MMQ).

N.3.1. Testing of an AC EVSE
Accuracy tests shall be performed at the following current levels:
(i) A point between 4 A and 10 A; and
(ii) A point between 40 % and 60 % of the MDA; and
(iii) A point between 70 % and 100 % of the MDA.

N.3.2. Type Evaluation Testing of a DC EVSE
Tests shall be performed at the following voltage points one between 350 VDC and 450 VDC and if supported by the EVSE a second at between 700 VDC and 900 VDC:
Accuracy tests shall be performed at the following current levels:
(i) A point between 10% and 20% of the MDA, but not less than 30 A;
(ii) A point between 40 % and 60% of the MDA; and
(iii) A point between 70 % and 100 % of the MDA.

N.3.3. Performance Verification in the Field of a DC EVSE
Accuracy tests shall be performed at any convenient voltage and the following current levels:
(i) A point between 10% and 20% of the MDA, but not less than 30 A; and
(ii) A point between 25 % and 100 % of the MDA, with the recommendation to test at the maximum power level within that range that is possible using the test equipment available.

Note: The test points (i) and (ii) above must not be at the same current level. It is recommended that the current levels should be separated to the extent that the test equipment will allow.

For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient for field verification provided that it is greater than 40 % of the MDA and no less than 30 A.

All DC EVSE are exempt from this requirement until January 1, 2028.

Change S.3.2 (b) to read:

(b) Maximum current deliverable

Add S.3.3 (e) to read.

(e) MCD = Maximum current deliverable

Add the following definitions to Appendix D:

Maximum current deliverable: The maximum current that the EVSE can deliver as installed under optimum conditions.

Maximum deliverable amperage: The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE and EV or test equipment.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

EVF-23.6 V S.5.2. EVSE Identification and Marking Requirements., and T.2. ~~Load~~Accuracy Test Tolerances.

Source:
Florida Department of Agriculture and Consumer Services; Electrify America; Tesla; EVGo, Siemens

Purpose:
The revised proposal would amend Handbook 44, Section 3.40 Tentative Code in the following ways:

1. Paragraph T.2.1 would be revised for DC chargers. The 1% (acceptance) / 2% (maintenance) tolerances would apply to devices installed after January 1, 2024. For devices installed before that date, the tolerances would be 5% (acceptance and maintenance).
2. For the sake of clarity and transparency for customers and inspectors, a device subject to the 5% tolerance would have to be marked as such. The proposal would require specific language for the marking.
3. If a manufacturer has achieved 1%-capable chargers earlier than the January 2024 timeframe, users of those chargers might prefer not to mark the chargers as 5% chargers; and then those chargers would be subject to the 1%/2% tolerance. The proposal includes language to establish this treatment.
4. The 5% tolerance for pre-2024 chargers would end on January 1, 2034. After that date, all DC chargers would be subject to the 1% (acceptance) / 2% (maintenance) tolerance.

Item under Consideration:
Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and ~~**indelibly**~~ **permanently** marked:

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.
.

(Amended 202X)

S.5.2.1. Marking of Accuracy Class, DC EVSEs Placed in Service Prior to 2024. - A DC EVSE that was placed into service prior to 2024 and is subject to the tolerances of T.2.2(a) is a Class 5 EVSE, and shall be marked with Class 5. The marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used

for the marking, provided the marking is visible to the customer prior to the beginning of the transaction.

(Added 202X)

T.2. ~~Load~~Accuracy Test Tolerances.

T.2.1. EVSE ~~Load~~ Accuracy Test Tolerances for AC Systems. – The tolerances for EVSE load tests **for AC Systems** are:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

(Amended 2022 **and 202X)**

T.2.2. EVSE Accuracy Test Tolerances for DC Systems. - The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For a DC system that was placed in service prior to January 1, 2024, and that is marked Class 5, acceptance and maintenance tolerances are: 5.0 %. This paragraph T.2.2(a) shall expire on January 1, 2034; after that date, all DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).

(b) For any DC system not subject to paragraph T.2.2(a), tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

(Added 202X)

All DC EVSE are exempt from this requirement until January 1, 2028.

Previous Action:
2023: Voting - Returned to Committee

Original Justification:

A. The effect of the proposed revisions

The changes we propose would work as follows: All DC chargers would remain exempt from the accuracy tolerances until January 1, 2028, as NCWM adopted at the 2022 annual meeting. When accuracy tolerances come into force, a DC charger installed after January 1, 2024, would have to satisfy the 1% (acceptance) / 2% (maintenance) tolerance, the same levels as for AC chargers. Buta DC charger installed before January 1, 2024, would have to meet only a 5% accuracy tolerance. That 5% accuracy tolerance would expire on January 1, 2034, at which point all the legacy chargers will have to have been retrofitted or replaced.

The proposal would require a charger that is subject to the 5% tolerance to display a marking, with specified language, informing customers and inspectors of that fact. But the proposal leaves open the possibility that a given manufacturer might achieve the 1%/2% tolerance earlier, and then would specify that capability for a given model. Devices in that model would not have to bemarked as 5% devices; but if they are not marked that way, they would of course be subject to the 1%/2% level as for new chargers.

B. The basic justification

DC and AC chargers are fundamentally different–in technology, in customer use, and in metering capabilities. AC charging technology, the older form, delivers energy in the same form—voltages and currents oscillating at 60 Hertz (in the United States) as utilities have provided it for a century. Because a vehicle has to convert AC energy to DC for charging the battery, AC charging stations operate at no more than 19.7 kW, and most no more than 6-7 kW. These charging rates will add 24-80 miles of range in an hour of charging a typical car, and consequently AC charging involves extended sessions–the median time that a customer uses an AC station is 22 hours.[3] The voltages delivered are no more than 480 volts ac, and the current is no more than 50 amps ac (andmore typically 30 amps ac). By contrast, DC chargers deliver energy in the same form that a battery ultimate needs it. Using voltages of 400 to 950 volts dc and currents up to 500 amps dc (higher levels are coming in the future for applications like charging heavy trucks), they are able todeliver 50kW, 150 kW, 350 kW, or higher charging rates. These stations will add 200-1400 milesof range in an hour of charging, or, more meaningfully, 400 miles of range in as little as 20 minutes. A customer at a DC station will arrive, charge briefly, and then depart. Customers incorporate AC chargers into their regular routines, such as by driving to work and charging there. DC chargers are more commonly used to support long-distance trips.[4]

For AC charging, manufacturers have been able to utilize metering technology that has been developed over a century for electric utilities. When Handbook 44, section 3.40 was developed in 2015, that AC metering technology was well understood. There have been long-established standards for AC revenue meters—though those standards, in the utility sector, are not necessarily the same in every respect as how a weights and measures standard would work.

One indication ofthe relatively mature state of AC metering is that NIST has long provided ordinary-course calibration services for AC watt-hour meters that operate at 60 Hertz, within ranges of 69 to 480 volts and 0.5 to 30 amps (sufficient to cover typical AC chargers).[5] DC metering technology, by contrast, has been "in research and development."[6] When section 3.40 was adopted, the accuracy tolerances of 1.0% (acceptance) and 2.0% (maintenance) were predictive and aspirational for DC chargers. As of November 2019, when California adopted its own regulation based on section 3.40, meters and chargers meeting that standard were not yet generally commercially available.[7] Meanwhile, NIST calibration services for DC watt-hour meters are non-standard, and are available only up to 240 volts and 5 amps[8]—far below the levels needed for testing DC chargers.

Argonne National Lab has studied the availability of DC metering technology. Our understanding is that its draft report (not yet finalized, so far as we are aware) concludes that thereare now on the market (at least in principle) meters for use in DC chargers that can meet a 1% acceptance / 2% maintenance tolerance. It is reasonable to conclude that the 1% / 2% tolerancewill be achievable in general. The current proposal is focused on how to handle the chargers that are installed before that point. Previously installed chargers will not in general be able to satisfy a 1% / 2% accuracy tolerance. To be clear, we do not suggest that every existing charger would be more than 2% inaccurate. Indeed, it would not genuinely be possible to make that assessment, given the lack of NIST-traceable measurement apparatus to test fast DC chargers in the field.

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[3] Idaho National Laboratory, "Plugged In: How Americans Charge Their Electric Vehicles," p.14, https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf.

[4] As the California Energy Commission has explained, "it is therefore useful to treat infrastructure for interregional travel (predominantly DCFCs) differently from infrastructure for intraregional travel (predominantly Level 1 and Level 2 chargers)." https://efiling.energy.ca.gov/GetDocument.aspx?tn=233986&DocumentContentId=66805 at page 14.

[5] https://shop.nist.gov/ccrz ProductDetails?sku=56200C&cclcl=en_US.

[6] Cal. Dep't of Food & Agriculture, Final Statement of Reasons on Electric Vehicle Fueling Systems, p.23 (Nov. 1, 2019).

[7] Id.

[8] https://shop.nist.gov/ccrz ProductDetails?sku=56110S&cclcl=en_US.

There is presumably a distribution of potential deviations among devices in the field. Given whatmetering technology has been commercially available, a 2% maintenance accuracy would lead to inspection problems for a high proportion of devices.

The proposal would establish a tolerance of 5% for devices installed before January 1, 2024. The justification for this particular choice of tolerance and timeline is as follows:

1. In 2019, California adopted a regulation that put a modified version of section 3.40 into force for new devices. DC chargers installed before January 2023 are subject to no weights and measures standards at all until 2033. DC chargers installed after January 2023 (and before January 2033) are subject to a maintenance tolerance of 5.0% (and acceptance tolerance of 2.5%). Consequently, in California, which represents roughly 30% of the currently-existing base of DC chargers, the maintenance tolerance will be 5.0% for the coming decade. A maintenance tolerance of 5.0% for legacy chargers in section 3.40 will be stricter overall than the California regulation (because it will apply to all legacy chargers, whereas the California standard applies only to post-2023 chargers), but will align with the numerical tolerance used in California. Although a 5.0% tolerance is among the larger tolerances used in Handbook 44, it is not unprecedented. And the fact that new chargers in California will be subject to that standard will mean EV charging customers have substantial experience with that chargers at that tolerance, and the 5.0% tolerance we propose would be the same transactional experience as customers in California (the largest EV charging market in the country) receive. It bears mention, too, that as Measurement Canada prepares to implement standards for AC chargers, the tolerance (acceptance and maintenance) will be 3.0%, not the 1% acceptance in Handbook 44. The cost of a typical charging session is $15 to $20. A 5.0% maintenance standard would mean a variation, beyond that, of an additional plus or minus 40 cents. As with any tolerance, that variation could at any given charger be for or against either side to the transaction.

2. The industry submitters have studied carefully their existing chargers, measurement devices and existing models now available. They believe the 5% maintenance tolerance is achievable at a manageable cost in the future, because it will generally not require extensive reconfiguring of cabinets and the installation of four-wire cables.

3. The cost of bringing legacy chargers into line with the 1%/2% standard would be extreme. Although equipment is not available to test DC fast chargers in the field, some operators have found in tests of existing devices that they can be brought to a 5% tolerance, but cannot meet the 1%/2% standard without replacing the meters or implementing an entirely new measurement system, which means a physical reconfiguration at each station and/or replacing the cables for delivering the energy to vehicles. Section 3.40 standards are based on the energy delivered at the connector to the car; in other words, a charger must account for losses in the cables. The most straightforward way to account for losses is to measure the voltage at the vehicle connector; that means the cable must have two additional high-voltage leads, to carry that voltage back to the meter.[9] In California's Initial Statement of Reasons (ISOR) for adopting specifications and tolerances requirement for commercial EVSE, California estimated that it costs approximately $20,000 to retrofit an existing DC charger.[10] We understand that cost to represent the cost (parts and labor) to replace the charging cable, and possibly to replace the meter if that task is simple. This cost may be a significant underestimate for some models of charger, because replacing the meter may not always be possible without physical reconfiguration of the space within the charger. Which charger models would require that sort of reconfiguration, and what proportion of the installed base they represent, is impossible to know without a detailed model-by-model study and detailed model-by-model installation data across manufacturers. The upper end of cost would be simply the cost of replacing a charger, which many operators would find preferable to physical reconfiguration of charger internals anyway. The

[9] Charging cables are themselves complex objects, with liquid coolant and high-voltage insulation. Cables for fast DC chargers that include additional high-voltage sensing leads were not available in 2015.
[10] https://www.cdfa.ca.gov/dms/pdfs/regulations/EVSE_ISOR.pdf.

International Council on Clean Transportation ("ICCT") reported in 2019 that fast DC chargers cost between $75,000 and $140,000 per charger, for the charger itself.[11] Installation costs range from $18,000 per charger (for six 150 kW chargers at a site) to $65,000 per charger (for one 350 kW charger at a site).[12] The total cost (installation and equipment) for a 4-charger site would be roughly $720,000. That said, some amount of the installation cost represents upgrades to electrical supply lines and basic site construction, costs that would not be incurred anew to replace equipment. So for a rough estimate, it is appropriate to use the lowest cost estimate from the ICCT, which is $17,692 (the cost per charger for a large site of 50 kW chargers). With that figure, replacing a 4-charger site of 350 kW chargers would cost roughly $630,000, or $157,000 per charger.

4. Based on data on the existing charge base from the National Renewable Energy Laboratory's Alternative Fuels Data Center ("AFDC"), we can assume there will be about 36,000 "pre-2024" DC chargers.[13] These are only a fraction of the overall chargers that will be installed nationwide over the coming decade, but bringing them into compliance with a 1%/2% tolerance will be highly costly. Taking out the 30% that are in California (which already has regulations with a 5.0% maintenance tolerance, for all post-2023 DC chargers), retrofitting all of those at the $20,000 cost would total $720 million. If meter replacement is not possible and those chargers must all be replaced, the total would be $5.6 billion. The actual cost of bringing the pre-2024 chargers to compliance with a 2.0% maintenance tolerance would be somewhere between these numbers.[14]

5. The January 2024 date moves faster than the California regulation. Under the California regulation, the 1% / 2% tolerance would not come into force until 2033. It appears that meters capable of that tolerance are now available on the market. The submitters propose January 2024 as the date for distinguishing "legacy" from "new" chargers, because the existence of these meters on the market is not all that is needed. Manufacturers have to access the meters, design products incorporating them; revise production lines; test the new products to ensure they are safe and reliable; and obtain third-party certifications (such as from Underwriters Laboratory) of the revised products. After those steps, a manufacturer can begin delivering a revised product to operators. Installation of a charger is not simply a matter of placing it on a counter; charging sites involve construction work, leading to the secure attachment of a charger to a specially built concrete pad. In other words, from the first delivery of a new model of charger to the first installations of those chargers also takes time. The January 2024 date is appropriate for expecting new chargers to incorporate meters that were available a few years before that date.

6. The proposal focuses on installation before January 2024, rather than using the concept of retroactive/non-retroactive that is more common in Handbook 44, because non-retroactive is ordinarily based on when a device is placed in service. Many states do not yet regulate EV chargers and consequently have no placed-in-service process. In these states, "placed in service" would not be a well-defined concept, and regulators might not have good ways to determine when a device was placed in service. Installation is a reasonably well-defined process, and it should be possible to

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[11] Michael Nicholas, "Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas," ICCT Working Paper 2019-14, p.2 tab. 2 (Aug. 2019), https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf.

[12] Id. at 4 tab. 4.

[13] According to the AFDC's station locator database, there are 6,580 DC stations with 22,767 chargers. The AFDC also reports that the number of DC ports grew 29% year-on-year to the second quarter of 2021. https://afdc.energy.gov/files/u/publication/electric_vehicle_charging_infrastructure_trends_second_quarter_2021.pdf. With growth at this rate, about 6,600 additional DCFC stations will be installed in 2022 and 2023, leading to a total of about 36,000 DC chargers that would be "pre-2024" chargers under the proposal.

[14] A charger that is not qualified for a given tolerance level may well be within the bounds of the tolerance, because there is some distribution in metering performance. Even if devices are replaced only after inspection, a significant fraction would need replacement, thus incurring this scale of cost. Moreover, it might be most sensible for an operator to ensure all its devices are qualified, rather than waiting to see what the results of inspection might be for a given charger.

identify when a given charger was installed. California's regulation has differing statusfor pre-2023 and post-2023 chargers, and it bases that line on installation.

7. The proposal also specifies 5.0% as the acceptance tolerance, not just the maintenance tolerance. As a practical matter in field inspections, the acceptance tolerance for pre-2024 chargerswill not be important. Section 3.40 (as amended at the 2022 NCWM meeting) exempts DC chargers from the accuracy tolerance until 2028. When they become subject to accuracy tolerances, no pre-2024 charger will be at the point of acceptance. The proposal specifies an acceptance tolerance for clarity in type evaluations, which ordinarily evaluate device models against the applicable acceptance tolerance.

8. The exemption until 2028 adopted at the 2022 meeting does not eliminate the need for this proposal. When DC chargers are subject to accuracy tolerance requirements, pre-2024 chargers will still need to meet the applicable tolerance or be retrofitted or replaced. The 2028 time frame is unreasonably soon to do that, given the cost estimates above. California estimated that chargershave an effective 10-year lifespan.[15] This estimate is highly uncertain, in part because it was based in part on older AC chargers. Newer DC chargers, using more advanced technology for significantly more expensive equipment, are likely to have usable lifetimes greater than 10 years. The proposal recognizes that, nonetheless, there is a tradeoff between the cost of retrofitting or replacing devices, and the value of tighter tolerances. Some number of chargers will fail and need replacement earlier than 10 years, thus reducing the number that eventually need to be retrofitted or replaced to comply with tighter accuracy tolerances. Overall, the proposal uses the same 10- year period that several states have already adopted.[16] Notably, the effect is significantly more stringent than in the California regulation. Under California's rule, a charger installed before 2023 is subject to no standards for 10 years, and then becomes subject to standards in 2033; a replacement of the charger in 2032 would be subject to the 5.0% maintenance tolerance. A charger installed in 2023 (and that hypothetical 2032 installation) would be subject to the 5.0% tolerance indefinitely, with no end point. Our proposal, by contrast, would make a pre-2024 charger subject to the 5.0% tolerance once the 2028 compliance dates kicks in but only until 2034, at which point the charger would have to be retrofitted, replaced, or otherwise brought to the 1%/2% tolerance.

C. Potential objections

In response to the industry's original proposal, some people commented that AC and DC chargers should be treated the same. As explained above, they are not the same, not only because of technology differences but also because customers use them and view them differently. California and NTEP have distinguished AC and DC chargers since at least 2021, and NCWM has already recognized important differences between them, in Handbook 44.

Some have also commented that there should not be parallel accuracy classes for a given application. But this approach is not unprecedented. In 1986, NCWM required new scales to be marked with an accuracy class. Pre-1986 scales could remain unmarked, and those unmarked scales were subject to various accuracy tolerances (depending on application) that ranged up to 5.0%, compared to the largest tolerance for any marked scale at 2.0%. For grain moisture meters, Handbook 44 has completely separate sections for pre-1998 and post-1998 devices, with some different tolerance specifications for older and newer devices. For both scales and grain moisture meters, there was no sunset date; the older devices have been allowed to continue in use for as long as they operated. We do not suggest that the circumstances with EV chargers are the same. Each of those past examples was based on justifications particular to that situation. Nonetheless, these examples show that it has been done to maintain parallel tolerances for a given application. In addition, there are already parallel, differing tolerances for EV chargers. If the proposal is not adopted, pre-2023 chargers in California will have no tolerance at all until 2033; post-2023 chargers will have a 5.0%

[15] Cal. Dep't of Food & Agriculture, Final Statement of Reasons, p.6.
[16] 4 Cal. Code of Regulations § 4002.11; Rev. Code Wash. § 19.94.190(6).

maintenance tolerance for the indefinite future; and chargers elsewhere in the country, including in states neighboring California, will have the existing Handbook 44 tolerances. The proposal shifts the line between differing tolerances, but the situation of differingtolerances for the same application is already in place without the proposal.

There have been claims that some manufacturers may be able to achieve 1% devices (DC chargers) before January 2024, and one or more may already have done so. Even so, the proposal is still warranted. Operators of EV chargers should not be forced to replace their existing chargers simply because they could not get access to chargers made by a given manufacturer. It is generally agreed that when section 3.40 was adopted, the equipment to satisfy it did not exist for DC chargers. Reaching that point has required research and development by meter manufacturers andcharger manufacturers. The goal of regulation should be to handle the technology transition in a reasonable, fair manner, without prejudice to operators that have made diligent efforts in procurement and operation of their chargers.

This proposal arrives without the formal approval of the U.S. National Work Group subgroup onEV charging. But a similar proposal did have general consensus at the Work Group. NIST personnel solicited views on the proposal through an email ballot at the end of June 2022. The resulting votes were 11 in favor, and 1 opposed. As of this filing, NIST has not provided information on whether this vote was sufficient for the subgroup to formally endorse the proposal. The one person voting "no" said that the person would have voted yes if the proposal included a 10-year end date for the 5% tolerance. The current proposal has that feature and thus addresses the only concern expressed by the sole "no" vote.

Comments in Favor:

Regulatory:

- 2024 Interim: A regulator from the State of Louisiana supports a voting status on the item.
- 2024 Interim: A representative from the Department of Energy supports a voting status on the item with the exemption date remaining as 2028.
- 2024 Interim: A regulator from the State of New Hampshire supports a voting status on the item.
- 2024 Interim: A regulator from the State of Pennsylvania supports a voting status on the item with a 2025 exemption date along with the Class 5,5% tolerance.
- 2024 Interim: A regulator from the State of Florida supported a voting status with the edits if the 2028 exemption date is changed to 2025.
- 2024 Interim: A regulator from the State of New York supported a voting status with the edits.
- 2024 Interim: A regulator from the State of California supported a voting status with the 2025 exemption date.

Industry:

- 2024 Interim: The submitter gave a presentation on the revisions as put forward on the Form 15 dated August 2023. The Form 15 was posted on the NCWM website. The member of industry representing Electrify America supports a voting status.
- 2024 Interim: A member of industry representing EVgo supports a voting status with current edits from SWMA, including the 5% tolerance on devices placed in service before 2024.
- 2024 Interim: A member of industry representing TESLA supports a voting status with the edits.
- 2024 Interim: A member of industry representing ABB E-Mobility supports a voting status with the edits.
- 2024 Interim: A member of industry representing ChargePoint supports a voting status with the edits. He added that he would like to see the allowance for digital displays to meet the requirement.

Advisory:

- None

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: A representative of NIST OWM stated the new language proposed in August 2023 needs further discussion with stakeholders to identify any impacts it may have on the industry and to address any inequities with existing devices. Additional comments are provided in NIST OWM's executive analysis. NIST OWM recommends a developing status.

Neutral Comments:

Regulatory:
- 2024 Interim: A regulator from Measurement Canada provided clarification on the justification of this item. He stated that Measurement Canada has a 1% acceptance tolerance for these devices.

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: The Committee considered the comments heard during open hearings and has updated the item with the changes requested by the submitter, assigning a voting status to the item. The submitter provided a presentation clarifying the updates as reflected in the August 2023 update. This presentation, along with the Form 15, has been posted on the NCWM website.

NCWM 2023 Annual Meeting: The Committee considering comments from the floor and modified the item to match that proposed by the CWMA. The Committee agreed to make the item voting not changing any dates in the proposal. The item did not receive enough votes to pass or fail. The item was returned to committee.

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and has assigned a Voting status to the item. The Committee worked on modifying the item based on the comments heard during open hearings and written comments submitted by NIST OWM.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: Scheleese Goudy from Electrify America presented on this item. Scheleese recommends this as a voting item with revisions.

Mike Harrington from Iowa supports item with changes and that we should not put accuracy markings regarding tolerances on the meter because we might need to then do that for all devices. Tolerances are currently public information and consumers can find them if needed. Accuracy class marking will help inspectors know what tests/tolerances to apply and should be on the devices. Mike supports this item as voting.

Greg VanderPlaats from Minnesota supported this item at the 2023 NCWM Annual Meeting. The language in this updated proposal is better than the previous version. Greg supports as a voting item.

The committee recommends this item as a voting item with the following changes:

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and ~~**indelibly**~~ **permanently** marked:

(a) voltage rating;

(b) maximum current deliverable;

(c) type of current (AC or DC or, if capable of both, both shall be listed);

(d) minimum measured quantity (MMQ); and

(e) temperature limits, if narrower than and within – 40 °C to + 85 °C (− 40 °F to + 185 °F).

S.5.2.1. Marking of Accuracy Class, DC EVSEs Placed in Service Prior to 2024. - A DC EVSE that was placed into service prior to 2024 and is subject to the tolerances of T.2.2(a) is an accuracy Class 5 EVSE, and shall be marked with Class 5. The marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used for the marking, provided the marking is visible to the customer prior to the beginning of the transaction. (Added 202X)

T.2. Test Tolerances.

T.2.1. EVSE ~~Load~~ **Accuracy** Test Tolerances for **AC Systems**. – The tolerances for EVSE load tests **for AC systems** are:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

T.2.2. EVSE Accuracy Test Tolerances for DC Systems. - The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For a DC system that was placed in service prior to January 1, 2024, and that is marked Class 5, acceptance and maintenance tolerances are: 5.0 %. This paragraph T.2.2(a) shall expire on January 1, 2034; after that date, all DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).

(b) For any DC system not subject to paragraph T.2.2(a), tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

All DC EVSE are exempt from this requirement until January 1, 2028.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting:

Updated language to this item was provided to the WWMA S&T Committee and posted to the WWMA website, {Events – Meeting Documents – EVF-23.6 Proposal}.

A presentation was given by the submitters of this item. The submitters spoke to:
- 5% tolerance for legacy devices
- Marking requirement of class 5 based on comments received during the 2023 NCWM Annual Conference.

General comments from industry supported a Voting status with the updated language.

Kevin Schnepp (California, Division of Measurement Standards): Supports this item with the recommended revision of the Exemption Date from 2028 to 2025.

Mahesh Albuquerque (Colorado, Division of Oil and Public Safety): Supports this item as Voting status.

Comments from regulatory officials were heard regarding the concern of the language "placed into service" and the removal of the language of "Install" with the potential effect to "legacy devices" being used in the marketplace.

Lenny Vang (EV Testing Solutions): Questioned where the data on the 5% tolerance resulted from and requested from the submitter the data to justify the 5% tolerance.

Scheleese Goudy (Electrify America): Clarified that the tolerances were aligned originally with California standards and existing devices in use.

Questions were raised about whether the marking requirement of "Class 5" if fully informative to a consumer.

The WWMA 2023 S&T Committee recommends this item be assigned a Developing status with the recommendation the submitter consider comments heard on the floor. This committee notes there are two items on the 2023 WWMA S&T agenda that propose changes to section T.2 Load Test Tolerances (also see EVF-24.2).

Updated language will be posted on the NCWM website.

SWMA 2023 Annual Meeting: The committee recommends the following language as a replacement for the above item:

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and **permanently** ~~indelibly~~ marked:

(a) voltage rating;

(b) maximum current deliverable;

(c) type of current (AC or DC or, if capable of both, both shall be listed);

(d) minimum measured quantity (MMQ); and

(e) temperature limits, if narrower than and within –40°C to +85°C (40 F to +185°F).

S.5.2.1. Marking of Accuracy Class, DC EVSEs Placed in Service Prior to 2024. - A DC EVSE that was placed into service prior to 2024 and is subject to the tolerances of T.2.2(a) is a Class 5 EVSE, and shall be marked with Class 5. The marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used for the marking, provided the marking is visible to the customer prior to the beginning of the transaction.

(Added 202X)

T.2. ~~Load~~ **Accuracy** Test Tolerances.

T.2.1. EVSE ~~Load~~ **Accuracy** Test Tolerances for **AC Systems**. – The tolerances for EVSE load tests **for AC systems** are:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

T.2.2 EVSE Accuracy Test Tolerances for DC Systems. -- The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For a DC system that was placed in service prior to January 1, 2024, and that is marked Class 5, acceptance and maintenance tolerances are: 5.0 %. This paragraph T.2.2(a) shall expire on January 1, 2034; after that date, all DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).

(b) For any DC system not subject to paragraph T.2.2(a), tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

All DC EVSE are exempt from this requirement until January 1, 2028.

Paul Floyd, Louisiana, supports the revised item.

Mrs. Goudy gave a presentation of this item and supports the revision along with the other submitter and requests the NCWM S&T committee revise the item to the included language. She also stated the 5% tolerance because the 2% tolerance is unobtainable for legacy devices. She suggested the date change 2028 to 2025 remain a separate item. Ms. Goudy also stated that industry would roll out the marking requirements via the indicating element.

Mauricio Meija, Florida, supported this item.

Tim Chesser, Arkansas, supported this item.

Steve Benjamin, NC, stated support for this item.

John Stokes, South Carolina, asked whether jurisdictions had considered treating EVF as a service rather than a motor fuel.

Tim Chesser responded to Mr. Stokes that Arkansas views it as both, and both would fall under Weights and Measures jurisdiction.

Paul Floyd, LA, responded to Mr. Stokes, that Louisiana has redefined retail electricity meters as a commercial weighing and measuring device.

Alex Beaton, EVGo, stated that they will work hand in glove with the manufacturer to make adding the marking requirement seamless and requested a voting status for the item.

Juana Williams, OWM, stated that that NIST has some concern that the use of multiple dates will cause confusion, and cautioned moving forward without considering past discussions on digital markings.

Perry Lawton, Tesco, supported changing the date from 2028 to 2025.

The committee recommends this item move forward as a Voting item using the above language.

NEWMA 2023 Interim Meeting: A presentation was given by a representative from Electrify America which described that this proposal would create a Class 5 EVSE device, which would alleviate concerns of having a tolerance percentage on the face of the device and requested a voting status. Regulators from the Commonwealths of Pennsylvania and Massachusetts, and the States of Vermont and New Jersey support the changes as they would address the legacy devices. A regulator from the State of New Hampshire commented that there are concerns with "placed in service" vs "installed". When something is placed in service, it may have been installed 10 years prior. A regulator from Holliston, Massachusetts questioned if the 2034 date is more of a convenience of manufacturers or a benefit to consumers and how are they supposed to know what a Class 5 means. He also questioned if the number is to be in Arabic or Roman numeral form. Regulators from the State of New York commented that he has concerns same as New Hampshire. They prefer installed date, not placed in service, do not think Class 5 is transparent to consumers, and questioned if it should be a user requirement instead of design requirement. Upon consensus of the body, the Committee recommends this item be Developing.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

EVF-23.7 W ~~N.1. No Load Test, N.2. Starting Load Test.~~, N.5.2. Accuracy Testing, And Appendix D: maximum deliverable amperes.

Source:
Electrify America

Purpose:
The proposal would have the testing conducted at the contemplated 10%. Because it is unlikely that tests would actually be at precisely 10%, the proposal would allow testing in a small range slightly above 10%.

Item under Consideration:
Amend Handbook 44 Electric Vehicle Fueling Systems Code as follows:

~~**N.1. No Load Test. A no load test may be conducted on an EVSE measuring system by applying rated voltage to the system under test and no load applied.**~~

~~**N.2. Starting Load Test. A system starting load test may be conducted by applying rated voltage and 0.5 ampere load.**~~

N.5.2. Accuracy Testing. –The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

(a) For AC systems:

(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes ~~**(expressed as MDA) as determined from the pilot signal**~~ for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.

(2) Accuracy test of the EVSE system at a load ~~**not greater than**~~ **between** 10 % **and 20%** of the maximum deliverable amperes ~~**(expressed as MDA) as determined from the pilot signal**~~ for a total energy delivered of at least the minimum measured quantity (MMQ).

(b) For DC systems (see note):

(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes ~~**current (expressed as MDA) as determined from the digital communication message**~~

~~**from the DC EVSE to the test standard**~~ for a total energy delivered of at least twice the minimum measured quantity (MMQ).

(2) Accuracy test of the EVSE system at a load **between** ~~**not more than**~~ 10 % **and 20%** of the maximum deliverable amperes ~~**(expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard**~~ for a total energy delivered of at least the minimum measured quantity (MMQ).

All DC EVSE are exempt from this requirement until January 1, 2028.
(Amended 2022)

Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient **provided that it is greater than 30% of the maximum deliverable amperes of the EVSE system**.

Appendix D:

maximum deliverable amperes. - The value in amperes, marked on an EVSE pursuant to paragraph S.5.2. EVSE Identification and Marking Requirements, of the maximum current that the EVSE can provide.

Previous Action:
2023: Developing

Original Justification:
The accuracy tests in section 3.40 contemplate testing an EV charger at two points, one at relatively low current and power, and the other at relatively high current and power. The low point was evidently intended to be at 10% of a charger's maximum current. It is likely that charger manufacturers have designed chargers with that 10% in mind as the "low" point of accuracy tests. But the code does not actually state that testing should be *at* 10%. It says testing can be at a current *less than* 10%. This formulation is problematic because it encompasses any current less than 10%. Zero is less than 10%, and 0.1 A is less than 10% even though it is less than the amount at which the code requires a charger to first register a load.

Even currents larger than these, but less than 10%, would be unnecessarily difficult for an accuracy test. The problem is that low currents are an area where accuracy is particularly difficult. For example, one common metering configuration is to measure the current being delivered by means of a shunt resistor, which generates a voltage from the high current passing through it. These resistors necessarily have very low resistances, because they are necessarily dissipating power in accordance with the resistance. A typical resistor in an EV charger metering setup might be 100 micro-ohms. For a 500 amps full-scale current in a DC charger, that resistor would be dissipating 25 watts of power - thus, a much larger resistor is not a practical option. At, say, 10 amps of delivered current, the voltage generated across the resistor would be 1 millivolt. A 1% measurement of that 1 millivolt would be 10 microvolts. At that level, a range of noise sources become quite significant, such as thermal EMF in the resistor itself and induced EMFs from the presence within the charger cabinet of voltages up to 480 volts ac or 950 volts dc, as well as any offsets or noise in the circuitry measuring the transduced voltage. The net result is that it is very challenging to achieve high accuracy at low currents in a device designed to handle and measure high currents. For reasons like these, the draft international (OIML) standard specifies that an accuracy test should be conducted *at* a given minimum current, rather than (like current Handbook 44) at any current *up to* that minimum.

Meanwhile, low currents are the levels least significant for transactional accuracy. At low current, a charger is delivering energy at a relatively low rate. As a practical matter, an EV will charge at the maximum rate possible in the circumstances. As the battery reaches a higher state of charge, it will draw less power from the EV, but only a small proportion of the overall energy will be delivered at low rates, precisely because the rates are low. Suppose, as a simplified example, an EV charges for 30 minutes at 300 amps and 30 minutes at 15 amps (at a voltage of 400 volts). The EV will have received 60 kWh in the first part of the session, and only 3 kWh in the second part. The low-current period of charging contributes relatively little to the accuracy/inaccuracy of the overall transaction.

Thus, it is important for Handbook 44 to set a minimum current for accuracy tests. Because the point of 10% of the maximum deliverable amperes is already in the code and has probably been used as a design basis for chargers, the proposal would keep that as the low-current point. The overall concept would be for testing to occur *at* 10% of maximum deliverable amperes, rather than at *up to* 10%. But it is impractical to specify a single point. An inspection that does not achieve a test at precisely the 10% should not, as a consequence, be an invalid inspection. To make this practical, the proposal would have the low-end test occur in a range of currents, namely 10% to 20% of the charger's maximum.

The code presents a similar problem for DC chargers tested using EVs as loads. The code allows an EV to be used as the load, rather than using a controlled load that draws the loads specified in the code. But the code provides no specifications about how to use an EV in this sort of test. So it is possible that a tester could use an EV that is, say, at 95% state of charge in the battery, and that would arrive at the charger and draw very low levels of current (sometimes called a "trickle charge"). For the reasons discussed above, that sort of test would not be a productive test of the meaningful accuracy of the charger. The code should set a minimum current for an EV-based test to be usable. The proposal would have that minimum be 30% of the charger's maximum. It is set at more than 10% because the EV-based test uses a single test point, which should therefore be somewhere in the middle of the charger's range.

The proposal would also add a definition of "maximum deliverable amperes." This quantity is the same as used in the existing code as the basis for the 10% figure, but it is not currently defined. The definition would state that maximum deliverable amperes means the amount marked on the charger. (The code already requires that amount to be marked.) This amount might be less than the manufacturer's specification for the potential maximum of the device, if for example the installation limits the charger to a particular amount, or the installer has selected a configuration with a lower maximum. But the maximum deliverable amount is a quantity that is fixed at installation, and marked on the charger. The current code suggests that maximum deliverable amperes is the amount that the charger communicates to a vehicle or test apparatus. That approach is confusingly ambiguous, because the charger might for various reasons sometimes communicate a lower available current than its marked maximum. The proposal clarifies that for accuracy tests based on a percentage of maximum current, the "maximum" being used is the maximum marked on the device.

These concepts have been discussed in the U.S. National Work Group's subgroup on EV charging. There is general consensus in favor of the proposal, but there has not been a quorum to vote formally in favor of it.

Finally, the proposal would eliminate the no-load and starting-load tests. These tests take unnecessary time, because an inspector has to wait to verify that a load of zero genuinely produces no response and a starting load of just 0.5 amps produces a response. Meanwhile, these tests are not meaningful for the transactional accuracy of an EV charger. In the process of establishing a handshake that the EV charger is connected to a vehicle, the charger might provide minute test amounts of current, so that a truly zero load is not pertinent to any real transaction; and these minute test currents may well e above 0.5 amps, so that this threshold is also not pertinent to transactions. It would be possible to verify that a charger does not register an energy delivery when no transaction is started, but that test would be redundant of verifying that the charger starts at zero. Meanwhile, 0.001 kWh (the minimum resolution under Handbook 44) corresponds to roughly 3 to 5 hundredths of a cent, so that verifying the registration of such tiny amounts given a tiny current is not helpful for the overall transactional accuracy.

The submitter is not aware of objections that would be raised to this proposal. The concept is consistent with the discussionsat the U.S. National Work Group based on information from testing over the past six years, and input from regulators and industry.

The submitter requested that this be a Voting item in 2023.

Comments in Favor:

Regulatory:

- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- None

Industry:
- 2024 Interim: The submitter of this item, representing Electrify America, recommended it be withdrawn due to it being combined with EVF-23.4.

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: The Committee has assigned a withdrawn status to the item at the request of the submitter due to it being combined with EVF-23.4.

NCWM 2023 Annual Meeting: The Committee heard from Keith Bradley, Electrify America (submitter) that they are working on updates.

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and assigned a Developing status to the item. The Committee recommends the submitter work with the NIST USNWG EVFE Subgroup for item development.

Regional Associations' Comments:
CWMA 2023 Interim Meeting: The committee heard comments on this item and item EVF 23.4 concurrently. Comments made about this item will also be found in the comments section on item EVF 23.4.

Theo Brillhart from Fluke presented material regarding the merge of EVF 23.4 and EVF 23.7 by the submitters as well as the passing of item EVF 23.1 at the 2023 Annual NCWM Meeting. The passing of item EVF 23.1 has forced a renumbering of sections within this current proposal. The submitters of EVF 23.4 and EVF 23.7 have reflected those changes in their proposal. With these changes (letter submitted), the submitter recommends this item as voting.

Scheleese Goudy from Electrify America agrees with the proposal because it makes testing easier. Language regarding '10 amps or above' fixes the concerns between item EVF 23.4 and item EVF 23.7.

Perry Lawton from TESCO applauds the work achieved between EVF 23.4 and EVF 23.7.

Steve Peter from Wisconsin supported this item.

The committee recommends this item moving forward as a voting item with the proposed changes by the submitter which are attached to the bottom of this report (same proposal referenced in item EVF 23.4). [APPENDIX C]

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting:

The Committee heard comments regarding item EVF-23.4 and this item. The WWMA S&T Committee received a letter with updated proposed language for this item and EVF-23.4. The letter has been posted to the WWMA website, {Events – Meeting Documents – Letter From the Submitters EVF-23.4 and EVF-23.7}. This letter has also been provided to the NCWM S&T Committee.

Comments were heard supporting the proposed language in the Joint Letter dated August 22, 2023.

Mr. Kevin Schnepp (California Division of Measurement Standards): Supported this item with an additional proposed revision of changing the Exemption Date from 2028 to 2025.

The WWMA 2023 S&T Committee recommends this item be assigned a Withdrawn status in favor of item EVF-23.4. Based on comments heard during open hearings from industry, and in consideration of the Letter from the Submitters this committee recommends that EVF-23.4 be updated with the proposed language in the letter and EVF-23.7 be withdrawn.

SWMA 2023 Annual Meeting: The committee recommends incorporating this item into EVF-23.4, and withdrawing this item based upon the proposed joint language provided in a letter dated August 22, 2023 from William Hardy and Keith Bradley the submitters of these two items.

The committee recommends this item be withdrawn.

NEWMA 2023 Interim Meeting: After hearing comments on EVF-23.4 and upon consensus of the body, the Committee recommends this item be Withdrawn.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

GMA – GRAIN MOISTURE METERS 5.56 (A)

GMA-19.1 W Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Method for All Grains and Oil Seeds.

Source:
NTEP Grain Analyzer Sector

Purpose:
Reduce the tolerances for the air oven reference method.

Item Under Consideration:
Amend Handbook 44, Grain Moister Meter Code 5.56 (a) as follows:

T.2.1. Air Oven Reference Method. – Maintenance and acceptance tolerances shall be as shown in Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance. (Amended 2001)

~~Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method~~		
~~Type of Grain, Class, or Seed~~	~~Tolerance~~	~~Minimum Tolerance~~
~~Corn, oats, rice, sorghum, sunflower~~	~~0.05 of the percent moisture content~~	~~0.8 % in moisture content~~
~~All other cereal grains and oil seeds~~	~~0.04 of the percent moisture content~~	~~0.7 % in moisture content~~

Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method for All Grains and Oil Seeds	
Tolerance	**Minimum Tolerance**
0.03 of the percent moisture content	**0.5 % in moisture content**

(Amended 2001 **and 20XX**)

Background/Discussion:
This item has been assigned to the submitter for further development. For more information or to provide comment, please contact:

Mr. Karl Cunningham
Illinois Department of Agriculture
217-785-8301, karl.cunningham@illinois.gov

Samples and list of grains that AMS, FGIS request from states to include in their ongoing calibration program. States and other interested parties wanted to verify that corn samples from their state were included in the calibration data for NTEP meters because of variations states reported between UGMA meter and other meter technologies on corn samples.

During the 2016 Grain Analyzer Sector Meeting, numerous instances of inconsistent moisture meter measurements involving grain shipments from U.S. interior facilities to U.S. export port facilities were reported. The Sector received a suggestion that if the UGMA can make better measurements, then the Sector should consider reducing the applicable tolerances in HB 44. At the 2016 and 2017 Grain Analyzer Sector meetings Mr. Charlie Hurburgh (Iowa State University) agreed to chair a GA Sector Task Group to review the current HB 44 tolerance with both UGMA meters and Non-UGMA meters. During the 2018 meeting Mr. Hurburgh reported that based on data he analyzed from Iowa State Weights and Measures Grain Inspection reports, UGMA meters read closer to the reference air oven moisture results than non-UGMA meters.

It was also noted during the 2018 NTEP Grain Analyzer Sector meeting that the current tolerances were developed in 1991 and have not been changed to coincide with the change in technology for these devices; and this action is needed for grain industry risk management.

Prior to the 2019 NCWM Interim Meeting, all four regional weights and measures associations agreed to forward the proposal as a voting item on the Interim Agenda. However, following the regional meetings, additional data was submitted to the Sector which indicates a need to consider developing different tolerance for some grain types. Through a subsequent ballot, and a majority vote, the Sector agreed to recommend changing the status of the item to developing to provide the Sector time to consider additional data and changes to its original proposal.

Comments in Favor:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: The Committee heard an update from a NIST OWM representative who commented that the NTEP Grain Analyzer Sector is requesting the item be withdrawn until further data can be collected.

Item Development:
NCWM 2024 Interim Meeting: The Committee heard comments that the NTEP Grain Analyzer Sector is requesting the item be withdrawn until further data can be collected. The Committee has assigned it a withdrawn status.

NCWM 2023 Annual Meeting: The S&T Committee heard comments from NIST that they were still waiting on sample data and that North Carolina had submitted some data for review as stated in the OWM Analysis.

NCWM 2023 Interim Meeting: The S&T Committee heard comments from the floor during open hearings. Mrs. Tina Butcher (OWM/NIST) commented that COVID has put a hamper on the collection of data that is needed for the study. Request that the item remain developing. The committee left the item Developing.

NCWM 2022 Annual Meeting: The Committee heard updates from Ms. Tina Butcher, NIST OWM. The original intent of this item was to apply the proposed tolerance to corn and soybeans, however, other grains were identified for areas of study. The Grain Sector was working with States to collect additional data; however, the pandemic has slowed the process. The Grain Sector is requesting additional time to collect this data. The Committee has agreed to maintain a Developing status for this item.

NCWM 2022 Interim Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that additional data is needed to assess the proposed tolerances. Ms. Lee added that states would be submitting more data. Ms. Lee requested that this item remain Developing. During the Committee's work session, the Committee agreed to a Developing status for this item.

NCWM 2021 Annual Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that additional data is needed to assess the proposed tolerances. Ms. Lee requested that this item remain Developing. During the Committee's work session, the Committee agreed to a Developing status for this item.

NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

NCWM 2020 Interim Meeting: The Committee heard from Ms. Diane Lee (NIST OWM) who stated that when this item was initially submitted the GMM Sector agreed to reduce tolerance based on data that was limited to corn and soybeans. Following the review of the initial data, additional data from Long Grain Rough Rice was reviewed and the sector agreed that additional data was needed on other grains to include oats, rice, and barley, prior to changing the tolerances. Ms. Lee requested that the item remain developing status as additional data is collected.

During the Committee's work session, the committee agreed to retain this item as Developing to allow the submitter to continue working with members of the grain analyzer sector to collect additional data.

NCWM 2019 Annual Meeting: Ms. Diane Lee (NIST OWM) provided an update on the history of the item. Ms. Lee noted that the NTEP Grain Analyzer Sector will review data from Arkansas at its 2019 meeting intended to assure that proposed changes to the tolerances can be applied to all grains. Ms. Lee speaking on behalf of the Sector stated that the Developing status assigned to this item is appropriate.

NCWM 2019 Interim Meeting: The NCWM S&T Committee heard comments to agenda item GMA-3. Mr. Loren Minnich (KS) commented that he spoke with Ms. Diane Lee (NIST OWM) and she reported that one state was concerned with the application of the reduced tolerances to all grain types, specifically grains with hulls or husks. Mr. Minnich suggested that this item be assigned a "Developing" status to allow for more research into this issue. The committee also received written comments from NIST, OWM (see NIST, OWM Analysis posted on the NCWM Website). During the 2019 Interim Meeting, the S&T Committee considered the comments during the opening hearing and comments submitted prior to the meeting and assigned a "Developing" status for this item.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: No comments were heard.
The committee recommends this item as developing to allow time to collect additional data.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting no comments were received from the body on this item.

The WWMA 2023 S&T Committee recommends this item remain a Developing status based on comments heard and included in the 2023 NCWM S&T Committee Annual Report; those comments indicate data is being collected and reviewed.

SWMA 2023 Annual Meeting: Jason Glass, Kentucky, recommended withdrawing the item due to lack of feedback from the submitter.

Aaron Webb, Maryland, stated that the current tolerances were already difficult to achieve, and would not support changing them.

The committee recommends Withdrawal of this item, due to no comments in support, feedback, or development of this item over several years.

NEWMA 2023 Interim Meeting: A regulator from the Commonwealth of Pennsylvania commented that the Task Group was still waiting for additional data to move forward with this item. A regulator from Holliston, Massachusetts recommended this item be withdrawn as it has been on the agenda for four years without data collection being completed, and once it has been collected and analyzed, it can be reintroduced. The States of New Hampshire, Vermont, Connecticut, and the Commonwealths of Pennsylvania and Massachusetts concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

OTH – OTHER ITEMS

OTH-16.1 V Non-Utility Electricity-Measuring Systems (NUEMS)

Source:
NIST, Office of Weights and Measures

Purpose:
1) Make the weights and measures community aware of work being done within the NIST U.S. National Work Group (USNWG) on Electric Vehicle Fueling and Submetering to develop proposed requirements for electric watthour meters used in submeter applications in residences and businesses;
2) Encourage participation in this work by interested regulatory officials, manufacturers, and users of electric submeters.
3) Allow an opportunity for the USNWG to provide regular updates to the S&T Committee and the weights and measures community on the progress of this work;
4) Allow the USWNG to vet specific proposals as input is needed.

Item Under Consideration:
Add Non-Utility Electricity-Measuring Systems Code to Handbook 44, as follows:

NIST Handbook 44 Device Code Requirements for

Non-Utility Electricity-Measuring Systems

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Section 3.XX. Non-Utility Electricity-Measuring Systems – Tentative Code

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

(Tentative Code Added 20XX)

NUEMS Acronym and Definition: As used throughout this code, a Non-Utility Electricity-Measuring System or "NUEMS" is defined as an electricity measuring system comprised of all the metrologically relevant components required to measure electrical energy, store the result, and report the result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured quantities.

Safety Note: This code does not specifically discuss Safety. It is essential that all personnel working with the devices covered by this code and associated electrical equipment be properly trained and adhere to all

applicable safety standards, regulations, and codes. See also General Code Paragraph G-N.1. Conflict of Laws and Regulations.

A. Application

A.1. General. – This code applies to measuring systems used in non-utility sales of electric energy wherein the sale is based in whole or in part on one or more measured quantities.

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

(a) The use of any measuring system owned, maintained, and/or used by a utility.

(b) Measuring systems used solely for delivering electric energy in connection with operations in which the amount delivered does not affect customer charges or compensation.

(c) Electric vehicle fueling systems. (See 3.40. Electric Vehicle Fueling Systems Code)

(d) Transactions not subject to weights and measures authority.

A.3. Additional Code Requirements. – In addition to the requirements of this code, Non-Utility Electricity-Measuring Systems shall meet the requirements of Section 1.10. General Code.

A.4. Type Evaluation. – The National Type Evaluation Program (NTEP) will accept for type evaluation only those measuring systems that have received safety certification by a nationally recognized testing laboratory (also referred to as "NRTL") and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code.

A.5. NUEMS Type Notation. – Code sections and subsections with an [ES] notation apply to External Sensor NUEMS only. Code sections and subsections with a [IS] notation apply to Internal Sensor NUEMS only. Code sections and subsections without [ES] or [IS] notation apply to both NUEMS types.

S. Specifications

S.1. Indicating and Recording Elements.

S.1.1. Units. – Units for any indicated or recorded measurements shall be as follows:

Active Energy: kilowatt-hours (kWh)

S.1.1.1. Numerical Value of Quantity-Value Divisions. – The value of an increment shall be equal to a decimal multiple or submultiple of 1.

Examples: quantity-value divisions may be 10; or 0.01; or 0.1; etc.

S.1.1.2. Digital Indications. – An indication shall include the display of a number for all places that are displayed to the right of the decimal point and at least one place to the left. Otherwise, leading zeros are not required.

S.1.2. Nominal Capacity. – A device shall have a minimum capacity indication of five digits of resolution. [Nonretroactive as of January 1, 20XX]

S.1.3. NUEMS Indications.

S.1.3.1. Primary Indicating Element. – Each NUEMS shall be equipped with a primary indicating element that includes a display visible and accessible after installation which at a minimum clearly indicates the number of kilowatt-hours measured by the NUEMS.

S.1.3.2. Test Output. – A NUEMS shall have either: (1) a rotating disk indicator; (2) a pulse output (visible or infrared), or (3) an electrical pulse (in the form of a closure relay or an electronic means), which provides a pulse with K_t or K_h Watt-Hours per pulse. The value of K_t or K_h shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any specific test.

S.1.3.3. Segments. – A segmented digital indicating element shall have an easily accessible provision for checking that all segments are operational.

S.1.3.4. Real-time Indicating Element. – If the indicating element is not on continuously, it shall be accumulated continuously so that real-time measurement is indicated during activation.

S.1.3.5. Multiple Loads, Single Indicating Element. – A primary indicating, or combination indicating-recording element coupled to two or more loads shall be provided with a means to easily, clearly, and definitely display information from a selected load and shall automatically indicate which load is associated with the currently displayed information.

S.1.3.6. NUEMS With External Sensors Located Remotely from the Test Output. – For NUEMS with external sensors located remotely from the test output which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the Test Output, means shall be provided to allow the test output to be remotely used.

S.1.3.7. NUEMS With a Register Ratio. – For NUEMS with a register ratio, the register ratio shall be indicated on the front of the registers that are not an integral part of the NUEMS nameplate. Means shall be provided for the tenant to read the register.

S.2. Design of Measuring Elements and Measuring Systems.

S.2.1. Metrological Components. – A NUEMS shall be designed and constructed so that metrological components are adequately protected from environmental conditions likely to be detrimental to accuracy based on the specified installation locations for the NUEMS.

S.2.2. Provision for Sealing. – Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that undetected access to metrologically significant mechanisms and parameters is prevented. Specifically, after sealing no adjustment or change may be made to:

(a) any measuring element;

(b) any metrological parameter that affects the metrological integrity of the device or system; and

(c) any wiring connection which affects the measurement.

When applicable, any adjusting mechanism shall be readily accessible for purposes of affixing a security seal. Audit trails shall use the format set forth in Table S.2.2. Categories of Device and Methods of Sealing.

Table S.2.2.
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 or shall not operate while in this mode.**	**The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information.**
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). **The device shall clearly indicate that it is in the remote configuration mode and record such message or shall not accumulate kWh while in this mode.**	**An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)**

S.2.4. NUEMS Watthour Registration Retention. – The NUEMS shall retain the total accumulated watthour registration and shall not be affected by electrical, mechanical or temperature variations, radio-frequency interference, power failure, or any other environmental influences to the extent that accuracy is impaired. This also applies to other billable quantities.

S.3. Markings. – The following identification and marking requirements are in addition to the requirements of Section 1.10 General Code, paragraph G-S.1. Identification.

S.3.1. Location of Marking Information. – The marking information may be placed either internally or externally (as specified in paragraphs S.3.2. Device Identification and Marking Requirements and S.3.3. Device Identification and Marking Requirements – External Sensors and in the associated tables) provided:

(a) the information is permanent and easily read; and accessible for inspection;

(b) the information is on a portion of the device that cannot be readily removed or interchanged (e.g., not on a service access panel). A readily removable cover is an acceptable location for the required information provided: (1) the information is permanently marked elsewhere on the device or is readily accessible through other means such as through an electronic marking display; or (2) a unique marking on the removable cover can be matched with what is programmed into or permanently marked on the ES NUEMS body, thus linking that marking (and any other markings) included on the cover with that specific device.

(c) accessing the information does not require accessing an area with live exposed voltages greater than 40 V.

The use of a key or tool to access internal marking information is permitted for retail electricity-measuring devices. Where possible, clear covers should be used to enable viewing of internally marked information.

S.3.2. Device Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each device shall have the following information conspicuously, legibly, and indelibly marked on the nameplate or register.

S.3.2.1. Device Identification and Marking Requirements, Internal Sensor (IS) NUEMS. – The following markings shall be physically marked on an Internal Sensor (IS) NUEMS:

(a) AC voltage range or rating in VAC;

(b) Watthour constant (K_h) or Watthour test constant (K_t);

(c) Register ratio (R_r) for NUEMS with a rotating disc and multiplier (if greater than one) preceded by "multiply by" or "mult by";

(d) Number of wires (W);

(e) Form designation (FM) (for A-base and socket NUEMS only); and

(f) Current Class (CL).

S.3.2.2. Device Identification and Marking Requirements of External Sensor (ES) NUEMS. – In addition to the identification requirements specified in Section 1.10 General Code, paragraph G-S.1. Identification, External Sensor (ES) NUEMS shall have the following legibly, and indelibly marked on the ES NUEMS body as shown in:

- **Tables S.3.2.2.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS; and**
- **Table S.3.2.2.b. Descriptors for Table S.3.2.2.a. Device Identification and Marking Requirements - External Sensor (ES) NUEMS.**

Table S.3.2.2.a.
Device Identification and Marking Requirements for External Sensor (ES) NUEMS

	Physical Marking	Electronic Marking Display*, **
Manufacturer or Distributor name, initials, or trademark (1)	R	D
Model Prefix (2)	O	D
Model (3)	R	D
Serial Number Prefix (4)	O	D
Serial Number (5)	R	D
NTEP CC Number with Prefix (6)	R	D
NUEMS Voltage Input Rating (7) *[Nonretroactive as of January 1, 2024]*	O	D
Voltage Sensor Rating (8) *[Nonretroactive as of January 1, 2024]*	O	D
Voltage Sensor Ratio (9) *[Nonretroactive as of January 1, 2024]*	O	D
NUEMS Current Input Rating (10) *[Nonretroactive as of January 1, 2024]*	O	D
Sensor Primary Current Rating (11) *[Nonretroactive as of January 1, 2024]*	O	D
Sensor True Ratio (12) *[Nonretroactive as of January 1, 2024]*	O	D
K_h or K_t (13)	O	D
Sensor Input Polarity (14)	R	--
Bi-directional (15)	O	D
Temperature Range if narrower than −20 °C to + 50 °C (− 4 °F to + 122 °F) (16)	O	D

R Required to be marked on the NUEMS
O Required to be marked on the NUEMS only if information is not available on a display
D Alternate when information is not marked physically on the NUEMS. If device identification and markings are provided on an electronic marking display, then all fields must be provided.

***"Electronic Marking Display" includes, but is not limited to, displays of the required marking information through a NUEMS display or other secondary display connected to the NUEMS. If the information is provided via a secondary display then the display shall be provided by the device owner/operator as specified in UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Marking Display, External Sensor (ES) NUEMS. Also see S.3.4. Electronic Marking Display Security Protocol.** ****Instructions on how to view required markings shall be marked on the device or provided in the NTEP CC.** **General:** • **Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.2.2.b. Descriptors for Table S.3.2.2.a. Device Identification and Marking Requirements - External Sensor (ES) NUEMS.** • **For requirements and details on application, see Table S.3.2.2.b. Descriptors for Table S.3.2.2.a Device Identification and Marking Requirements - External Sensor (ES) NUEMS.**

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Table S.3.2.2.b. Descriptors for Table S.3.2.2.a Device Identification and Marking Requirements - External Sensor (ES) NUEMS
1. Manufacturer's Identification. Marked per General Code paragraph G-S.1. Identification.
2. Manufacturer's Model Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the ES NUEMS body, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated NUEMS is not required to be physically marked per General Code paragraph G-S.1. Identification (b)(1).
3. Manufacturer's Model Identifier. Also see General Code paragraph G-S.1. Identification.
4. Serial Number Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the ES NUEMS body, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated NUEMS is not required to be physically marked per General Code paragraph G-S.1. Identification (c)(1).
5. Serial Number. Also see General Code paragraph G-S.1. Identification.
6. NTEP Certificate of Conformance Number and Prefix. Marked per General Code paragraph G-S.1. Identification.
7. NUEMS Voltage Input Rating (V). The nominal voltage input(s) for the voltage channel of the ES NUEMS body (e.g., 120VAC, 600VAC, 120-480VAC, etc.). Multiple forms of the term such as "Rated Voltage," "Max Voltage," and "Reference Voltage" are permitted. ***[Nonretroactive as of January 1, 2024]***
8. Voltage Sensor Rating (V_{nom}). The nominal input at the voltage sensor. If a voltage sensor is not used this marking is not required. If a voltage sensor is used, a multiplier can be used in place of V_{nom} and voltage sensor ratio. The Voltage Sensor Rating shall be prefaced with the abbreviation "V_{nom}". ***[Nonretroactive as of January 1, 2024]***

9. Voltage Sensor Ratio (V_{rat}). Ratio of sensor primary voltage to sensor output voltage. If a voltage sensor is not used this marking is not required. If a voltage sensor is used, a multiplier can be used in place of V_{nom} and voltage sensor ratio. The Voltage Sensor Ratio shall be prefaced with the abbreviation "V_{rat}".

[Nonretroactive as of January 1, 2024]

Example of Voltage Sensor Ratio Marking:

480V:120V

10. NUEMS Current Input Rating (I_{nom}). The nominal current or voltage input for the current channel of the ES NUEMS body. The NUEMS Current Input Rating shall be prefaced with the abbreviation "I_{nom}".

The output of the current sensor must match the input configuration of the ES NUEMS body. This is determined by dividing Sensor Primary Current Rating (11) by the True Ratio (12). The computed quotient must match the NUEMS Current Input Rating (10).

[Nonretroactive as of January 1, 2024]

Example 1:

Sensor Primary Current Rating = 200A

True Ratio = 100A:5A

Calculation: (200A) ÷ (100A/5A) = (200A) ÷ (20) = 10A

Example 2:

Sensor Primary Current Rating = 200A

True Ratio = 400A:0.3V

Calculation: (200A) ÷ (400A/0.3V) = (200A) * (0.3V/400A) = 60W/400A = 0.15V

NOTE: W=Watts=Amperes*Volts

11. Sensor Primary Current Rating (SI_{nom}). The nominal current input through the sensor. The Sensor Primary Current Rating shall be prefaced with the abbreviation "SI_{nom}".

[Nonretroactive as of January 1, 2024]

12. Current Sensor Ratio. The ratio of sensor primary amperes to sensor output amperes or volts shall be physically marked on a NUEMS unless it is displayed electronically. This is to be expressed as xxxA:yyyA or xxxA:yyyV. The number of digits is the number needed to express the values. The Current Sensor Ratio must match the marked ratio of the sensor as required in Table S.3.3.a.

[Nonretroactive as of January 1, 2024]

Examples of current sensor ratio markings include:

200A:5A

400A:0.3V

13. Kh or Kt. Watthour constant or watthour test constant.

14. Sensor Input Polarity. Sensor input connection with intended polarity shall be physically marked on the NUEMS when direction-sensitive.

15. Bi-Directional. A NUEMS equipped to register the accumulation of energy in both directions (i.e., for delivered and received energy).

16. Temperature Range if Narrower Than − 20 °C to + 50 °C (− 4 °F to + 122 °F): If the device is rated for use over a range that is narrower than and within − 20 °C to + 50 °C (− 4 °F to + 122 °F), this must be physically and/or electronically marked.

S.3.3. Device Identification and Marking Requirements – External Sensors. – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each external sensor that is non-integral with the ES NUEMS body shall have the following conspicuously, legibly, and indelibly marked as shown in Table S.3.3.a. Device Identification and Marking Requirements – External Sensors and in Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements – External Sensors.

Table S.3.3.a.
Device Identification and Marking Requirements - External Sensors

	Physical Marking on Sensor	Electronic Marking Display*
Manufacturer name, initials, trademark (1)	R	D
Model Prefix (2)	O	D
Model (3)	R	D
Serial Number Prefix "S/N" (4)	O	D
Serial Number (5)	R	D
True Ratio (6) *[Nonretroactive as of January 1, 2024]*	R	D
Maximum Primary Current (7)	O	D
Rated Frequency (Hz) (8)	O	D
Maximum Safety Voltage Rating (9)	O	D
Polarity (10)	R	--

R Required to be marked on the device
O Required to be marked on the device if information is not available on an electronic marking display
D Required when data is displayed on an electronic marking display

*"Electronic Marking Display" includes, but is not limited to, displays of the required marking information through a NUEMS display or other secondary display connected to the NUEMS. If the information is provided via a secondary display then the display shall be provided by the device owner/operator as specified in UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Marking Display, External Sensor (ES) NUEMS. Also see S.3.4. Electronic Marking Display Security Protocol.

Notes:

- Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements - External Sensors.
- For requirements and details on application, see Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements - External Sensors.

Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements - External Sensors
1. Manufacturer's Identification. Marked per General Code paragraph G-S.1. Identification.
2. Manufacturer's Model Prefix. The General Code paragraph G-S.1. Identification (b)(1) model prefix marking requirement for the sensor(s) may be met with a physical marking. Alternatively, the marking requirement may be satisfied through an electronic display provided that the NUEMS has its NTEP number clearly identified, conspicuously and indelibly marked on the ES NUEMS body, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings).
3. Manufacturer's Model. Also see General Code paragraph G-S.1. Identification.
4. Serial Number Prefix. For a NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the sensor(s), where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated sensor is not required to meet General Code paragraph G-S.1. Identification (c)(1).
5. Serial Number. Also see General Code paragraph G-S.1. Identification.
6. Voltage Sensor Ratio or Current Sensor Ratio. The ratio, in primary amperes or volts to secondary amperes or volts shall be physically marked on each sensor. This is to be expressed as xxxA:yyyA; or xxxA:yyyV; or xxxV:yyyV. The number of digits is the number needed to express the values. [Nonretroactive as of January 1, 2024] **Examples of current sensor ratio markings include:** **200A:5A** **400A:0.3V** **Examples of voltage sensor ratio markings include:** **480V:120V**
7. Maximum Primary Current. The maximum primary current at which the sensor can be safely and accurately operated.
8. Rated Frequency. A sensor shall be marked with its rated frequency if other than 40Hz to 400Hz.
9. Maximum Safe Operating Voltage. A sensor shall be marked with a Maximum Safe Operating Voltage if it is less than 600VAC. **Examples of sensor maximum safe operating voltage ratings:** • **250 Vac** • **250 VAC** • **50 V** **Note: The maximum safe operating voltage rating marking may not be higher than the voltage to which the device was verified during type evaluation.**
10. Polarity Marking. The sensor shall be marked to indicate proper orientation when the accuracy of the NUEMS is affected by orientation.

S.3.4. Electronic Marking Display Security Protocol – If an Electronic Marking Display is used as described in Table S.3.2.2.a. and Table S.3.3.a. protocols shall be in place to prevent tampering with the displayed markings and/or data.

S.3.5. Abbreviations and Symbols. – When using abbreviations or symbols on an ES NUEMS body, sensor, or indicator, the following shall be used.

Symbol	Description
AC	Alternating Current (i.e., VAC)
Cl	Class
FM	Form
Hz	Hertz, Frequency or Cycles Per Second
I_{nom}	NUEMS Current Input Rating
K_h	Watthour Constant; Revolution or Pulse
K_t	Watthour Test Constant
kWh	Kilowatt-hour
Rr	Register Ratio
SI_{nom}	Sensor Primary Current Rating
TA	Test Amperes
V	Volts
V_{nom}	Voltage Sensor Rating
V_{rat}	Voltage Sensor Ratio
W	Wire (example 240V 3W)
Wh	Watthour

S.3.6. Abbreviations and Symbols – These are abbreviations that may occur but are not required to be used or limited to the listed abbreviations.

Symbol	Description
Δ	Delta Power Supply
B	Burden
BIL	Basic Lightning Impulse Insulation Factor
IEEE	Institute of Electrical and Electronics Engineers
Mult By	Multiply By
PD	Printable Data
PTR	Potential Transformer Ratio (Same as VTR)
SD	Soft Data
VTR	Voltage Transformer Ratio
Y	WYE Power Supply

N. Notes

N.1. NUEMS No-Load Test. – A NUEMS no-load test shall be conducted by applying rated voltage to the NUEMS under test and no current load applied. This test shall be conducted during type evaluation and may be conducted during field testing as deemed necessary. The test duration shall be ten minutes.

N.2. NUEMS Starting Load Test. – A NUEMS starting load test shall be conducted by applying rated voltage at a load of 0.25% of the Current Class (CL) or the Sensor Primary Current Rating at unity power factor. The test shall be conducted during type evaluation and may be conducted during field testing as deemed necessary.

N.3.NUEMS Minimum Test Duration. – A NUEMS full load test shall consist of a minimum of 10 K_t or K_h output indications and a light load test shall consist of a minimum of one K_h or K_t output indication.

N.4. NUEMS Test Loads.

(a) Internal Sensor (IS) NUEMS shall be balanced-load tested, and may be single-element tested, for NUEMS accuracy at full and light loads.

(b) External Sensor (ES) NUEMS shall be single-element tested for system accuracy at full and light loads. NUEMS testing shall be accomplished by applying the test load to the sensor(s) with the voltage circuits energized. When it is not feasible to test the system by injecting a primary current, testing using customer load shall be sufficient for field verification.

(c) The reference voltage phases (A, B, or C) at the NUEMS shall be the same phase as the load.

N.5. Test of a NUEMS.

(a) The test load applied for a full load test shall be 15 % of either the Current Class (CL) or the Sensor Primary Current Rating.

(b) The test load applied for a light load test shall be conducted at 1.5 % to 3 % of either the Current Class (CL) or the Sensor Primary Current Rating.

(c) The test load applied for a full load test of a NUEMS for a 0.5 power factor lagging setting shall be 15 % of either the Current Class (CL) or the Sensor Primary Current Rating. This test shall be conducted during type evaluation and may be conducted during in-service (field) or laboratory testing as deemed necessary.

(d) The test load applied for a light load test for a 0.5 power factor lagging setting shall be conducted at 3 % to 6 % of either the Class (CL) or the Sensor Primary Current Rating. This test shall be conducted during type evaluation and may be conducted during in-service (field) or laboratory testing as deemed necessary.

(e) All tests shall be made at the rated voltage ± 10 %.

N.6. Repeatability Tests. – When conducted, tests for repeatability shall include a minimum of three consecutive tests at the same load, similar time period, etc. and be conducted under conditions where variations in factors are reduced to minimize the effect on the results obtained.

T. Tolerances

T.1. Tolerances, General.

(a) The tolerances apply equally to errors of underregistration and errors of overregistration.

(b) The tolerances apply to all electric energy measured at any load within the rated measuring range of the device.

(c) Where sensors or other components are used, the provisions of this section shall apply to the entire NUEMS.

T.2. No-Load Test. – A NUEMS shall not indicate more than one K_t or K_h.

T.3. NUEMS Starting Load Test. – The K_t or K_h output indications shall continue to advance. The purpose of this section is to verify that the NUEMS accumulates energy at the starting load.

T.4. Load Test Tolerances. – Tolerances for NUEMS shall be as shown in Table T.4. Tolerances for NUEMS. When it is not feasible to test the system by injecting a primary current, tolerances specified under "Tests Conducted at 0.5 Lagging Power Factor" shall apply.

Table T.4.
Tolerances for NUEMS

	Tests Conducted at Unity Power Factor	Tests Conducted at 0.5 Lagging Power Factor
Acceptance Tolerances	1.0 %	2.0 %
Maintenance Tolerance	2.0 %	3.0 %

T.5. Repeatability. – When multiple load tests are conducted at the same load condition, the range of the load test results shall not exceed 25 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

UR. User Requirements

UR.1. Selection Requirements.

UR.1.1. Customer Indicating Element, Accessibility. – For systems in which the primary indicating element is not reasonably accessible to the customer, one of the following shall be provided.

(a) Console display which is accessible to the customer on which the customer can unambiguously select the NUEMS output associated with this load.

(b) Remote display which is provided to customer as a part of the system.

(c) At the option of the customer, an application that provides readings in real time.

UR.1.2. NUEMS Required. – When a tenant is not directly served by the serving utility, and charges for electric energy are not included in the fixed periodic rent charges, a dedicated NUEMS that measures only the energy used at the discretion of the tenant shall be used.

UR.1.3. Suitability of Equipment. – A NUEMS shall be suitable for use on its electrical system.

UR.1.3.1. Service Applications. – A NUEMS shall accurately measure all loads 5 percent or greater of the electric service capacity of the tenant. Service capacity shall be determined by the master thermal overload protectors to the tenants' service or by the rated capacity of the wiring and its circuits used to provide power from the service panel to the tenant.

$$\underline{Annual\ Max = \sum_{phases} [(Phase\ Voltage * Current\ Class)/1000] * HoursPerYear}$$

NOTE: Current Class is equivalent to Sensor Primary Current Rating.

UR.1.3.2. Quantity-Value Division. - The configured quantity-value division shall not exceed the minimum increment to be used in billing.

UR.1.4. Sensors. – Each sensor output shall be correctly matched to the corresponding ES NUEMS body input.

UR.2. Installation Requirements.

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

UR.2.2. Load Range. – A device shall be installed so that the current and voltage will not exceed the maximum continuous ratings of the NUEMS. If necessary, means to limit current and/or voltage shall be incorporated in the installation.

UR.2.3. Regulation Conflicts and Permit Compliance. – If any provision of this section (UR.2. Installation Requirements) is less stringent than that required of a similar installation by the National Electrical Code®, as amended and adopted by the Local Authority having Jurisdiction, the installation shall be in accordance with the National Electric Code.

The installer of any new NUEMS service shall obtain all necessary permits and shall conform to all applicable regulations.

UR.2.4. NUEMS Installation Requirements.

UR.2.4.1. Certification. – It is the responsibility of the owner of a NUEMS to obtain written approval for each metered load service from the serving utility, public utility commission, or other entity with jurisdiction over electric utilities in the location the NUEMS is to be installed.

The required approval shall meet the requirements of that entity and shall identify the address, space, or number, of the premise served by the NUEMS connection; be signed by an agency representative; and shall clearly state the:

- **the installation meets all installation and accessibility requirements for similar installation governed by the presiding entity.**
- **installation is on a tariff schedule that qualifies for electric meter use,**
- **billing format, rates, and charges conform to all applicable tariff rules,**
- **date of such determination, and**
- **designee's name and title if performed by a designee, and the name and title of the presiding entity authorizing the designee to make the determination.**

The approval shall be provided to the local Weights & Measures authority prior to a NUEMS being used for commercial purposes.

UR.2.4.2. NUEMS Test Features. – All NUEMS shall be provided with test features to facilitate common tests methods used in the electrical submetering industry.

UR.2.4.3. Safety Mechanism. – NUEMS installations that are equipped with current sensors with a current output that is not self-limiting shall have a mechanism installed to allow the NUEMS, or its components, to be connected to or removed for safe testing without the risk of dangerous voltages that can result from secondary open circuit current sensors.

UR.2.4.4. Metered Circuits (Submeter Load Service). – For NUEMS with separate line and load service connections, all electricity used by a tenant shall be taken exclusively from the load service of the tenant's NUEMS. This service and its associated NUEMS shall accurately measure the tenant's load and be capable of being used only at the discretion of the tenant.

UR.2.4.5. Dedicated Tenant NUEMS Service. – A NUEMS shall serve only the space, lot, building, room, suite, stall, slip, or any other termed premise occupied and/or used by the tenant.

UR.2.4.6. NUEMS Tenant Premise Identification. – Tenant premise identification shall be clearly and permanently shown on or at the NUEMS, and on all separate components of a NUEMS, including, but not limited to, current sensor(s), modem(s), and transmitter(s) if equipped. Remote indications and all printed indications shall be readily identifiable and readily associated with the tenant's premise. Printed indications shall also include time and date information. For field configured systems the information shall be after actual configuration is established.

UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Marking Display, External Sensor (ES) NUEMS. – When required markings are provided via an electronic display the owner/operator of the NUEMS is responsible for providing means for viewing this information on the site at the time of inspection or on request. See also Table S.3.2.2.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS.

UR.2.4.8. External Sensors Located Remotely From the Pulse Output. – If the NUEMS is installed in such a way that testing cannot be conducted by a single inspector from a reasonable testing position, then means shall be provided to allow the pulse output to be remotely used at the sensor location. For example, a portable device that receives the pulse by radio/WiFi and provides the pulse to the test equipment.

UR.3. Use of Device.

UR.3.1. Recorded Representations. – A record, either printed or electronic, providing the following information on electrical energy usage shall be available at the end of the billable interval:

(a) the total quantity of the energy delivered with unit of measure;

(b) the total computed price of the energy sale;

(c) the unit price of the energy.

For systems capable of applying multiple unit prices for energy during the billable interval, the following additional information is required:

(1) A schedule of the rate time periods and the unit price applied for each

(2) the total quantity of energy delivered during each;

(3) the total purchase price for the quantity of energy delivered during each rate time period.

UR.4. Submitting a NUEMS for Testing. – Each NUEMS Submitted for inspection shall have all necessary components assembled, connected, and configured as intended for use. Components may include, but are not limited to, the ES NUEMS body, sensor(s), indicator(s), etc."

Appendix D. Definitions

The following definitions are proposed for addition to NIST Handbook 44 Appendix D, Definitions at the time when the status of this Tentative Code is changed from "tentative" to "permanent." Until such time that the status of the code is designated as "permanent," these proposed definitions will remain in this section of the Tentative Code.

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

A

active energy. – The integral of active power with respect to time. Typically measured in units of kilowatt-hours (kWh), or watt-hours.

$$E(T) = \int_0^T v(t) \cdot i(t) \cdot dt \qquad \textit{Eq. 1}$$

Where T is much greater than the period of the AC line frequency.

alternating current (AC). – An electric current that reverses direction in a circuit at regular intervals. [3.XX]

ampere. – The practical unit of electric current. It is the quantity of current caused to flow by a potential difference of one volt through a resistance of one ohm. One ampere is equal to the flow of one coulomb of charge per second. One coulomb is the unit of electric charge equal in magnitude to the charge of 6.24 x 10^{18} electrons. [3.XX]

audit trail. – An electronic count and/or information record of the changes to the values of the calibration or configuration parameters of a device. [1.10, 2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]

(Added 1993)

B

balanced load. – Balanced load is used to indicate equal currents in all phases and relatively equal voltages between phases and between each phase and neutral (if one exists); with approximately equal watts in each phase of the load. [3.XX]

basic lightning impulse insulation level (BIL). – A specific insulation level expressed in kilovolts of the crest value of a standard lightning impulse. (Example: BIL = 10 Kv) [3.XX]

bidirectional. – A NUEMS equipped to register the accumulation of energy in both directions (i.e., for delivered and received energy:

A bidirectional NUEMS shall fall into at least one of the following categories:

- **(a) Single register or net meter that displays the difference between the delivered and received energy; or**
- **(b) Separate register(s) for delivered or received. [3.XX]**

burden (B). – The impedance of the circuit connected to the instrument transformer's secondary winding. (Example: B = 21 Ohms Max) [3.XX]

C

calibration parameter. – Any adjustable parameter that can affect measurement or performance accuracy and, due to its nature, needs to be updated on an ongoing basis to maintain device accuracy, e.g., span adjustments, linearization factors, and coarse zero adjustments. [2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]

(Added 1993)

configuration parameter. – Any adjustable or selectable parameter for a device feature that can affect the accuracy of a transaction or can significantly increase the potential for fraudulent use of the device and, due to its nature, needs to be updated only during device installation or upon replacement of a component, e.g., division value (increment), sensor range, and units of measurement. [2.20, 2.21, 2.24, 3.30, 3.37, 3.XX, 5.56(a)]

(Added 1993)

current. – The rate of the flow of electrical charge past any one point in a circuit. The unit of measurement is amperes or coulombs per second. [3.XX]

current class (CL). – For Internal Sensor (IS) NUEMS, the manufacturer's designated maximum rated current a NUEMS can measure continuously without damage and without exceeding limits of accuracy. (Example: CL 200) [3.XX]

current sensor. – A device able to measure and output analog or digital representations of one or more currents. Examples of current sensors are current transformers, low-voltage current transducers, and Rogowski coils. *(OWM is seeking written permission from National Electrical Manufacturers Association (NEMA) to reprint. Oral permission was received.)*

E

Electronic Marking Display – A device used for the electronic visual presentation of marking requirements.

element. – A combination of a voltage-sensing unit and a current-sensing unit, which provides an output proportional to the quantities measured. NUEMS can include multiple elements based on service type. For some IS NUEMS, this is also referred to as a "stator." *(OWM is seeking written permission from National Electrical Manufacturers Association (NEMA) to reprint. Oral permission was received.)* [3.XX]

energy flow. – The flow of energy between line and load terminals (conductors) of a NUEMS. Flow from the line to the load terminals is considered energy delivered. Energy flowing in the opposite direction (i.e., from the load to line terminals) is considered as energy received. [3.XX]

equipment, commercial. – Weights, measures, and weighing and measuring devices, instruments, elements, and systems or portion thereof, used or employed in establishing the measurement or in computing any basic charge or payment for services rendered on the basis of weight or measure. As used in this definition, measurement includes the determination of size, quantity, value, extent, area, composition (limited to meat and poultry), constituent value (for grain), or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award. [1.10, 2.20, 2.21, 2.22, 2.24, 3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.38, 3.XX, 4.40, 5.51, 5.56.(a), 5.56.(b), 5.57, 5.58, 5.59]

(Added 2008)

ES NUEMS body – The element of the NUEMS that calculates the electricity usage using the signals from the external sensors. [3.XX]

external sensor. – Any voltage sensor or current sensor not located inside of the meter body NUEMS itself and not inside the sealed enclosure containing the NUEMS. [3.XX]

event counter. – A nonresettable counter that increments once each time the mode that permits changes to sealable parameters is entered and one or more changes are made to sealable calibration or configuration parameters of a device. [2.20, 2.21, 3.30, 3.37, 3.39, 3.XX, 5.54, 5.56(a), 5.56(b), 5.57]

(Added 1993)

event logger. – A form of audit trail containing a series of records where each record contains the number from the event counter corresponding to the change to a sealable parameter, the identification of the parameter that was changed, the time and date when the parameter was changed, and the new value of the parameter. [2.20, 2.21, 3.30, 3.37, 3.39, 3.XX, 5.54, 5.56(a), 5.56(b), 5.57]

(Added 1993)

F

form designation (FM). –An alphanumeric designation denoting the circuit arrangement for which the NUEMS is applicable and its specific terminal arrangement. The same designation is applicable to equivalent NUEMS for all manufacturers. (Example: FM 2S) [3.XX]

H

hertz (Hz). – Frequency or cycles per second. One cycle of an alternating current or voltage is one complete set of positive and negative values of the current or voltage. [3.XX]

I

internal sensor. – Any voltage sensor or current sensor located inside of the meter body NUEMS itself or inside the sealed enclosure containing the NUEMS. [3.XX]

K

kilowatt (kW). – A unit of power equal to 1,000 watts. [3.XX]

kilowatt-hour (kWh). – A unit of energy equal to 1,000 watthours. [3.XX]

L

line service. – The service terminals or conductors connecting the (NUEMS) to the power source. [3.XX]

load service. – The service terminals or conductors connecting the (NUEMS) to the electrical load (e.g., vehicle, tenant, etc.). [3.XX]

load, full. – A test condition with rated voltage, current at 100% of test amps level, and power factor of 1.0. [3.XX]

load, light. – A test condition with rated voltage, current at 10% of test amps level, and power factor of 1.0. [3.XX].

M

master meter, electric. – A (NUEMS) owned, maintained, and used for commercial billing purposes by the serving utility. All the electric energy served to a submetered service system is recorded by the master meter. [3.XX]

metrological components. – Elements or features of a measurement device or system that perform the measurement process or that may affect the final quantity determination or resulting price determinations. This includes accessories that can affect the validity of transactions based upon the measurement process. The measurement process includes determination of quantities; the transmission, processing, storage, or other corrections or adjustments of measurement data or values; and the indication or recording of measurement values or other derived values such as price or worth or charges. [3.XX]

N

nominal current – The manufacturer's designated maximum rated current a NUEMS can measure continuously without damage and without exceeding limits of accuracy.

nominal voltage – The manufacturer's designated maximum rated voltage a NUEMS can measure continuously without damage and without exceeding limits of accuracy.

non-integral. – Used to describe external sensors that can be disconnected from the meter body. [3.XX]

non-utility electricity measuring system (NUEMS). – An electricity measuring system comprised of all the metrologically relevant components required to measure electrical energy, store the result, and report the result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured.

O

ohm. – The practical unit of electric resistance that allows one ampere of current to flow when the impressed potential is one volt. [3.XX]

P

percent error. – Percent error is calculated as follows:

percent error = (NUEMS reading – standard reading)/standard reading x 100

[3.XX]

power factor (PF). – The ratio of "active power" to "apparent power" in an AC circuit. It describes the efficient use of available power. [3.XX]

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

determining factors in sales representations of individual deliveries or weights. (See "indicating element" and "recording element.") [1.10, 3.XX]

R

reactive power. – For sinusoidal quantities in a two-wire circuit, reactive power is the product of the voltage, the current, and the sine of the phase angle between them, using the current as the reference. [3.XX]

register ratio (R_r). – The number of revolutions of the gear meshing with the worm or pinion on the rotor shaft per complete rotation of the fastest (most sensitive) wheel or dial pointer. [3.XX]

remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device.[2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]

(Added 1993)

retail device. – A measuring device primarily used to measure product for the purpose of sale to the end user. [3.30, 3.32, 3.37, 3.39, 3.XX]

(Amended 1987 and 2004)

S

sensor ratio. – The stated ratio of the primary circuit current or voltage compared to the secondary circuit current or voltage. (example: CSR = 200 : 0.1) [3.XX]

serving utility. – The utility distribution company that owns the master meter and sells electric energy to the owner of a submeter system. [3.XX]

starting load. – The minimum load above which the device will indicate energy flow continuously. [3.XX]

submeter. – A meter or meter system downstream of the electric master meter. [3.XX]

T

tenant. – The person or persons served electric energy from a non-utility electricity-measuring system (NUEMS). [3.XX]

test amperes (TA). – The full load current (amperage) specified by the device manufacturer for testing and calibration adjustment. (Example: TA 30). [3.XX]

thermal overload protector. – A circuit breaker or fuse that automatically limits the maximum current in a circuit. [3.XX]

U

unit price. – The price at which the product is being sold and expressed in whole units of measurement. [1.10, 3.30, 3.XX]

(Added 1992)

utility. – A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution facilities for delivery of electric energy for use primarily by the public. Included are investor-owned electric utilities, municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few

entities that are tariff based and corporately aligned with companies that own distribution facilities are also included.

A list of recognized utilities in the U.S. can be found at the U.S. Energy Information Administration (EIA) at: https://www.eia.gov/electricity/data/eia861 [3.XX]

V

volt. – The practical unit of electromotive force. One volt will cause one ampere to flow when impressed across a resistance of one ohm. [3.XX]

W

watt. – The practical unit of electric power. In an alternating-current circuit (AC), the power in watts is volts times amperes multiplied by the circuit power factor. [3.XX]

watthour (Wh). – The practical unit of electric energy, which is expended in one hour when the average power consumed during the hour is one watt. [3.XX]

meter – self-contained. – A meter in which the terminals are arranged for connection to the circuit being measured without using external instrument transformers. [3.XX]

watthour constant (K_h). – The expression of the relationship between the energy applied to the meter and the output indication, expressed as "watthours per revolution" or "watthours per output indication." [3.XX]

watthour test constant (K_t). – The expression of the relationship between the energy applied to the meter and the output indication, expressed as "watthours per output indication," when the meter is in test mode [3.XX]

Background/Discussion:
This item has been assigned to the submitter for further development. For more information or to provide comment, please contact:

Electric Vehicle Refueling Subgroup:
Ms. Juana Williams, Technical Advisor
NIST Office of Weights and Measures
301-975-2196, juana.williams@nist.gov

Electric Watthour Meters Subgroup:
Ms. Diane Lee, Chair
NIST Office of Weights and Measures
301-975-4405, diane.lee@nist.gov

This item was submitted as a Developing item to provide a venue to allow the USNWG to update the weights and measures community on continued work to develop test procedures and test equipment standards within its Electric Vehicle Refueling Subgroup. This item will also serve as a forum in which to report work on the development of a proposed tentative code for electric watthour meters in residential and business locations by the USNWG's Electric Watthour Meters Subgroup and a placeholder for its eventual submission for consideration by NCWM.

Ms. Tina Butcher (NIST OWM), Chairman of the USNWG on Electric Refueling & Submetering has continued to provide regular updates to the Committee on this work. See the Committee's 2016 through 2018 Final Reports for details.

Comments in Favor:

Regulatory:
- None

Industry:

- 2024 Interim: A member of industry representing EZ Meter supported a voting status. He would like to see the item move forward and supports the title change to NEUMS. He also added he does not agree with having the marking requirements on the meter.

Advisory:

- None

Comments Against:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- 2024 Interim: A regulator from the State of California agrees with the proposed changes in the CACASA letter and supports incorporating the language in the item. He commented that there is a concern with allowing certain marking requirements made available by mobile devices, resulting in complicated investigations and may be difficult for inspectors to inspect devices in the field. The regulator supports an informational status with Mr. Kimura's edits.

Industry:

- None

Advisory:

- 2024 Interim: A representative of NIST OWM supported an informational status on the item. He also mentioned the committee may consider a tentative voting status pending agreement with all stakeholders. The NIST OWM analysis is posted on the NCWM website.

Item Development:

NCWM 2024 Interim Meeting: The Committee heard comments from the floor during open hearings and has assigned a voting status with the edits provided by Mr. Kimura and the NIST OWM crosswalk, both of which are posted on NCWM's website. The Committee also made edits to Table S.3.2.2.a. to address the concerns of identification requirements brought up during open hearings.

NCWM 2023 Annual Meeting:
Henry Alton (METERGY) spoke as a member of industry and a member of the workgroup. He stated the item is ready for a vote and it has been worked on by the members of the workgroup, including regulators. The commentator referred to a letter of support submitted to the committee which was posted on NCWM website.

Andrew Kimura (Santa Cruz County, CA) requested the de-escalation of the item from voting to developing. The commentator noted the regulators on the work group were not in agreeance with the final draft of the agenda item. He provided feedback on specific areas and presented a PowerPoint during open hearing. Mr. Kimura stated the final draft of the agenda item does not address concerns by regulators. The commentator requested the work group consult with regulators to address specific concerns as presented during open hearings and in a letter submitted by the California Agricultural Commissioner and Sealers Association (CACASA). He commented there is no intent to delay the item any further, but expressed the need to develop the item further to address regulators concerns.

Mattew Douglas (Division of Measurement Standards, CA) referenced the letter submitted by California Agricultural Commissioner and Sealers Association (CACASA) and requested de-escalation of the item from voting to developing. He requested the work group work with regulators for further development.

Jose Arriaga (Orange County, CA) requested the de-escalation of the item from voting to developing. He requested the work group work closely with regulators for further development.

Austin Shepard (San Diego County, CA) requested de-escalation of the item from voting to developing. He requested the work group work with regulators for further development.

The committee agreed with many of the comments heard during open hearings and decided to downgrade the item to Informational prior to the voting session. The committee was notified the task group was no longer working on this specific item as it has considered it fully developed. The committee believes the Informational status will allow for further development of the item through the S&T Committee.

The committee received written comments from Mr. Kimura, the regulator representing the County of Santa Cruz, CA who presented during open hearings. Written comments included specific, proposed changes to the item which were referred to in open hearings and that were represented in the letter submitted by CACASA. The committee heard from a member of industry in support of the item and considered the National Electrical Manufactures Association (NEMA) presentation posted on NCWM's website.

The committee considered the edits submitted by Mr. Kimura and cross-referenced those changes to the NIST OWM Electric Watthour Subgroup – Recommended Crosswalk. The committee has decided to incorporate the recommended edits from NIST OWM's crosswalk into the item under consideration to be forwarded to the regions. Additional changes recommended by Mr. Kimura are available for review on the NCWM website.

NCWM 2023 Interim Meeting: Ms. Tina Butcher (NIST) commented that the USNWG on Electric Watthour Meters Subgroup believes that the draft code is ready for consideration as a voting item. Ms. Butcher asked for continued feedback from the weights and measures community. During the committee work session, the committee agreed that the item is fully developed and has merit, and assigned the item a voting status.

NCWM 2022 Interim Meeting: Matt Douglas (California – DMS) stated that California supports the development of this item but has concerns about identity marking requirements being on a separate document. Also that the devices should be easy to test before and after instillation. This device should allow for electronic data logger. Juana Williams (NIST) commented that the subgroup had provided a draft code that is on the website. Ms. Williams requested comments be submitted to Tina Butcher (NIST) or Lisa Warfield (NIST) by March 22, 2022. Ms. Williams stated these comments will be used to provide and updated draft for the 2022-2023 submission cycle and the item remain in developing status. The Committee agreed that the item be given a Developing status.

As discussed at the weighing sector meeting, multiple vehicle types are tested during the NTEP publication 14 test. If a specific vehicle type is failed or not tested, there needs to be a restriction on the vehicle types passed on the certificate. This restriction must also be marked on the device.

NCWM 2021 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided an update on the developments in the Electric Watthour Code which is included in the NIST OWM analysis. Ms. Butcher noted that the Electric Watthour

Code is in Development and anticipates a Code by Fall 2021. There was discussion on definitions for electric master meters and possibly separating the definitions for gas and water master meters and Ms. Butcher requested that this item be given a developing status. The Committee agreed that the item be given a Developing status.

NCWM 2021 Interim Meeting: The Committee heard from Ms. Tina Butcher who provided an update on the developments in the Electric Watthour Code which is include in the NIST OWM analysis and Ms. Butcher requested that this item be given a developing status. The Committee agreed that the item be given a Developing status.

NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

NCWM 2020 Interim Meeting: The Committee heard from Ms. Butcher who provided an update on developments in the Electric Watthour Meters Code which is also included in the NIST OWM analysis. Ms. Butcher requested that this item be given a developing status.

During the Committee work session, the committee agreed that this item should be given a Developing status.

NCWM 2019 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided the Committee with an update on the further development of this item. Ms. Butcher reported that the EWH SG will meet next in August 2019 to continue its work and requested this item remain on the S&T Committee agenda as a Developing item. During the committee's work session, the Committee agreed with the submitter to retain this item in a Developing status.

NCWM 2019 Interim Meeting: The Committee heard no comments on this item. At its work session, Committee members agreed with the submitter and the Regional Associations that this item should be assigned a Developing status.

NCWM 2018 Interim Meeting: No comments were heard on this item and the Committee agreed to maintain its "Developing" status. The Committee did not take comments during open hearings on Developing items at the 2018 NCWM Annual Meeting and agreed to allow only the submitter of a Developing item (or block of Developing items) to provide an update on the progress made to further develop the item(s) since the 2018 NCWM Interim Meeting. The Committee received an update on this item from Ms. Tina Butcher (NIST OWM), Chair of the USNWG on Electric Refueling & Submetering. See the Committee's 2018 Final Report for Details.

OWM personnel were unable to attend the 2019 NCWM Interim Meeting due to the Federal Government shutdown in early 2019 due to a lack of appropriations; however, OWM provided written comments to the Committee on this item in the advance of the meeting, including the following update on this item:

- The Electric Watthour Meter Subgroup (EWH SG) of the USNWG on Electric Vehicle Fueling & Submetering has held multiple in-person and web meetings since the 2017 NCWM Annual Meeting.
- The SG met in September 2017, November 2017, May 2018, and August 2018. All meetings included web-conferencing to allow those not able to attend in person to participate.
- The SG developed a proposed addition to NIST Handbook 130's Uniform Regulation for the Method of Sale (MOS) of Commodities (see Item MOS-8 on the L&R Committee's Agenda) to specify a method of sale for electrical energy sold through these systems and submitted the proposal to the four regional weights and measures association meetings in Fall 2018.
    - Three of the four regions recommend the MOS proposal on the L&R Agenda as a voting item, with the fourth abstaining due to lack of experience with these systems within the region.
- The SG continues work on a proposed code for EWH-type meters for NIST Handbook 44 and expects to have a draft ready for the 2020 NCWM cycle.

- OWM requests this item be maintained on the S&T Committee's agenda as a Developing Item while the SG finalizes its proposed HB 44 draft. OWM will continue to apprise the Committee of progress.
- At their Fall 2018 meetings, all four regional associations indicated support for maintaining this as a Developing item on the Committee's agenda.
- The SG will hold its next in-person meeting in February 2019 in Sacramento, CA. *(Technical Advisor's Note: This meeting was rescheduled to April 2019.)*
- Those interested in participating in this work are asked to contact SG Chair, Ms. Lisa Warfield, or Technical Advisor, Ms. Tina Butcher.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as informational.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting:

The proposed language for consideration is posted on the WWMA website {Events – Meeting Documents – OTH-16.1 Recommended Edits Agenda Item}. Comments heard on the floor were regarding the proposed updated language.

Austin Shepard (San Diego County, California): Supports this item moving forward as a Voting item with the proposed changes as posted on the WWMA website.

Due to the substantial changes to the proposed language the WWMA S&T Committee recommends this item remain Informational to allow the body of the NCWM the opportunity to review those proposed changes and provide feedback to the NCWM S&T Committee. The committee further recommends the NCWM S&T Committee consider the updates provided by Andrew Kimura – Santa Cruz County California in their deliberations.

The proposed language will be included in the WWMA S&T Committee 2023 Final Report as an Appendix to the item. Additional documentation of these changes will be published on NCWM's website.

SWMA 2023 Annual Meeting: Andrew Kimura, Santa Cruz County, California, submitted a letter detailing many recent changes to this item ahead of our annual meeting.

Lisa Warfield, OWM, asked the Committee if they were considering the printed language or the language submitted by Andrew Kimura at the NCWM Interim.

The committee will consider this item with Mr. Kimura's most recent revisions.

The committee recommends this item remain an Informational item, so that the NCWM S&T Committee can continue to develop it with the opportunity to escalate it to voting status after the NCWM Interim Meeting.

NEWMA 2023 Interim Meeting: No comments were heard on this item and the Committee does not have a recommendation.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

OTH-24.2 V Appendix D, Definitions: National Type Evaluation Program (NTEP) and Certificate of Conformance (CC)

Source:
Jerry Buendel

Purpose:
Add a definition of Certificate of Conformance (CC) and a definition of National Type Evaluation Program (NTEP) to Handbook 44, Appendix D.

Item under Consideration:
Amend Handbook 44 Appendix D, Definitions as follows:

Certificate of Conformance (CC) - A document issued under the National Type Evaluation Program (NTEP). The CC is evidence of conformance of a model or models of a particular device, measurement system, instrument, or element and positively identifies the design with the requirements of this Handbook and of NCWM Publication 14, "National Type Evaluation Program, Technical Policy, Checklists, and Test Procedures". Active CCs are maintained by the certificate holder and indicate that the devices are being manufactured or remanufactured in conformance with the CC. An inactive CC is a Certificate which was previously active, but the device, measurement system, instrument or element is no longer being manufactured for commercial applications. However, devices, measurement systems, instruments or elements already manufactured, installed or in inventory may be used, sold, repaired and resold under inactive CCs.

National Type Evaluation Program (NTEP) – A program administered by NCWM. NTEP is a program of cooperation between the NCWM, NIST, other federal agencies, the states, and the private sector for determining, on a uniform basis, conformance of a model or models of a particular device, measurement system, instrument, or element that positively identifies the design with the relevant provisions of this Handbook and NCWM, Publication 14, "National Type Evaluation Program, Technical Policy, Checklists, and Test Procedures."

Previous Status:
2024: New Proposal

Original Justification:

- The term National Type Evaluation Program (NTEP) is used in the General, Scales, Automatic Weighing System, Hydrogen Gas-Measuring, Electric Vehicle Fueling Systems, Grain Moisture Meter, Near-Infrared Grain Analyzers, and Multiple Dimension Measuring Devices codes, and in Appendix A. Fundamental Considerations.
- Some users of the Handbook, including regulatory officials, have little or no knowledge of NTEP and the significance of Certificates of Conformance.
- The terms NTEP and Certificate of Conformance appear in NCWM's Basic Competency, Professional Certification, and Service Agent examinations. Examinees are expected to be able to understand NTEP CCs and apply information found on the CCs.
- The definition for NTEP and CC are taken from NIST Handbook 130, Uniform Regulation for National Type Evaluation. The statements on inactive CCs are taken from the NCWM website, NTEP Frequently Asked Questions page.
- The absence of definitions could cause enforcement or other legal issues.

The submitter requested Voting status for 2024.

Comments in Favor:

Regulatory:

- 2024 Interim: Representatives from the States of Maryland, New Hampshire, and Florida support this item for voting with revisions that were provided by the submitter.

Industry:

- 2024 Interim: The Scale Manufacturers Association commented that this item is fully developed and recommends a voting status.

Advisory:

- 2024 Interim: A representative from NIST OWM commented that the item, with revisions, is fully developed.

Comments Against:

Regulatory:

- None

Industry:

- None

Advisory:

- None

Neutral Comments:

Regulatory:

- None

Industry:

- None

Advisory:

- 2024 Interim: The submitter of this item provided revisions, and explanations for the revisions, of the definitions for the term "National Type Evaluation Program (NTEP)" and "Certificate of Conformance (CC)".

Item Development:

NCWM 2024 Interim Meeting: During open hearings, the Committee heard comments from the submitter addressing the updated and revised language to the definitions of "National Type Evaluation Program (NTEP) and "Certificate of Conformance (CC)" to provide a more clear and accurate definition. The Committee also heard positive comments from regulators, industry, and advisory members in consideration of the item and the revisions. The Committee has agreed to assign this item a voting status.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: Greg VanderPlaats from Minnesota stated that Jerry Buendel proposed this item because in developing tests for service agents on the national level it was discovered that those terms are not defined in Handbook 44. Service people will have questions on these definitions. Recommend voting status for this item.

The committee recommends this item as voting.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting comments were heard from California, Arizona, and Oregon. The consensus was in support for the item, as it is needed. Comments were also heard suggesting simplifying both definitions and possibly removing the language regarding policy.

Based on the comments heard during the open hearings the WWMA 2023 S&T Committee recommends that this item be assigned a Developing status and recommends the submitter address the comments heard during open hearings.

SWMA 2023 Annual Meeting: The committee heard no comments on this item during Open Hearings.

The committee approves of defining these terms but acknowledges the language could be cleaned up some in regard to the differences in Active and Inactive status. Clarifying that both active and inactive certificates are both Certificates of Conformance. We would suggest striking "which the certificate holder maintains in active status" from the first sentence of the Certificate of Conformance definition (Lines 24-25.)

The committee recommends this item move forward as a Voting item.

NEWMA 2023 Interim Meeting: The States of New Hampshire, New Jersey, New York, and the Commonwealth of Massachusetts support voting. Upon consensus of the body, the Committee recommends this item be Voting.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

ITEM BLOCK 1 (B1) - TRANSFER STANDARD METER

Source:
California Department of Food and Agriculture, Division of Measurement Standards

B1-LMD-24.1 V ~~*N.3.5.3. Field Standard Meter Test*~~**N.3.5.3. Transfer Standard Meter Test.**

Purpose:
Replace the undefined term "Field Standard Meter" with the defined term "Transfer Standard", harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove the non-retroactive status from the section.

Item under Consideration:
Amend Handbook 44 Liquid Measuring Devices Code as follows:

~~*N.3.5.X. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.*~~

~~*(Added 2023)*~~

~~*[Nonretroactive as of January 1, 2023]*~~

N.3.5.3. Transfer Standard Meter Test. – When comparing a meter with a calibrated transfer standard meter, the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.

(Added 2023) **(Amended 20XX)**

Previous Status:
2024: New Proposal

B1-VTM-24.1 V ~~*N.3.1. Field Standard Meter Test*~~N.3.1. Transfer Standard Meter Test.

Purpose:
Replace the undefined term "Field Standard Meter" with the defined term "Transfer Standard", harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove the non-retroactive status from the section.

Item under Consideration:
Amend Handbook 44 Vehicle Tank Meters Code as follows:

~~*N.3.1. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.*~~
~~*(Added 2023)*~~
~~*[Nonretroactive as of January 1, 2023]*~~

N.3.1. Transfer Standard Meter Test. – When comparing a meter with a calibrated transfer standard meter, the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
(Added 2023) **(Amended 20XX)**

Previous Status:
2024: New Proposal

Original Justification:
If the term "Field Standard Meter", which is undefined, remains in NIST HB 44 this will lead to confusion regarding what a "Field Standard Meter" is. This proposal is intended to remove this confusion by replacing this term with one that is defined in NIST HB 44. The item is a test note which would only apply to tests of devices moving forward, the item also identifies when it was added to NIST HB 44, therefore a non-retroactive status is not necessary.

The section to be amended was recently added to NIST HB 44. There may be an additional purpose regarding the non-retroactive status of the section.

The submitter requested Voting status for this item in 2024 as a retroactive provision.

B1-LPG-24.3 V N.3.2. ~~Field Standard Meter~~Transfer Standard Meter Test.

Purpose:
Replace the undefined term "Field Standard Meter" with the defined term "Transfer Standard" and harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards.

Item under Consideration:
Amend Handbook 44 Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

N.3.2. ~~Field Standard Meter~~ Transfer Standard Meter Test. – **When comparing a meter with a calibrated transfer standard meter,** ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
(Added 2023) **(Amended 20XX)**

Previous Status:
2024: New Proposal

Original Justification:
If the term "Field Standard Meter", which is undefined, remains in NIST HB 44 this will lead to confusion regarding what a "Field Standard Meter" is. This proposal is intended to remove this confusion by replacing this term with one that is defined in NIST HB 44.

The section to be amended was recently added to NIST HB 44.

The submitter requested Voting status for this item in 2024 as a retroactive provision.

B1-MLK-24.1 V ~~*N.3.2. Field Standard Meter Test.*~~**N.3.2. Transfer Standard Meter Test.**

Purpose:
Replace the undefined term "Field Standard Meter" with the defined term "Transfer Standard", harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove the non-retroactive status from the section.

Item under Consideration:
Amend Handbook 44 Milk Meters Code as follows:

~~***N.3.2. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.***~~
~~***(Added 2023)***~~
~~***[Nonretroactive as of January 1, 2023]***

N.3.2. Transfer Standard Meter Test. – When comparing a meter with a calibrated transfer standard meter, the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
(Added 2023) **(Amended 20XX)**

Previous Status:
2024: New Proposal

Original Justification:
If the term "Field Standard Meter", which is undefined, remains in NIST HB 44 this will lead to confusion regarding what a "Field Standard Meter" is. This proposal is intended to remove this confusion by replacing this term with one that is defined in NIST HB 44. The item is a test note which would only apply to tests of devices moving forward, the item also identifies when it was added to NIST HB 44, therefore a non-retroactive status is not necessary.

The section to be amended was recently added to NIST HB 44. There may be an additional purpose regarding the non-retroactive status of the section.

The submitter requested Voting status for this item in 2024 as a retroactive provision.

B1-MFM-24.1 V N.3.2. ~~Field Standard Meter~~**Transfer Standard Meter** Test.

Purpose:
Replace the undefined term "Field Standard Meter" with the defined term "Transfer Standard", harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove the non-retroactive status from the section.

Item under Consideration:
Amend Handbook 44 Milk Meters Code as follows:

N.3.2. ~~Field Standard Meter~~ Transfer Standard Meter Test. – **When comparing a meter with a calibrated transfer standard meter,** ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested except for tests of the minimum measured quantity specified for the meter.

(Added 2023) **(Amended 20XX)**

Previous Status:
2024: New Proposal

Original Justification:
If the term "Field Standard Meter", which is undefined, remains in NIST HB 44 this will lead to confusion regarding what a "Field Standard Meter" is. This proposal is intended to remove this confusion by replacing this term with one that is defined in NIST HB 44.

The section to be amended was recently added to NIST HB 44.

The submitter requested Voting status for this item in 2024 as a retroactive provision.

Comments in Favor:

Regulatory:
- 2024 Interim: The submitter, a representative from the State of California, recommended the item be given a voting status. After hearing comments from a representative from Endress + Hauser Flow USA, the submitter agreed to modify the item to insert the word "meter" after each instance of the words "transfer standard" within the proposal.

Industry:
- None

Advisory:
- None

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:

- 2024 Interim: A representative from Endress + Hauser Flow USA commented that this item was settled last year and offered a language change to add the word "meter" after each instance of the words "transfer standard" within the proposal. With this new addition, the commenter proposes a voting status, but without it, a developing status.

Advisory:

- 2024 Interim: A representative from NIST voiced support for adding the word "meter" after each instance of the words "transfer standard".

Item Development:

NCWM 2024 Interim Meeting: During open hearings, the Committee heard from the submitter, who requested a voting status. The Committee also heard from a representative from Endress + Hauser Flow USA, who requested the addition of the word "meter" after each instance of the words "transfer standard" within the proposal, and the submitter agreed to the addition. The Committee has agreed to give this item a voting status.

Regional Associations' Comments:

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this block as voting.

WWMA 2023 Annual Meeting: Due to the WWMA S&T Committee Chairman being a submitter of this item, Matt Douglas (California Department of Food and Agriculture, Division of Measurement Standards) abstained from the committee during open hearings, committee work sessions, and the voting session.

During the WWMA 2023 annual meeting the following comments were received:

Matt Douglas (California, CDFA, DMS): Clarified the intent of this item is to replace undefined terms with HB44 defined terms recently adopted at the 2023 NCWM Annual Conference.

Based on comments from the floor there was consensus with the item moving forward with a Voting status. Clarifying questions were asked and answered with sufficient responses during open hearings regarding the newly adopted definitions (Type 1 & Type 2 Transfer Standard) and the non-retroactive status removal from the code sections as they are in the notes section of HB44.

The WWMA S&T Committee recommended this item be assigned a Voting status. In review of this item and based on comments heard from the body, this committee feels this Block of items is fully developed, has merit, and meets the intended purpose.

SWMA 2023 Annual Meeting: The committee heard no comments on this item during Open Hearings.

The committee supports this item as it harmonizes the language used in these codes with existing language in other related sections of the handbook.

The committee recommends this item move forward as a Voting item.

NEWMA 2023 Interim Meeting: The States of New Hampshire, New Jersey and New York supports voting. Upon consensus of the body, the Committee recommends this item be Voting.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

ITEM BLOCK 2 (B2) – LPG RETAIL MOTOR-FUEL DISPENSERS

Note: During the 2024 Interim Meeting, the Committee agreed to block individual items LPG-24.1, LPG-24.2, and OTH-24.1 into new Item Block 2.

Source:
National Propane Gas Association

B2-LPG-24.1 V ***S.1.5.7. Totalizers for ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices., S.2.6.1. Electronic Stationary (Other than Stationary ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices). S.6.2. Automatic Timeout Pay-at-Pump ~~Retail Motor Fuels Devices~~Liquefied Petroleum Gas Retail Motor-Fuel Devices.*** **and,** ***S.4.3. Location of Marking Information: ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices.***

Purpose:
The proposal is a companion to the main proposal to modify 3.32, S.2.5.1 and S.2.5.2, and the proposal to change the definition of Liquefied Petroleum Gas Retail Motor-Fuel Device. The purpose of this proposal is to correlate the terminology in 3.32 for LP-gas and use only the defined term as proposed in the companion proposal.

Item under Consideration:
Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

S.1.5.7. Totalizers for ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices. – ~~Retail motor-fuel dispensers~~Liquefied petroleum gas retail motor-fuel devices *shall be equipped with a nonresettable totalizer for the quantity delivered through the metering device.*

[Nonretroactive as of January 1, 2017]

(Added 2016) **(Amended 20XX)**

S.2.6.1. Electronic Stationary (Other than Stationary ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices). – *For individual deliveries, if there is no product flow for three minutes the transaction must be completed before additional product flow is allowed. The three-minute timeout shall be a sealable feature on an indicator.*

[Nonretroactive as of January 1, 2021]

(Added 2021) (Amended 2023 **and 20XX**)

S.2.6.2. Automatic Timeout Pay-at-Pump ~~Retail Motor-Fuel Devices~~Liquefied Petroleum Gas Retail Motor-Fuel Devices – *Once a device has been authorized, it must deauthorize within three minutes if not activated. Reauthorization of the device must be performed before any product can be dispensed. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than three minutes.*

[Nonretroactive as of January 1, 2022]

(Added 2021) **(Amended 20XX)**

S.4.3. Location of Marking Information; ~~Retail Motor-Fuel Dispensers~~Liquefied Petroleum Gas Retail Motor-Fuel Devices. *– The marking information required in General Code, paragraph G-S.1. Identification shall appear as follows:*

(a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;

(b) either internally and/or externally provided the information is permanent and easily read; and

(c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

The use of a dispenser key or tool to access internal marking information is permitted for ~~**retail motor-fuel dispensers**~~ **liquefied petroleum gas retail motor-fuel devices**.

[Nonretroactive as of January 1, 2003]

(Added 2006) **(Amended 20XX)**

Previous Status:
2024: New Proposal

Original Justification:
This is a companion to this group's proposal to Appendix D and the definition of "liquefied petroleum gas retail motor-fuel device." The proposed change to the definition will more precisely define what a liquefied petroleum gas retail motor-fuel device is. This is a UL-listed device that is electricity-powered and that has all of the features required by Handbook 44. It includes a safety nozzle that connects to the fill valve on the vehicle which will not flow gas unless a positive connection is made. These devices are required by NFPA 58 for all LP-gas dispensers installed at refueling facilities open to the public.

Opposition would most likely come from those opposed to the primary changes in S.2.5.1 and S.2.5.2.
Opposition may also come from those concerned about vehicles that do not have the K15 mating connection on the fill valve of the vehicle. Rebuttal to that would be that propane industry sources indicate that older vehicles that do not have the K15 connection are being retrofit at a high rate to incorporate the safety features of the K15 connection.

The submitter requested Voting status for these items in 2024.

B2-LPG-24.2 V *S.2.5. Zero-Set-Back Interlock.*

Purpose:
The proposal will address practical issues that propane retailers encounter when trying to comply with the zero setback requirements for propane stationary meters in Handbook 44.

Item under Consideration:
Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

S.2.5. Zero-Set-Back Interlock.

S.2.5.1. Zero-Set-Back Interlock, Electronic Stationary Meters (Other than Stationary ~~Retail Motor-Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor-Fuel Device) and Electronic Vehicle-Mounted Meters. *– A device shall be constructed so that after an individual delivery or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating element and, if equipped, recording element have been returned to their zero positions.*

[Nonretroactive as January 1, 2021]

(Added 2019) (Amended 2021 **and 202X**)

S.2.5.2. Zero-Set-Back Interlock for Stationary ~~Retail Motor-Fuel Devices~~ Liquefied Petroleum Gas Retail Motor-Fuel Device. *– A device shall be constructed so that:*

(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;

(b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and

(c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

[Nonretroactive as of January 1, 2017]

(Added 2016) **(Amended 202X)**

Previous Status:

2024: New Proposal

Original Justification:

This proposal reflects the intent of U-Haul International, Inc. and the National Propane Gas Association's Technology, Standards and Safety Committee, a volunteer organization comprised of 2500+ members, including propane retail marketers and others providing products or services to the propane industry.

The intent behind enacting the current version of S.2.5.2 was to create consistency among motor-fuel devices used for all products. This proposal strikes a balance between a consistent standard for retail motor-fuel devices and the diverse applications and industry standard for dispensing LP-Gas. To that end, this proposal addresses only those devices used exclusively for retail motor-fuel transfer. Multi-use LP-Gas devices that are used for the filling motor-fuel and other containers, including grill cylinders, forklift cylinders, cylinders used on recreational vehicles and even motor fuel containers, are covered by S.2.5.1.

Most LP-Gas dispensed is for purposes other than motor-fuel. (Less than 3% of all LP-Gas used in the United States is used for transportation. *See* U.S. Department of Energy, Alternative Fuels Data Center afdc.energy.gov/fuels/propane_basics.html.) Pursuant to NFPA 58, this is accomplished by a trained and certified employee dispensing LP-Gas, typically using analog (mechanical) meters, into cylinders and tanks. The analog (mechanical) meters are safe and effective, and most notably exempt from the zero-set-back requirement because S.2.5.1 only applies to electronic devices. Clearly, Handbook 44 recognizes this reality as S.2.5.1 does not require that all LP-Gas dispensers have zero-set-back interlocks, only electronic devices. S2.5.1 is most appropriate because currently there is no readily available technology that can be used to retrofit an analog device. When looked at from a cost/benefit perspective, one has to question the expense of replacing an analog device with an electronic device at a location that mostly serves portable cylinders and not motor vehicle tanks when LP-Gas's use is so limited in transportation.

Furthermore, NFPA 58 currently does not allow the public to refuel its LP-Gas powered motor vehicles. All motor vehicles or other containers must be filled by a specially trained employee. A proposed change has been introduced for consideration in the 2023 edition of NFPA 58 that would permit public refueling of motor vehicles as long as the dispensing system meets very specific safety requirements, including a specialized nozzle, and is furnished with visible instructions. Upon the acceptance of this new public refueling allowance, the LP-Gas industry agrees that Zero-Setback-interlocks are needed. This public, self-service motor vehicle dispensing systems will be listed to Underwriters Laboratories Standard 495 and will be dedicated to the filling of motor vehicles.

For the minimal amount of retail motor fuel customers that a typical LP-Gas dispenser serves, both U-Haul and NPGA feel that this proposal represents the most equitable approach to date for balancing the need to ensure fair transactions and consistent standards with how the LP-Gas industry currently dispenses LP-Gas and LP-Gas's future transportation applications as envisioned by the proposed changes to NFPA 58 without conducting costly industry-wide retrofits of existing, functioning multi-use equipment. Handbook 44 needs to work with industry to make technical standards economically feasible lest it risk the advancement of LP-Gas as a viable and clean motor-fuel.

At its August 2022 meeting, the Central Weights and Measures Association recommended LPG-23.1 as a Developing Item with the following comment: *"The Committee has concerns regarding a consumer/customer starting a deliver when the device is not on zero."* In response, there are two points to make regarding the transfer of liquid propane into a container. The first is that any transfer made into cylinders (not mounted on vehicles) would have to be done by propane service personnel. The customer would not be permitted to transfer product into any cylinder, even if they own that container.

Secondly, LPG-23.1 is intending to clarify that dispensers which are used *exclusively for retail motor fuel* will be subject to the zero setback requirements. It is only these dispensers, which are installed at public retail motor vehicle refueling stations, that are permitted to be operated by the general public to refuel vehicles. Therefore, because of the zero setback and time-out provisions in Handbook 44, there really is no opportunity for the customer to "game" the dispenser system.

We propose to strike the nonretroactivity date from the proposal in recognition that vehicles that will be refueling from these dispensers will be utilizing the proper connection. New vehicles have had the connection for several years and existing vehicles are being retrofit to accommodate the safety features that the K15 connection offers. The revisions proposed to the definition of "liquefied petroleum gas retail motor-fuel device" will complete the loop and ensure that the dispenser technology is consistent with the requirements of NFPA 58 "LP-Gas Code."

B2-OTH-24.1 V Appendix D, Definitions: liquefied petroleum gas retail motor-fuel device.

Source:
National Propane Gas Association

Purpose:
The proposal is a companion to the main proposal to modify 3.32, S.2.5.1 and S.2.5.2. There is another proposal that will substitute the term "liquefied petroleum gas retail motor-fuel device" for the terms "retail motor-fuel dispenser" and "retail motor-fuel device" throughout 3.32.

Item under Consideration:
Amend Handbook 44 Appendix D, Definitions as follows:

liquefied petroleum gas retail motor-fuel device. – A device designed for the measurement and delivery of liquefied petroleum gas used as a fuel for internal combustion engines in vehicles bearing a state or federal license plate for use on public roads. **The device can be operated either by trained personnel or the customer.** ~~**The term means the same as "retail motor-fuel dispenser" and "retail motor-fuel device" as it appears in section 3.32 LPG and Anhydrous Ammonia Liquid Measuring Devices.**~~ [3.32]

Note: These devices are required to be listed to UL 495 Power-Operated Dispensing Devices for LP-Gas and equipped with a Type K15 nozzle in accordance with ISO/DIS 19825, Road vehicles- Liquefied petroleum gas refueling connector.

(Added 2022) **(Amended 202X)**

Previous Status:
2024: New Proposal

Original Justification:
This is a companion to this group's proposal to 3.32, S.2.5.1 and S.2.5.2. The proposed change to the definition will more precisely define what a liquefied petroleum gas retail motor-fuel device is. This is a UL-listed device that is electricity-powered and that has all of the features required by Handbook 44. It includes a safety nozzle that connects to the fill valve on the vehicle which will not flow gas unless a positive connection is made. These devices are required by NFPA 58 for all LP-gas dispensers installed at refueling facilities open to the public.

Opposition would most likely come from those opposed to the primary changes in S.2.5.1 and S.2.5.2. Opposition may also come from those concerned about vehicles that do not have the K15 mating connection on the fill valve of the vehicle. Rebuttal to that would be that propane industry sources indicate that older vehicles that do not have the K15 connection are being retrofit at a high rate to incorporate the safety features of the K15 connection.
The submitter requested Voting status in 2024.

Comments in Favor:

Regulatory:
- None

Industry:
- 2024 Interim: A representative from the National Propane Gas Association supports the items and requested that they be blocked together. The idea behind proposals is to keep the code nonretroactive and the definition in OTH-24.1 using "exclusively K-15 nozzle" addresses analog and older devices.

Advisory:
- None

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST OWM recommended withdrawing the items due to the definition using "K-15 nozzle" as is could result in the code only applying to devices with that connection. The representative does not support as it would separate out analog devices.

Neutral Comments:

Regulatory:
- 2024 Interim: A representative from the State of California recommended blocking the items together as they are contingent upon each other. The commenter thought the original purpose was to remove nonretroactivity and supports a developing status.

Industry:
- None

Advisory:
- None

Item Development:
NCWM 2024 Interim Meeting: During open hearings, these items were grouped together to facilitate comments on like items. Comments were heard for and against the items. During the work session, the Committee updated the title of LPG-24.1 and pluralized "device" in several subsections, updated the title of LPG-24.2, added amendment dates, reformatted the entire item, and added the code reference in OTH-24.1. Based on comments received during open hearings and from regions, the Committee decided to block LPG-24.1, LPG-24.2 and OTH-24.1 into Block 2. The Committee agrees that the items are fully developed and is assigning the block a voting status.

Regional Associations' Comments:
The below comments are on LPG-24.1.
CWMA 2023 Interim Meeting: Greg VanderPlaats from Minnesota asked if LPG 23.1 needs to pass before this item can be considered.

The committee recommends this item as a voting item blocked with item OTH 24.1.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively:

Mr. Kevin Schnepp (California, Div. of Measurement Standards): Recommended items LPG-24.1, LPG-24.2, and OTH-24.1 be blocked. Mr. Scott Simmons (Colorado Div. of Oil and Public Safety) agreed.

Mr. Scott Simmons (Colorado, Div. of Oil and Public Safety): Commented that the items clarify what an LPG RMFD is, and that the zero-setback interlock requirement is only intended to apply to LPG RMFD, for example a standalone dispenser on an island. The result of applying this requirement to other LPG devices may negatively impact businesses and consumers through a rise in cost.

Mr. Kurt Floren (Los Angeles County, California) and Scott Simmons (Colorado Div. of Oil and Public Safety) had a discussion regarding the possibility of clarifying existing language in NIST HB 44 3.32 S.2.5.1 and S.2.5.2. which most find confusing. Mr. Kenn Burt (San Luis Obispo County, California) suggested that merging sections S.2.5.1. and S.2.5.2. might be a method of addressing the confusion of how to apply the code sections.

Mr. Kevin Schnepp (California, Div. of Measurement Standards): Questioned whether the intent of the items could better be addressed by exempting analog LPG devices from a zero-setback interlock requirement.

During open hearings there was a consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in HB 44 which most find confusing, and possibly merging S.2.5.1 and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be Blocked with LPG-24.2 and OTH-24.1 and that the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter time to address the comments heard during open hearings.

SWMA 2023 Annual Meeting: Steve Benjamin, North Carolina, stated he sees this item as cleanup and that a follow up item will be needed next year.

The committee recommends blocking this item with LPG-24.2 and OTH-24.1.

The committee recommends this item move forward as a Developing item.

NEWMA 2023 Interim Meeting: The State of New York opposes this item and does not see the need for the changes. Upon consensus of the body, the Committee recommends this item be Developing.

The below comments are on LPG-24.2.

CWMA 2023 Interim Meeting: Greg VanderPlaats from Minnesota asked if there is a concern with one of the LPG items passing and not the others. Should they be blocked together?

The committee recommends this item as a voting item.

The committee believes that this item is an attempted revision of item LPG 23.1 and should not have been submitted. Now that this item has been submitted, the committee recommends that the discussion history for LPG 23.1 be moved to LPG 24.2. These recommendations are intended to clean up what we perceive to be an administrative error in that LPG 24.2 should not have been created but should have been an update to item LPG 23.1.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively:

Mr. Kevin Schnepp (California, Div. of Measurement Standards): Recommended items LPG-24.1, LPG-24.2, and OTH-24.1 be blocked. Mr. Scott Simmons (Colorado Div. of Oil and Public Safety) agreed.

Mr. Scott Simmons (Colorado, Div. of Oil and Public Safety): Commented that the items clarify what an LPG RMFD is, and that the zero-setback interlock requirement is only intended to apply to LPG RMFD, for example a standalone dispenser on an island. The result of applying this requirement to other LPG devices may negatively impact businesses and consumers through a rise in cost.

Mr. Kurt Floren (Los Angeles County, California) and Scott Simmons (Colorado Div. of Oil and Public Safety) had a discussion regarding the possibility of clarifying existing language in NIST HB 44 3.32 S.2.5.1 and S.2.5.2. which most find confusing. Mr. Kenn Burt (San Luis Obispo County, California) suggested that merging sections S.2.5.1. and S.2.5.2. might be a method of addressing the confusion of how to apply the code sections.

Mr. Kevin Schnepp (California, Div. of Measurement Standards): Questioned whether the intent of the items could better be addressed by exempting analog LPG devices from a zero-setback interlock requirement.

During open hearings there was a consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in HB 44 which most find confusing, and possibly merging S.2.5.1 and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be Blocked with LPG-24.2 and OTH-24.1 and that the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter time to address the comments heard during open hearings.

SWMA 2023 Annual Meeting: Steven Benjamin, North Carolina, asked the committee to double check the language used in the agenda because he believed it to be incorrect. The committee found that the language format was incorrect compared to the language used in the Form 15. The committee has decided to consider the language and formatting used in the item's Form 15. This language is as follows:

S.2.5. Zero-Set-Back Interlock.

S.2.5.1. Zero-Set-Back Interlock, Electronic Stationary Meters (Other than Stationary ~~Retail Motor-Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor-Fuel Device) and Electronic Vehicle-Mounted Meters. *– A device shall be constructed so that after an individual delivery or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating element and, if equipped, recording element have been returned to their zero positions.*

~~[Nonretroactive as January 1, 2021]~~

S.2.5.2. Zero-Set-Back Interlock for Stationary ~~Retail Motor-Fuel Devices~~ Liquefied Petroleum Gas Retail Motor-Fuel Device. *– A device shall be constructed so that:*

(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;

(b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and

(c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

~~*[Nonretroactive as of January 1, 2017]*~~

The committee recommends this item move forward as a Developing item, with the language and formatting used in the Form 15 and suggests blocking the item with LPG-24.1 and OTH-24.1.

NEWMA 2023 Interim Meeting: The State of New York opposes this item and does not see the need for the changes, the new wording is no longer in italics and questions if the submitters are suggesting it be retroactive as it is not stated in justification. It was pointed out that this item is similar to LPG-23.1 but does not include UHaul and the National Propane Gas Association requested withdrawal of LPG-23.1 in this proposal. Upon consensus of the body, the Committee recommends this item be Developing.

The below comments are on OTH-24.1.
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item as voting item blocked with item LPG 24.1.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively:

Mr. Kevin Schnepp (California Div. of Measurement Standards): Recommended items LPG-24.1, LPG-24.2, and OTH-24.1 be blocked. Mr. Scott Simmons (Colorado Div. of Oil and Public Safety) agreed.

Mr. Scott Simmons (Colorado Div. of Oil and Public Safety): Commented that the items clarify what an LPG RMFD is, and that the zero-setback interlock requirement is only intended to apply to LPG RMFD, for example a standalone dispenser on an island. The result of applying this requirement to other LPG devices may negatively impact businesses and consumers through a rise in cost.

Mr. Kurt Floren (Los Angeles County, California) and Scott Simmons (Colorado Div. of Oil and Public Safety) had a discussion regarding the possibility of clarifying existing language in NIST HB 44 3.32 S.2.5.1 and S.2.5.2. which most find confusing. Mr. Kenn Burt (San Luis Obispo County, California) suggested that merging sections S.2.5.1. and S.2.5.2. might be a method of addressing the confusion of how to apply the code sections.

Mr. Kevin Schnepp (California Div. of Measurement Standards): Questioned whether the intent of the items could better be addressed by exempting analog LPG devices from a zero-setback interlock requirement.

During open hearings there was a consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in HB 44 which most find confusing, and

possibly merging S.2.5.1 and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be Blocked with LPG-24.2 and OTH-24.1 and that the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter to address the comments heard during open hearings.

SWMA 2023 Annual Meeting: The committee did not receive any comment on this item during Open Hearings.

The committee supports the modification of the definition for Liquefied Petroleum Gas Retail Motor-fuel Device.

The committee recommends blocking this item with LPG-24.1 and LPG-24.2.

The committee recommends moving this item forward as a Developing item.

NEWMA 2023 Interim Meeting: The States of New York and New Jersey, and the Commonwealth of Massachusetts recommend this item be developing as it is a companion to LPG-24.1. Upon consensus of the body, the Committee recommends this item be Developing.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to https://www.ncwm.com/publication-15 to review these documents.

ITEM BLOCK 3 (B3) – MILK METER TOLERANCES

Note: During the 2024 Interim Meeting, the Committee agreed to block individual items VTM-20.2 and MLK-23.2 into new Item Block 3.

B3-VTM-20.2 A Table T.2. Tolerances for Vehicle Mounted Milk Meters.

NOTE: This item was revised based on changes that were made by the Committee at the 2021 Interim Meeting. The item under consideration was removed from the voting consent calendar at the 2021 Annual Meeting and the S&T Committee made this a developing item.

Source:
POUL TARP A/S

Purpose:
Change tolerances to accommodate more efficient milk-metering systems.

Item Under Consideration:
Amend Handbook 44, Vehicle-Tank Meters Code as follows**:**

T.2. Tolerance Values. – Tolerances shall be as shown in Table 1. Accuracy Classes and Tolerances for Vehicle-Tank Meters Other Than Vehicle-Mounted Milk Meters and Table 2. Tolerances for Vehicle-Mounted Milk Meters.
(Amended 1995 **and 20XX**)

Table 2. Tolerances for Vehicle-Mounted Milk Meters		
~~**Indication (gallons)**~~	~~**Maintenance Tolerance (gallons)**~~	~~**Acceptance Tolerance (gallons)**~~
~~100~~	~~0.5~~	~~0.3~~
~~200~~	~~0.7~~	~~0.4~~
~~300~~	~~0.9~~	~~0.5~~
~~400~~	~~1.1~~	~~0.6~~
~~500~~	~~1.3~~	~~0.7~~
~~Over 500~~	~~Add 0.002 gallon per indicated gallon over 500~~	~~Add 0.001 gallon per indicated gallon over 500~~

Table 2. Tolerances for Vehicle-Mounted Milk Meters		
	Acceptance Tolerance	**Maintenance Tolerance**
Complete Measuring System	0.5%	0.5%
Meter Only	0.3%	0.3%

(Added 1989) **(Amended 20XX)**

Previous Action:
2023: Assigned to the Milk Meter Tolerance Task Group
2022: Assigned to the Milk Meter Tolerance Task Group
2021: Voting – Returned to Committee
2020: Assigned to the Milk Meter Tolerance Task Group

Original Justification:
Existing tolerances are based on the accuracy of the Flow meter itself. The proposed Tolerances are based on Milk Metering Systems where the magnetic flow meter is a part of the Milk Metering system handling milk containing air.

The accuracy of the Flow meter will always be influenced by the way it is used. The only way you can obtain the accuracy described by the manufacture is when the flow meter is operating as a "stand alone" unit and, equally important, only if the product passing through the flow meter is complete air-free.

The submitter provided the following:

During the past 20 years, the need for improved efficiency in the collection of milk has resulted in the use of milk pumping equipment being installed on milk tankers.

One of the most obvious places for a modern Dairy to optimize is the amount of time that the milk tanker uses to make a collection. If you can reduce the collection time at each farmer, the Dairy will be able to get a significant reduction in collection and transport cost for the benefit of the Farmer, Consumer and the Dairy itself. At the same time, you will get an environmental benefit as a result of reduced CO2 in the milk collection process.

The consequence of introducing pump systems on milk tankers is that it causes air to be mixed with the milk which again will influence the accuracy of the magnetic flow-meter mounted in the system. Milk entrains air unlike petroleum liquids which do not. As you know, the flow meter will count anything that passes through the meter – liquid as well as air – and it is therefore essential that as much air as possible is removed from the milk before it reaches the flow-meter. However, it is widely recognized that it is not possible to remove all the air from the milk, which will result in an inaccuracy.

It is therefore essential that the tolerances for vehicle mounted milk pump systems using magnetic flow-meters for determining milk volume reflects todays way of collecting milk. This means that existing Tolerance for milk meters cannot be used when the milk meter is a part of a system where different system parts will influence the accuracy of the count. Such milk metering systems will need to be classified with their own tolerances.

Based on our 25 years of experience as a manufacturer of these systems and more than 3000 installations on milk trucks operating in more than 15 countries, we would like to propose that the Tolerance for Vehicle Mounted Milk Metering Systems is changed from 0.3% to 0.5% and that the tolerances will be listed and classified separately and not be associated with products from the oil industry. Our proposal is consistent with Weights & Measures tolerances accepted around the world.

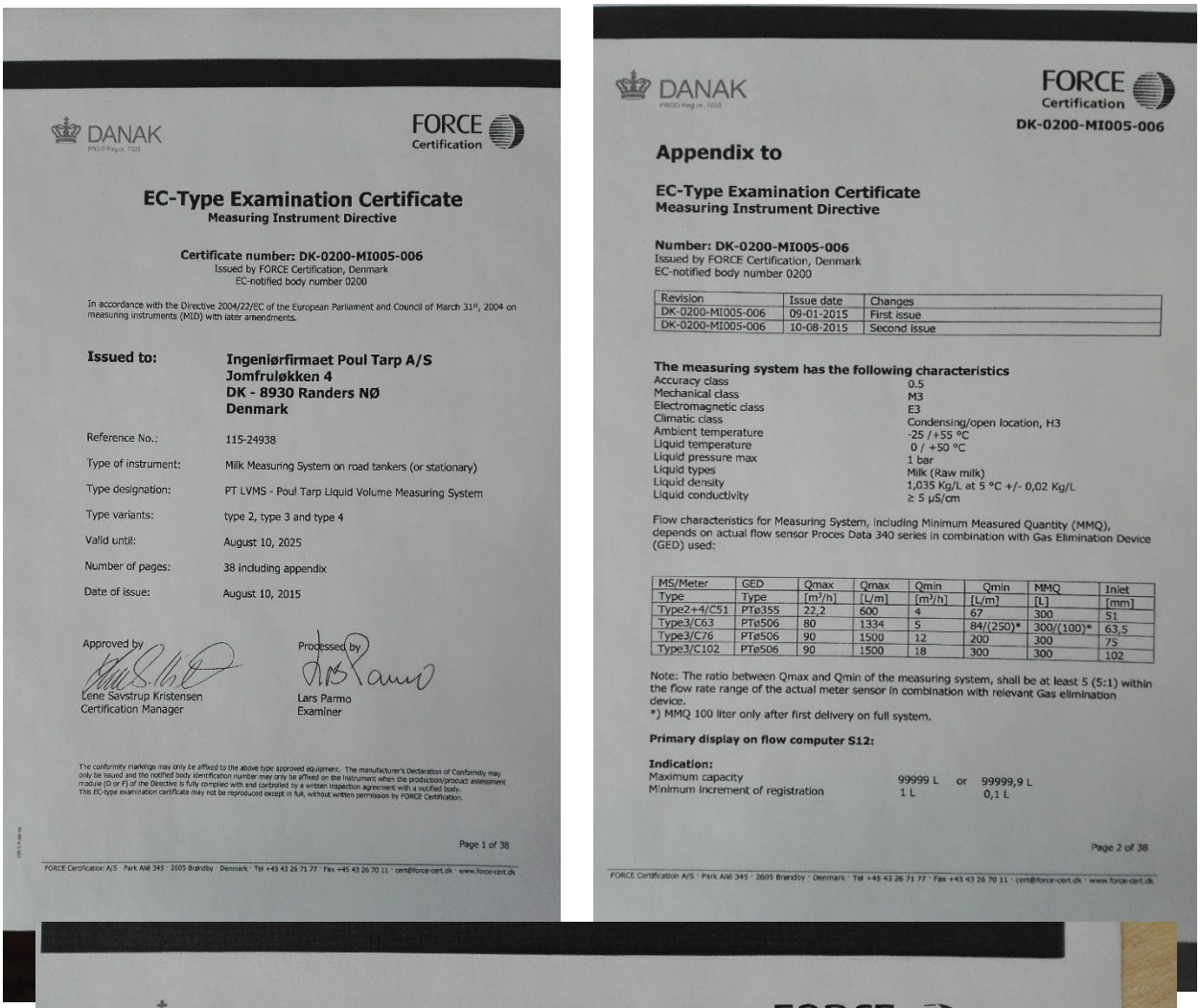
We hope that the NCWM will consider our proposal and we will be more than happy to meet with you and answer any questions you may have. We believe that a change of Tolerance is necessary in order for the Handbook 44 to reflect today´s milk collection and the technical progress within milk collection.

Yours sincerely

Poul Tarp
President POUL TARP A/S

The POUL TARP milk pump system holds an MID approval which is recognized and in accordance with guidelines and standards described in the **OIML - INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY**

1 FLOW COMPUTERS REGULATION IN THE US:



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FORCE Certification

EC-Type Examination Certificate
Measuring Instrument Directive

Certificate number: DK-0200-MI005-006
Issued by FORCE Certification, Denmark
EC-notified body number 0200

In accordance with the Directive 2004/22/EC of the European Parliament and Council of March 31st, 2004 on measuring instruments (MID) with later amendments.

Issued to:	**Ingeniørfirmaet Poul Tarp A/S** **Jomfruløkken 4** **DK - 8930 Randers NØ** **Denmark**
Reference No.:	115-24938
Type of instrument:	Milk Measuring System on road tankers (or stationary)
Type designation:	PT LVMS - Poul Tarp Liquid Volume Measuring System
Type variants:	type 2, type 3 and type 4
Valid until:	August 10, 2025
Number of pages:	38 including appendix
Date of issue:	August 10, 2015

Approved by
Lene Savstrup Kristensen
Certification Manager

Processed by
Lars Parmo
Examiner

The conformity markings may only be affixed to the above type approved equipment. The manufacturer's Declaration of Conformity may only be issued and the notified body identification number may only be affixed on the instrument when the production/product assessment module (D or F) of the Directive is fully complied with and controlled by a written inspection agreement with a notified body. This EC-type examination certificate may not be reproduced except in full, without written permission by FORCE Certification.

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FORCE Certification
DK-0200-MI005-006

Appendix to

EC-Type Examination Certificate
Measuring Instrument Directive

Number: DK-0200-MI005-006
Issued by FORCE Certification, Denmark
EC-notified body number 0200

Revision	Issue date	Changes
DK-0200-MI005-006	09-01-2015	First issue
DK-0200-MI005-006	10-08-2015	Second issue

The measuring system has the following characteristics

Accuracy class	0.5
Mechanical class	M3
Electromagnetic class	E3
Climatic class	Condensing/open location, H3
Ambient temperature	-25 /+55 °C
Liquid temperature	0 / +50 °C
Liquid pressure max	1 bar
Liquid types	Milk (Raw milk)
Liquid density	1,035 Kg/L at 5 °C +/- 0,02 Kg/L
Liquid conductivity	≥ 5 µS/cm

Flow characteristics for Measuring System, including Minimum Measured Quantity (MMQ), depends on actual flow sensor Proces Data 340 series in combination with Gas Elimination Device (GED) used:

MS/Meter Type	GED Type	Qmax [m³/h]	Qmax [L/m]	Qmin [m³/h]	Qmin [L/m]	MMQ [L]	Inlet [mm]
Type2+4/C51	PTø355	22,2	600	4	67	300	51
Type3/C63	PTø506	80	1334	5	84/(250)*	300/(100)*	63,5
Type3/C76	PTø506	90	1500	12	200	300	75
Type3/C102	PTø506	90	1500	18	300	300	102

Note: The ratio between Qmax and Qmin of the measuring system, shall be at least 5 (5:1) within the flow rate range of the actual meter sensor in combination with relevant Gas elimination device.
*) MMQ 100 liter only after first delivery on full system.

Primary display on flow computer S12:

Indication:

Maximum capacity	99999 L	or	99999,9 L
Minimum increment of registration	1 L		0,1 L

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Applied documents

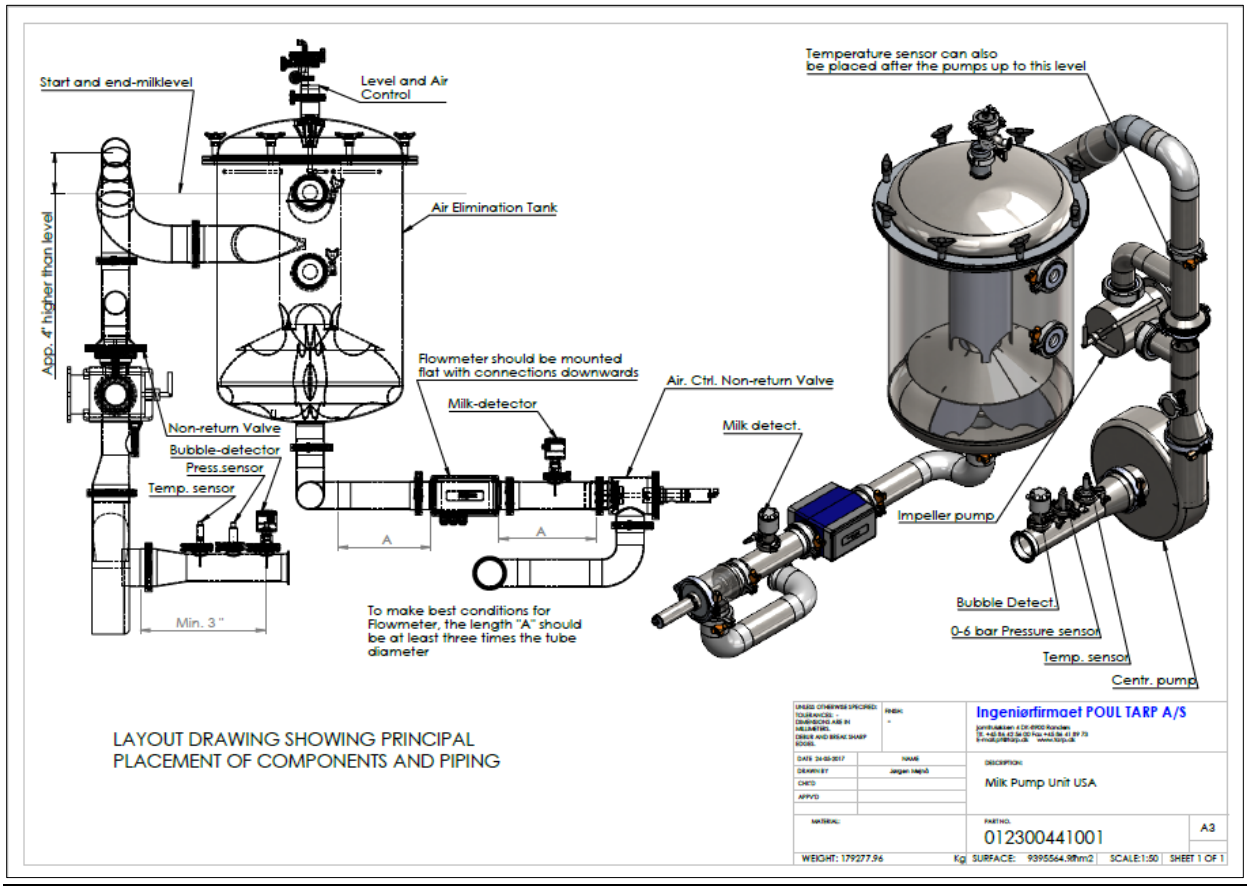
Recommendations	Guides
OIML R117 (1995)	WELMEC Guide 10.5 Marking of fuel dispensers (2006)
OIML R117-1 (2007)	WELMEC Guide 10.6 Sealing of fuel dispensers (2008)
OIML D11 (2004)	
OIML R117-2 Annex – E (CD2)	

Applied Evaluation Certificates belonging to this Type Examination Certificate:

- Evaluation Certificate Force Certification No. 115-24938.05, issued 10.08.2015
- Evaluation Certificate and Description NMI no. TC7204 rev 6, issued 26 august 2014
- Documentation folder NMI no. TC7204-4

Technical documentation
Reference no.: 114-30557.

The standards related to metrological aspects come from OIML R117-1 for liquids (Dynamic measuring systems for liquids other than water, part 1: Metrological and technical requirements) and documents D11 (General requirements for electronic measuring instruments) and D31 (General requirements for software-controlled measuring instruments) from OIML.



B3-MLK-23.2 A Table T.1. Tolerances for Milk Meters

Source:
Milk Meter Tolerances Task Group

Purpose:
Eliminate the current tolerance structure of a decreasing permissible tolerance allowance as the size of the test draft increases.

Item Under Consideration:
Amend Handbook 44, Milk Meters Code, as follows:

T.2. Tolerance Values. – Maintenance and acceptance tolerances shall be as shown in Table 1. Tolerances for Milk Meters.

(Amended 1989 **and 20XX**)

~~Table 1.~~ ~~Tolerances for Milk Meters~~		
~~Indication (gallons)~~	~~Maintenance Tolerance (gallons)~~	~~Acceptance Tolerance (gallons)~~
~~100~~	~~0.5~~	~~0.3~~
~~200~~	~~0.7~~	~~0.4~~
~~300~~	~~0.9~~	~~0.5~~
~~400~~	~~1.1~~	~~0.6~~
~~500~~	~~1.3~~	~~0.7~~
~~Over 500~~	~~Add 0.002 gallon per indicated gallon over 500~~	~~Add 0.001 gallon per indicated gallon over 500~~

Table 1. **Tolerances for Milk Meters**		
	Acceptance Tolerance	**Maintenance Tolerance**
Complete Measuring System	**0.5%**	**0.5%**
Meter Only	**0.3%**	**0.3%**

(Added 1989) **(Amended 20XX)**

Previous Action:
2023: Assigned to Milk Meter Tolerance Task Group

Original Justification:
This is a companion item to VTM-20.2 [Vehicle Mounted Milk Meters] currently being considered. It would be logical to block these two items as the data and discussion for changes to both Handbook 44 sections will be identical. This proposal is being made to eliminate the current tolerance structure of a decreasing permissible tolerance allowance as the size of the test draft increases. The proposed changes are identical to the current tolerance structure in the international community that follow OIML R-117. Without the changes to the tolerances, it would be possible for a device to be within tolerance at small test drafts and be out of tolerance for larger test drafts that are more representative of a typical delivery.

If OIML tolerances are adopted, the tolerances that are currently in place may increase at larger test drafts.

Requested Status by Submitter: Voting Item

Comments in Favor:

Regulatory:
- 2024 Interim: A regulator from the State of California supports the continued development of these items and recommends an assigned status.

Industry:
- None

Advisory:
- 2024 Interim: A representative from NIST commented on the analysis that was published by NIST and supported the items remaining assigned to the task group.

Comments Against:

Regulatory:
- None

Industry:
- None

Advisory:
- None

Neutral Comments:

Regulatory:
- None

Industry:
- None

Advisory:
- 2024 Interim: The Chairperson of the Milk Meter Tolerance Task Group reported that he was just appointed and requested the scope of the task group be expanded to study the possibility of creating a section dedicated to devices measuring milk, and that the items remain assigned.

Item Development:
A Milk Meter Tolerance Task Group was formed and assigned to this item. Please contact the task group chair for more information:

Aaron Yanker
Milk Meter Tolerance Task Group
303-869-9098, aaron.yanker@state.co.us

NCWM 2024 Interim Meeting: During open hearings, the Committee heard from Mr. Aaron Yanker, the newly appointed chairperson of the Milk Meter Tolerance Task Group. The Committee agrees with the chairperson that these items should remain assigned, and the scope of the task group should be expanded to study the possibility of creating a new section in the handbook to capture all devices that measure milk. To facilitate better discussion and the possibility of new proposals, the Committee has blocked these items together. The Committee requests the task group provide an update on the items in the block, as well as the feasibility of establishing a new section in the handbook during the 2024 Annual Meeting.

NCWM 2023 Annual Meeting: The Chair of the Specifications and Tolerances Committee asked for a volunteer for chair of the task group.

NCWM 2023 Interim Meeting: Matt Curran (State of Florida) – appears that this item is lowering the tolerance to get a device to fit. Supports as voting if that is the case. Tina Butcher (NIST OWM) commented in support of assigned status and that the application systems and meter needs clarification. The committee decided to leave this item as assigned status and hopes a new task group chair steps forward.

NCWM 2022 Annual Meeting: The Milk Meter Task Group Chair, Mr. Charles Stutesman (KS) provided an update on the task group's activity. Mr. Stutesman solicited comments and feedback from membership to continue efforts towards development. He also stated the task group is seeking a representative from the Western regional to serve on the task group and mentioned Mr. Aaron Yonkers of Colorado as a potential member. Mr. Stutesman mentioned he is intending to submit a request to the Committee to expand the task group's scope, including the gathering of all milk meter codes for consolidation into a single code.

NCWM 2022 Interim Meeting: Mr. Charlie Stutesman (KS) spoke as chairperson of the Milk Meter Task Group. He requested that this item be assigned back to the task group for further development. Mr. Stutesman provided an update on the task group meeting in January 2022 in which they discussed tolerances in both 3.31 Vehicle Tank Meters and 3.35 Milk Meters and the need to have the tolerance be applied to both vehicle mounted and station meters as the manufacturers are developing meters that will be capable of being installed in either application. The tolerance tables can be found in the supporting documents. Mr. Stutesman also renewed the task groups request to expand its scope to include possibly creating a new code that contains requirements of both vehicle mounted and stationary milk meters and metering systems due to the unique properties of milk as a liquid. Speaking on behalf of himself, Mr. Stutesman (KS) stated that he has provided a document in the supporting documents that outlines the four active and five inactive NTEP certified meters and metering systems in terms of test draft size and applicable tolerances. He noted that the active four have a range of 0.12%-0.6%. He also noted that milk meters are the only liquid measuring device where the volume tolerance decreases as the draft size increases and suggests percentages more in line with OIML tolerance would be more appropriate. Mr. Ken Ramsburg (MD) suggested combining the two tolerances to be used for field evaluations. Ms. Diane Lee (NIST OWM) commented that the task group should work toward making all test methods uniform. Mr. Doug Musick (KS) and Mr. Matt Douglas (CA) supported assigning this item to the task group for further development. During committee work sessions, the committee agreed to assign this item back to the milk meter task group so they may continue to ascertain data. In addition, the committee agreed to request that NCWM Chairman Ivan Hankins expand the scope of the task group to include all reference to milk meters, meter systems and related test methods, specifications and tolerance in an effort to harmonize the codes.

NCWM 2021 Annual Meeting: Mr. Charlie Stutesman provided an update on the milk meter task group activities. Mr. Stutesman noted that there was a field trip to observe milk metering systems. He noted that the proposed tolerances will align the milk tolerances with the OIML tolerances for milk meters and Mr. Stutesman noted that the OIML tolerances provides one tolerance for the meter and another tolerance for a milk metering system. He also noted that it may be impractical to perform an air eliminator test on these devices due to comingling of product.

During the committees work session, the Committee agreed to a Voting Status for this item and added it to its voting consent calendar.

During the voting session, Mr. Charlie Stutesman asked that consideration be given to adding a non-retroactive date to the proposed tolerances. It was questioned during the discussion that if a non-retroactive date was added to the tolerances, then, what tolerances would apply to existing meters that had been manufactured and tested prior to the non-retroactive date. One of the concerns expressed with having a new tolerance table without a nonretroactive date was whether or not existing devices would be required to be reevaluated in the NTEP. The conference voted against adding the nonretroactive requirement to the proposed tolerance table and the item under consideration to change the tolerances failed to receive the 27 votes from the House of State Representatives, so the item failed and went back to the S&T committee. The S&T Committee agreed to a Developing status for this item.

Note: For reference, the Item under Consideration that was included in the 2021 NCWM Interim Meeting Agenda is provided below:

Table 2. Tolerances for Vehicle-Mounted Milk Meters		
Indication (gallons)	**Maintenance Tolerance (gallons)**	**Acceptance Tolerance (gallons)**
100	**~~0.5~~ 0.6**	**~~0.3~~ 0.5**
200	**~~0.7~~ 1.2**	**~~0.4~~ 1.0**
300	**~~0.9~~ 1.8**	**~~0.5~~ 1.5**
400	**~~1.1~~ 2.4**	**~~0.6~~ 2.0**
500	**~~1.3~~ 3.0**	**~~0.7~~ 2.5**
Over 500	Add **~~0.002~~ 0.006** gallons per indicated gallon over 500	Add **~~0.001~~ 0.005** gallons per indicated gallon over 500

NCWM 2021 Interim Meeting: The Committee heard from Mr. Charles Stutesman (KS, Char of the Milk Meter Task Group) who gave an update on the task group activities. Mr. Stutesman reported that the Milk Meter Task group worked via e-mail communication and reviewed and discussed the proposed Milk Meter Tolerances in Agenda item VTM-20.2. The Milk Meter Task Group also discussed the tolerances that are included in NIST HB 44 for Milk meters in various parts of HB 44 which include the VTM, Section 3.31, Farm Milk Tanks, Section 4.42., Mass Flow Meters, Section 3.37, and Milk Meters, Section 3.35. Mr. Stutesman also reported that the task group reviewed OIML tolerances for milk meters. Mr. Stutesman stated that after a review of the various tolerances, the task group agreed that the OIML tolerances provide tolerances that encompassed the system of measuring milk and not just a tolerance for the performance of the meter. The Milk Meter Task group agreed with proposing the use of the OIML milk meter tolerance as the milk meter tolerances in the VTM code. Mr. Stutesman provided a copy of the proposed changes to VTM-20.2. The proposed tolerances will align the tolerances in the VTM Code for Milk Meters with OIML Milk Meter Tolerances. Mr. Stutesman requested that this item move forward as a Voting item. The Committee also heard from Clark Cooney who noted that he supported the items as Developing because one company mentioned meeting the existing tolerances. It was mentioned that the company's testing was only performed over a limited range of volumes.

During the committees work session the committee agreed with the proposal from the milk meter task group to adopt OIML tolerances for milk meters in the VTM code, that this item be given a voting status, and that the item under consideration be replaced with the work groups proposal to adopt OIML tolerances. The committee also agreed with expanding the task group to address other milk meter codes in HB 44. The Item Under Consideration above are the tolerances agreed to by the milk meter task group and that align with OIML tolerances.

NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

NCWM 2020 Interim Meeting: Mr. Carey McMahon (Poul Tarp) provided a presentation on his company's VTM milk metering system advocating for expanding tolerances for these systems.

Ms. Leigh Hamilton (Piper) provided a presentation concerning the piper system and stated in her presentation that piper currently has an approved NTEP certificate for their device that is in service in the U.S. Ms. Leigh opposes this item to increase the tolerances for milk meters and noted in her presentation that there may not be a need to increase the tolerances in order to move forward in allowing innovation in milk measurements.

Mr. Charles Stutesman (KS) provided a presentation on research that KDA has done on the history of 3 HB 44 Codes (3.31. VTMs, 3.35. Milk Meters, and 4.42. Farm Milk Tanks) and the issue of Piper's NTEP Certificate. Mr. Stutesman discussed complications involved in measurement of product using various methods and potential shortcomings of Piper's NTEP Certificate.

Mr. Doug Musick (KS) stated that he does not believe there is enough information presented to change existing tolerances and noted that the Piper system was only evaluated for accuracy up to a measurement of 300 gallons. He also noted that he believes that Piper's certificate should be amended to qualify the system for draft sizes up to 300 gallons. Mr. Mike Keilty (Endress + Hauser) commented that he had concerns with Piper's certificate. Ms. Hamilton noted that Piper followed and followed guidelines as provided during the NTEP evaluation. Ms. Diane Lee (NIST OWM) stated that the committee may want to consider a developing status for this item and that more information is needed concerning air elimination methods for milk metering systems.

A representative from the Dairy Farmers of America, stated that they oppose the increase in tolerance but supports the use of VTM metering systems. Mr. Carey McMahon (Poul Tarp) pointed out that the Poul Tarp system can be accurate for any size measurement, but the beginning and end of the measurement would not be accurate measures (within tolerance) due to entrained air in the product when the flow is not uniform. Mr. Dmitri Karimov (MMA) stated that the proposal should be further developed and pointed out that due to the tolerance structure becoming more stringent as the volume of the measurement increases, the acceptance tolerance at 500 gallons is unreasonable. Mr. Hal Prince (Florida) stated that he does not agree with expanding the tolerances. Mr. Prince believes that air elimination should be the focus and that the proposal should be assigned to a task group. Mrs. Tina Butcher (NIST OWM) noted that testing should be performed using multiple quantities and flowrates. Mr. Charles Stutesman (KS) pointed out that confusion is generated by multiple HB 44 codes addressing the measurement of milk and that the proposal should be assigned to a TG to sort this out. Mr. Stutesman also pointed out there is no requirements in HB 44 for air elimination pertaining to milk metering in these codes. Mrs. Butcher noted that the current HB 44 requirements may not be flexible enough for this new technology and that the existing codes may need to be reviewed and updated.

Ms. Leigh Hamilton (Piper) stated that this is not simply a consideration of only a change in tolerances. There are other requirements (currently in the OIML standard) that should also be considered in making any changes to the existing HB 44 requirements. Mr. Mike Keilty (Endress+Hauser) stated that air elimination is a difficult problem to mitigate and noted that he is not sure if it is necessary to expand the existing tolerances or make other amendments. Mr. Carey McMahon (Poul Tarp) stated that using the existing HB 44 tolerances in the VTM Code, at a draft of 5000 gallons, the tolerance value is highly unreasonable (KS) noted that the type evaluation performed on the Piper system was limited to a draft of 300 gallons. If evaluation had included other draft sizes, the Piper system mat have failed the testing.

Mr. Ken Ramsburg (MD) stated that the proposal should be given a developing status. Mr. Ramsburg agreed that there is no existing requirement for this type of system addressing air elimination and stated that the flow meter, air eliminator, plumbing, and pumps all need to be considered during evaluation and the evaluation should be conducted on the system.

Mr. Tim Chesser (AR) questioned whether the flow meter used in the system is appropriate and noted that there are many unanswered questions surrounding this issue. Mr. Jim Willis (NY) recommended a developing status for this item. Mr. Kevin Schnepp (CA) stated that although he is opposed to relaxing existing tolerances, he supports the development of this proposal by an assigned task group.

During the Committee's work session, the committee agreed that this item has merit and should be given an Assigned status. The charge to the assigned task group will be to address three HB 44 codes (VTM, Farm Milk Tanks and Milk meters) to review the requirements and tolerances found in these codes and assess the need for changes.

Regional Associations' Comments:

The below comments are on VTM-20.2:

CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item be blocked with MLK 23.2 and remain as assigned with the task group so that a chair can be assigned and established concerns continued to be addressed.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Aaron Yanker (Milk Meter Tolerance Task Group): Commented that there is currently no Chair for the Task Group, and no updates were available.

The WWMA S&T Committee recommended this item remain Assigned to the NCWM Milk Meter Tolerance Task Group for further development. The committee looks forward to a Chair being assigned and an update provided. This committee also recommends this item be blocked with MLK-23.2.

SWMA 2023 Annual Meeting: This is an assigned item however Dr. Matt Curran, Florida, recommended blocking this item with MLK-23.2.

The committee recommends this item remain an Assigned item.

NEWMA 2023 Interim Meeting: The State of New Jersey stated that the Task Group still does not have a chair, despite several requests from the NCWM S&T Committee, that manufacturers can meet the tolerances currently in the handbook, and recommends withdrawal. The Commonwealths of Massachusetts and Pennsylvania, and the State of New York concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

The below comments are on MLK-23.2
CWMA 2023 Interim Meeting: No comments were heard.

The committee recommends this item be blocked with VTM 20.2 and remain as assigned with the task group so that a chair can be assigned and established concerns continued to be addressed.

WWMA 2023 Annual Meeting: During the WWMA 2023 annual meeting the following comments were received:

Mr. Aaron Yanker (Milk Meter Tolerance Task Group): Commented that there is currently no Chair for the Task Group, and no updates were available.

The WWMA S&T Committee recommended this item remain Assigned to the NCWM Milk Meter Tolerance Task Group for further development. The committee looks forward to a Chair being assigned and an update provided. This committee also recommends this item be blocked with VTM-20.2.

SWMA 2023 Annual Meeting: This is an assigned item however Dr. Matt Curran, Florida, recommended blocking this item with VTM 20.2.

The committee recommends this item remain an Assigned item.

NEWMA 2023 Interim Meeting: The State of New Jersey stated that the Task Group still does not have a chair, despite several requests from the NCWM S&T Committee, that manufacturers can meet the tolerances currently in the handbook, and recommends withdrawal. The Commonwealths of Massachusetts and Pennsylvania, and the State of New York concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

Additional letters, presentations, and data may have been submitted for consideration with this item. Please refer to www.ncwm.com/publication-15 to review these documents.

Mr. Jason Flint, New Jersey | Committee Chair
Mr. David Aguayo, San Luis Obispo County, California | Vice-Chair
Mr. Brett Willhite, Minnesota | Member
Mr. James Willis, New York | Member
Mr. Mark Lovisa, Louisiana | Member
Mr. Éric Turcotte, Measurement Canada | Canadian Technical Advisor
Mr. Loren Minnich, NIST OWM | NIST Technical Advisor
Ms. Juana Williams, NIST, OWM | NIST Technical Advisor
Mr. Allen Katalinic, NCWM | NTEP Technical Advisor
Mr. Jeff Gibson, NCWM | NCWM Technical Advisor
Mr. Greg Gholston, Mississippi | Committee Coordinator

Specifications and Tolerances Committee

APPENDIX A

Item SCL-23.3 – Final Report of the Verification Scale Division Task Group

*Note: This appendix originally appeared for **Item Block 2 - Define True Value For Use In Error Calculations**, which was withdrawn and replaced by **SCL-23.3 - Verification Scale Division e: Multiple Sections Including, T.N.1.3., Table 6., T.N.3., T.N.4., T.N.6., T.N.8., T.N.9., T.1., T.2., S.1.1.1., T.N.1.2., Table S.6.3.a., Table S.3.6.b., Appendix D, S.1.2.2., Table 3., S.5.4., UR.3., Table 8.** The Committee decided to preserve the appendix, since it remains relevant to item SCL-23.3.*

Participants:
Doug Musick, Chair (KS)
Ross Andersen (NY, Retired and original submitter of the item)
John Barton (NIST OWM)
Luciano Burtini (Measurement Canada)
Anthony Bong Lee (Orange County, CA)
Steve Cook (CA, Retired)
Darrell Flocken (NTEP)
Eric Golden (Cardinal Scale)
Jan Konijnenburg (Rice Lake Weighing Systems)
Richard Suiter (Richard Suiter Consulting)
Steve Timar (NY)
Howard Tucker (FL)

The mission of the task group, as defined by the S&T Committee, is to review Handbook 44, Section 2.20. Scales and relevant portions of OIML R76, using the items included in S&T Agenda Items: Block 2 as a reference point, and recommend changes as necessary to:

1. Clarify how the error is determined in relation to the verification scale division (e) and the scale division (d)
2. Clarify which is the proper reference; the verification scale division (e) or the scale division (d) throughout this section
3. Ensure proper selection of a scale in reference to the verification scale division (e) and the scale division (d)
4. Clarify the relationship between the verification scale division (e) or the scale division (d)

This report is divided into three sections:
1. Clarify the relationship between e and d, i.e., ensure we understand the terms. (Mission items 4 and1)
2. Propose changes to the Scales Code, if necessary, to ensure the code correctly identifies e or d as appropriate to the code paragraph. (Mission items 2 and 3)
3. Address other issues that arose as potential problems that might require additional investigation beyond the scope of this workgroup.

PART 1. Clarify the Relationship Between e and d.

We begin by looking at current HB44 definitions. The verification scale division e is used to express tolerance values and it is used in classification. The designations of e and the accuracy class are made by the manufacturer. The scale division d is a function of the actual scale function and display. Note that for weight classifiers, the weighing instrument may never display quantity at the resolution of e, and for ungraduated devices there is no scale division d to permit comparison to e.

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

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

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

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

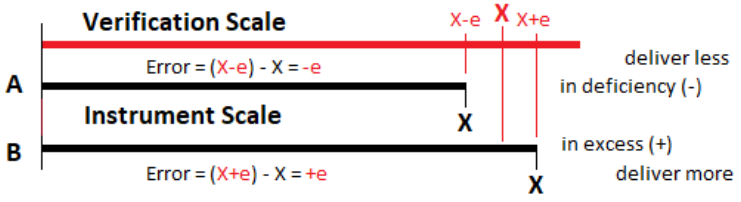
The values of e and d must be understood as referring to different things. The verification scale refers to the scale of measurement for the reference (or true value), think of the reference standard. The instrument scale refers to the scale of measurement of the instrument under test. Consider this assortment of instruments in the table below. It should be clear that the divisions of the verification scale do not always equal those on the instrument scale and may not even be in the same units. In addition, when we employ an artifact, like a test weight or slicker plate measure, the divisions of the verification scale are not visible since the artifact represents a single point on the measurement scale of the reference.

Instrument Scale	Scale div d	Verification "True Value" Scale	Scale div e	Relation e to d
Rule	1/16 in	Standard Rule or Tape	1/16 in	e = d
Taximeter	1/10 mi	Road Course	2 ft	e << d
LMD's	0.1 gal	Prover indication	5 cu in	e > d
Mass Flow Meter	1 lb	Reference Scale	0.01 lb	e < d
Weighing Devices	0.01 lb	Test Weight (artifact)	mfr choice	e < d, e = d, e > d
Test Measure	1 cu in	Slicker Plate (artifact)	?	e ? d

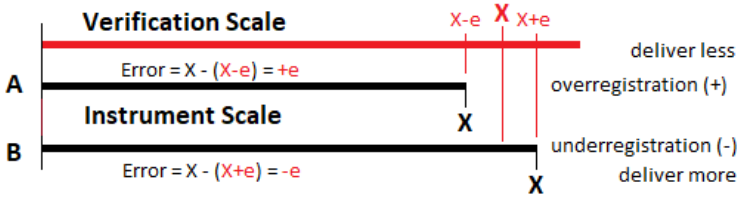
For weighing instruments, it turns out that e and d have no fixed relationship. It is different for weight classifiers (e < d), for most instruments (e = d), and for high resolution instruments (e>d). The critical point is that the instrument scale and the verification scale are independent of each other. Once you have disconnected e (declared by the manufacturer) from d (displayed on the instrument), it may now become evident that much of our confusion arose because we thought of them as connected in some way.

In the graphics below both error and tolerance are always expressed in terms of the divisions (e) of the verification scale. The primary assumption is that the verification scale is constant, and it is the displayed scales of the instruments we test that move. The scales in black are depicted as in error by +1 e or –1 e.

Error of delivery =
verification scale – instrument scale
+ in excess
– in deficiency

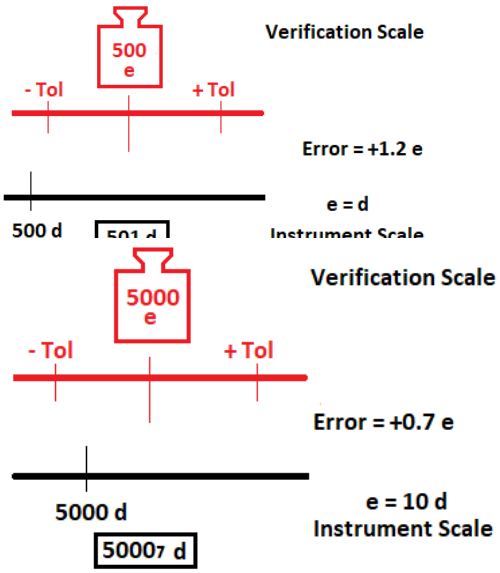


Error of Indication =
instrument scale – verification scale
+ over registration
– underregistration



Much of our confusion arises because scales are tested using artifacts with no visible scale divisions. We could mirror this in the test of a fuel dispenser. Normally you stop the test at 5 gallons on the instrument scale and read the error as – 3 cu in from the test measure (verification) scale. Now change that procedure and stop the test at the zero mark on the test measure. How would you determine the error? Assume the instrument now reads 5.012 gal. The error is -0.012 gal (-3 cu in), and we calculate it as verification scale – instrument scale. We determined the error from the instrument scale. The verification scale division, however, did not switch from the test measure to the instrument simply because we changed the procedure. The verification scale division remains 1 cu in and is still on the test measure, the reference.

Consider the Class III scale at right where e = d. Technically you can't see divisions on either scale since the artifact has no visible divisions and the instrument is digital. The correct instrument indication of 500 d is 1.2 e short of 500 e on the verification scale. You could mirror this by applying 498.8 e of test weights to get indication of 500 d. It is not in tolerance, but only if you apply error weights in your test.



Consider the Class II scale at right where e = 10 d. You can't see divisions on either scale because the test weight is an artifact and the instrument are digital. The correct instrument indication of 50,000 d is short of the 5,000 e on the verification scale by 7 d. Thus, we say the error is +0.7 e. Error = instrument scale – verification scale. This instrument is clearly in tolerance. No error weights are necessary to see to finer than 1 e.

The principles of classification are found in the following HB44 paragraphs. In principle, the manufacturer tells the official what accuracy is to be applied to the instrument.

T.N.1. Principles.

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

T.N.1.2. Accuracy Classes. – Weighing devices are divided into accuracy classes according to the number of scale divisions (n) and the value of the scale division (d).

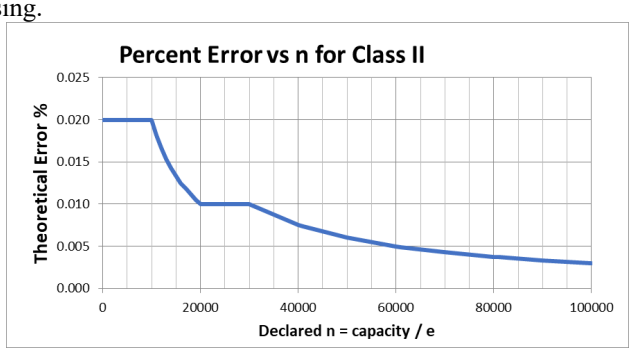
T.N.1.3. Scale Division. – The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.

Yet, the T.N.1.2. and T.N.1.3. paragraphs conflict with the definitions. According to the definition of e, it is e "by which the tolerance values and the accuracy class applicable to the device are determined." When the Scales Code was drafted prior to adoption in 1984, it appears some things were lost in translation from the OIML R76 on which it was based. What was lost can be expressed as those things not included in HB44 and those things incorrectly translated in HB44.

For example, R76 expresses the classification information in four required markings, and one auxiliary marking. R76 requires marking of Class, Max, e, and Min, and requires marking of d if different from e. Those markings describe the maximum and minimum loads and the relative accuracy. In contrast, HB44 requires marking of Class, capacity, and d, and requires marking of e if different from d. HB44 does not require marking of minimum load. While R76 considers minimum load part of the class structure, HB44 does not.

It is this switch of e and d that causes confusion because the translation of R76 to HB44 lost some of the meaning. Much of the second part of this report covers the changes required to rectify the situation. The workgroup is attempting to ensure the Code states e when the requirement applies to e and d when it applies to d. The workgroup is also proposing to add important material from R76 that is missing.

Some additional confusion comes from the stepped tolerance structure. For example, it is common to think that the instrument gets 1 division of error over the first tolerance step (maintenance). The correct interpretation of the code requires the instrument maintain a % accuracy based on the number of divisions of load at the break points. The space under the step riser is not supposed to be used by the instrument provided you eliminate the rounding error.



Between 1 division and 10,000 divisions for Class II in R76, this is 0.02%. At 10,000 e, 0.02% is 2 e. At 1,000 e, 0.02% is 0.2 e, and at minimum load of 50 e, 0.02% is 0.01 e. The principle is: the larger the number of verification scale divisions (n) the more accurate the instrument must be, i.e. relative error. Section 2.2 of R76 makes this clear by stating that e represents absolute accuracy and n represents relative accuracy. The Scales Code has no parallel section. It is the relative accuracy that should be our focus, but that's not found in HB44.

PART 2. Proposed changes to the Scales Code (related issues are grouped for convenience)

Group 1. Changes to clarify definitions relating to e.

verification scale division, value of (e). – A value, expressed in units of weight (mass) and specified by the manufacturer of a device, by which the tolerance values and the accuracy class applicable to the device are determined. The verification scale division is applied to all scales, in particular to ungraduated devices since they have no graduations. ~~The verification scale division (e) may be different from the displayed scale division (d) for certain other devices used for weight classifying or weighing in pre-determined amounts, and certain other Class I and II scales.~~[2.20]
(Amended 20XX)

The last sentence is explained fully in the technical requirements in the Code. The workgroup finds it unnecessary and believe it contributes to confusion.

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

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

(Amended 20XX)

scale division, number of (n). – See "verification scale division, number of (n)"

The addition of the word "verification" to the definition of n is essential since without it the section refers to the scale division d. The second definition for n was added as a cross reference since the revision will move from the s section to the v section.

Group 2. Changes to ensure proper classification of instruments.

T.N.1.2. Accuracy Classes. – Weighing devices are divided into accuracy classes according to the number of verification scale divisions (n) and the value of the verification scale division ~~(d)~~ (e).
(Amended 20XX)

T.N.1.3. Verification Scale Division. – The tolerance for a weighing device is ~~related to the value of the scale division (d) or the value of the~~ in the order of magnitude of the verification scale division (e) and is generally expressed in terms of ~~d or~~ e.
(Amended 20XX)
These changes bring the principles in the T.N. section in agreement with the definitions. Classification is exclusively based on e.

Table 3.
Parameters for Accuracy Classes

Class	*Value of the Verification Scale Division (~~d or~~ e[1])*	*Number of Verification Scale[4] Divisions (n)*	
		Minimum	*Maximum*
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	*--*
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*

[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.~~ The verification scale division e does not always equal the displayed scale division d. To ensure the correct value for e is used, refer to required markings on the device (see also notes 3 and 4 in Table S.6.3.b.).

[2] A Class III scale marked "For prescription weighing only" may have a verification scale division (e) not less than 0.01 g.
(Added 1986) (Amended 2003)

[3] The value of a verification scale division for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of verification scale divisions, n, shall be not less than 1000.

[4] On a multiple range or multi-interval scale, the number of verification divisions, n, for each range independently shall not exceed the maximum specified for the accuracy class. The number of verification scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.
(Added 1997)

[5] The minimum number of verification scale divisions, n, 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, 2003, ~~and~~ 2004 and 20XX)
The middle section of the table was not included for brevity. Notes continue below:

The changes to the header of Table 3 ensure the classification is based on e consistent with the definitions and the principles in T.N.1. The scale division d is not involved in classification. This change should reduce confusion. The changes to the notes at the bottom of the table again ensure e is correctly referenced instead of d or the "scale division." Referencing "n" in notes 3, 4, and 5 ensure that it is referring to e since n = capacity / e.

Table S.6.3.a.
Marking Requirements

To Be Marked With ⇓	**Weighing Equipment**				
	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
Model Designation and Prefix (1)	X	X	X	X	X
Serial Number and Prefix (2)	X	X	X	X	X (16)
Certificate of Conformance Number (CC) (23)	X	X	X	X	X (23)
Accuracy Class (17)	X	X (8)	X (19)	X	
Nominal Capacity (3)(18)(20)	X	X	X		
Value of Scale Division, "d" (~~3~~ 4)	X	X			
Value of Verification Scale Division, "e" (~~4~~ 3)	X	X			
Temperature Limits (5)	X	X	X	X	

Note: The remainder of the table was not included for brevity.

The changes to column 1 in the 7th and 8th rows simply reverse the references to the notes in Table S.6.3.b. They reflect the primacy of e in classification, which is addressed in parallel changes to notes 3 and 4 in Table S.6.3.b. (see changes to Table S.6.3.b. below).

Table S.6.3.b.
Notes for Table S.6.3.a. Marking Requirements

1. Manufacturer's identification and model designation and *model designation prefix.** *[*Nonretroactive as of January 1, 2003*] (Also see G-S.1. Identification.) *[Prefix lettering may be initial capitals, all capitals or all lower case]* (Amended 2000)

2. *Serial number [Nonretroactive as of January 1, 1968] and prefix [Nonretroactive as of January 1, 1986].* (Also see G-S.1. Identification.)

3. The device shall be marked with the nominal capacity. *The nominal capacity shall be shown together with the value of the verification scale division, "e" (e.g., 15 × 0.005 kg, 30 × 0.01 lb, or capacity = 15 kg, ~~d~~ e = 0.005 kg) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device. Each verification scale division value ~~or weight unit~~ with its associated nominal capacity shall be marked on multiple range or multi-interval scales. In the absence of a separate marking of the scale division "d" (see Note 4), the value of the scale division "d" shall be equal to the value of the verification scale division "e."* *[Nonretroactive as of January 1, 1983]* (Amended 2005 and 20XX)

4. *Required only if different from ~~"d"~~ "e." This does not apply to an ungraduated device (equal arm scale) where the graduations do not refer to a fixed weight value.* *[Nonretroactive as of January 1, 1986]* *(Amended 20XX)*

The original Scales Code adopted 1984 made d the primary mandatory marking but this resulted in confusion. The changes make e the mandatory marking and now requires d only if different from e.

The changes regarding multiple range and multi-interval scales makes the note say what we have always been applying. The intent was for each range or subrange of the instrument to have marking of capacity and e. The "or weight unit" could refer to lb or kg, but that is clearly not the intent.

There is some concern if this might pose problems for existing equipment. If the marking is of the form "capacity 30 lb x 0.01 lb" the workgroup sees not conflict. However, markings in the form "capacity = 30 lb d = 0.01 lb" would cause a conflict as devices using that form would no longer conform with the proposed changes. The workgroup decided to refer this to the scale manufacturers to see if there are any devices in the marketplace that would be affected. We also learned that this might cause a conflict with Measurement Canada as they do see devices with markings of capacity= d=. Note this is not an issue when e ≠ d as both markings is already required by the combination of notes 3 and 4. If necessary, a note with qualification "devices manufactured before January 1, 20XX" could be added to accept existing scales marked with d = provided d = e.

S.1.2.2. Verification Scale ~~Interval~~ Division

The magnitude of the verification scale division e relative to the scale division d for different types of devices is given in Table S.1.2.2. Relative Magnitude of e to d.

Table S.1.2.2. Relative Magnitude of e to d	
Type of device (see Note)	Relative magnitude of e to d
Graduated, without an auxiliary indicating device	e = d
Graduated, with an auxiliary indicating device	e > d and e is chosen by the manufacturer according to Table 3. and S.1.2.2.1.
Graduated, and marked for use in special applications (weight classifier)	e ≤ d and e is chosen by the manufacturer according to Table 3. and S.1.2.2.4.

Note: Ungraduated devices, e.g. equal arm balances where the scale graduations do not represent a fixed weight quantity, are not included in this table since they have no scale divisions (d) to permit comparison with (e).

S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales. – If e ≠ d, the verification scale ~~interval~~ division "e" shall be determined by the expression:

$$d < e \leq 10\ d$$

If the displayed scale division (d) is less than the verification scale division (e), then the verification scale division shall be less than or equal to 10 times the displayed scale division.

The value of e must satisfy the relationship, $e = 10^k$ of the unit of measure, where k is a positive or negative whole number or zero. This requirement does not apply to a Class I device with d < 1 mg where e = 1 mg. If e ≠ d, the value of "d" shall be a decimal submultiple of "e," and the ratio shall not be more than 10:1. If e ≠ d, and both "e" and "d" are continuously displayed during normal operation, then "d" shall be differentiated from "e" by size, shape, color, etc. throughout the range of weights displayed as "d."

(Added 1999) (Amended 20XX)

S.1.2.2.2. Class I and II Scales Used in Direct Sales. *– When accuracy Class I and II scales are used in direct sale applications the value of the displayed division "d" shall be equal to the value of the verification scale interval "e."*
[Nonretroactive as of January 1, 2020; to become retroactive as of January 1, 2023]

(Added 2017)

S.1.2.2.3. Deactivation of a "d" Resolution. – It shall not be possible to deactivate the "d" resolution on a Class I or II scale equipped with a value of "d" that differs from "e" if such action affects the scale's ability to round digital values to the nearest minimum unit that can be indicated or recorded as required by paragraph G-S.5.2.2. Digital Indication and Representation.

(Added 2018)

S.1.2.2.4. Class III and IIII Scales. The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales, "e" must be less than or equal to "d."

(Added 1999)

~~S.5.3.~~ S.1.2.2.5. Multi-Interval and Multiple Range Scales~~, Division Value~~. – On a multi-interval scale ~~and~~ or a multiple range scale, the value of "e" shall be equal to the value of "d."

(Added 1986) (Amended 1995 and 20XX)

S.1.2.2.6. Class IIIL Scales. On Class IIIL scales the value of "e" shall equal the value of "d." (Added 20XX)

(Add new definition)

auxiliary indicating device. – a means to increase the display resolution of a weighing device, such as a rider or vernier on an analog device, or a differentiated least significant digit to the right of the decimal point on a digital device. [2.20]

(Added 20XX)

Section S.1.2.2. is a key part of understanding application of e and d. The first change was to make references uniform to verification scale "division" as used in all other parts of the code. This section currently uses the term verification scale "interval". Several additions of the term "scale' were also added to S.1.2.2.1. for clarity. Of note, R76 exempts Class I from the e not greater than 10 d requirement when e = 1 mg or less.

A major addition is the new text and table in T.1.2.2. This would create a parallel section in HB44 to R76 section 3.1.2 and Table 2. This section describes four types of instruments:

1. Graduated without an auxiliary indicating device – most instruments e = d
2. Graduated with an auxiliary indicating device – Class I and II with high resolution e > d
3. Graduated & marked for special applications – weight classifiers (round down instruments) e < d
4. Ungraduated – equal arm balances where graduations don't refer to fixed weight quantities. No d

These four types also impact application of minimum load in Table 8.

The current S.5.3. was moved to this section as S.1.2.2.5. to keep these paragraphs dealing with the magnitude of e and d together. A new paragraph S.1.2.2.6. was added to address Class IIIL where e should always equal d. Now all classes (I, II, III, IIIL, and IIII) are covered in S.1.2.2. to clarify relative magnitude of e and d.

The addition of the definition rounds out the expansion of this section

~~S.5.4.~~ S.5.3. Relationship of Minimum Load Cell Verification Interval Value to the Verification Scale Division. *– The relationship of the value for the minimum load cell verification scale interval, v_{min}, to the verification scale division, ~~d~~ e, for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent[1] weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):*

(a) $v_{min} \leq \frac{~~d^*~~ e}{\sqrt{N}}$ *for scales without lever systems; and*

(b) $v_{min} \leq \frac{~~d^*~~ e}{\sqrt{N} \times \text{(scale multiple)}}$ *for scales with lever systems.*

~~*[*When the value of the scale division, d, is different from the verification scale division, e, for the scale, the value of e must be used in the formulae above.]*~~

This requirement does not apply to complete weighing/load-receiving elements or scales, which satisfy all the following criteria:

- *the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;*
- *the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and*
- *the complete weighing/load-receiving element or scale is equipped with an automatic*

zero-tracking mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.

[Nonretroactive as of January 1, 1994]

(Added 1993) (Amended 1996, ~~and~~ 2016, and 20XX)

The renumbering resulted from the move of S.5.3. to the S.1.2.2. section as S.1.2.2.5. The other changes correctly reference e instead of d in this section. Technically, v_{min} for load cells corresponds to verification scale division e for weighing instruments. They are accuracy ratings declared by the manufacturer. There is no significant change for the inspector in properly referring to e since for scales where e = d the issue is moot and when e ≠ d the section already directed the use of e. With the change the inspector will always use e.

Group 3. Changes to clarify appropriate application of tolerances (Marked Scales)

Table 6.
Maintenance Tolerances
(All values in this table are in verification scale divisions "e")

Tolerance ~~in Scale Divisions~~								
	1		**2**		**3**		**5**	
Class	**Test Load**							
I	0 -	50 000	50 001 -	200 000	200 001 +			
II	0 -	5 000	5 001 -	20 000	20 001 +			
III	0 -	500	501 -	2 000	2 001 -	4 000	4 001 +	
IIII	0 -	50	51 -	200	201 -	400	401 +	
III L	0 -	500	501 -	1 000	(Add 1 ~~d~~ e for each additional 500 ~~d~~ e or fraction thereof)			

The proper reference in this section has always been e, and this is how it has always been interpreted. The current language says "scale divisions" which technically refers to d. This means we weren't following the Code. The removal of "in Scale Divisions" after Tolerances in the second row was made to provide parallel construction with the header for Test Load. The parenthetical at the top should be sufficient to cover both sections of the table.

The change for Class IIIL was made since e should be used to specify tolerances and we added S.1.2.2.6. requiring that d = e for this class.

T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales. – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class IIIL, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 e ~~d~~ or 0.1 % of the scale capacity, whichever is less.

(Amended 1986 and 20XX)

T.N.4.3. Single Indicating Element/Multiple Indications. – In the case of an analog indicating element equipped with two or more indicating means within the same element, the difference in the weight indications for any load other than zero shall not be greater than one-half the value of the verification scale division (e) ~~(d)~~ and be within tolerance limits.

(Amended 1986)

The reference to tolerances in T.N.3.4. and T.N.4.3. should follow the principle of expressing tolerances in e.

Group 4. Changes to clarify appropriate application of tolerances (Unmarked Scales)

T.1. General. – The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table T.1.1. Tolerances for Unmarked Scales.

Note: When Table T.1.1. refers to T.N. sections it shall be accepted that the scale division d on the unmarked scale always equals the verification scale division e.
(Amended 20XX)

Prior to 1984, tolerances were based on percentage of load for most scales. There was no concept of verification scale division e. In the T.N. section all tolerances are expressed in e. The note is added to clarify that d for the T. section is always equal to e from the T.N. section.

The workgroup noted that several specific paragraphs in the T. section for unmarked scales refer to tolerances in terms of d. Those sections are shown below. With the addition of the note to T.1. General, it was decided that it was not appropriate or necessary to change the d to e in these paragraphs.

T.2.2. General. – Except for scales specified in paragraphs T.2.3. Prescription Scales through T.2.8. Railway Track Scales: 2 d, 0.2 % of the scale capacity, or 40 lb, whichever is least.

T.2.4.2. With More Than One-Half Ounce Capacity. – 1 d or 0.05 % of the scale capacity, whichever is less.

T.2.7. Vehicle, Axle-Load, Livestock, and Animal Scales.

T.2.7.1. Equipped With Balance Indicators. – 1 d.

T.2.7.2. Not Equipped With Balance Indicators. – 2 d or 0.2 % of the scale capacity, whichever is less.

T.2.8. Railway Track Scales. – 3 d or 100 lb, whichever is less.

Group 5. Changes to clarify appropriate scale selection (reference Table 8)

Table 8.
Recommended Minimum Load

Class	Value of Verification Scale Division "e" ~~(d or e*)~~	Recommended Minimum Load in scale divisions "d" (See notes) ~~(d or e*)~~
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
	equal to or greater than 0.1 g	50
III	All**	20
III L	All	50
IIII	All	10

~~*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. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."~~

The displayed scale division d is not always equal to the verification scale division e. To ensure the correct values are used, refer to required markings on the device (see also notes 3 and 4 in Table S.6.3.b.).

For an ungraduated device, the scale division d shall be replaced with the verification scale division e in the last column.

**A minimum load of ~~10 d~~ 5 e is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

In the header, the change in column 2 references e and the change in column 3 references d and directs you to the notes. Currently, the Code references (d or e) in both columns which causes confusion. We're never sure which one to use. The justification for d in the last column follows below.

It is vital to understand that Table 8. is tied closely to Table 3. You will find that header to the first two columns in both tables, with these changes, will be identical. The workgroup also revised the * note to remove the * and use parallel text to revised note 1 of Table 3. The notes section contains two special exceptions to the general values in column 3 the table. The first directs you to use e in the last column for ungraduated instruments, as these have no d values. The second directs you to use a minimum load of 5 e for weight classifiers. This aligns the value with R76. Note that the use of d for weight classifiers leads to unusual situations. Two weight classifiers with 100 lb capacity and e of 0.05 lb should have the same minimum load. However, they might have very different d values, say 1 lb and 0.2 lb. Declaring minimum load as 10 d for these result in very large differences of 10 lb minimum load for the first instrument and 2 lb for the second. Since e < d for weight classifiers, the minimum load is correctly expressed in e.

Understanding Minimum Load

In R76, minimum load "Min" is included in the principles of classification, see 2.2. below. There are 4 mandatory markings; Class, Max, Min and e. When R76 was translated into HB44 a conscious decision was made to remove Min from the classification and make it a user requirement. Thus, HB44 only has 3 mandatory markings; Class, Capacity, and d. We have already proposed to change the d to e above.

> **2.2 Principles of the metrological requirements**
>
> The requirements apply to all instruments irrespective of their principles of measurement.
>
> Instruments are classified according to:
>
> - the verification scale interval, representing absolute accuracy; and
> - the number of verification scale intervals, representing relative accuracy.
>
> The maximum permissible errors are in the order of magnitude of the verification scale interval. They apply to gross loads and when a tare device is in operation they apply to the net loads. The maximum permissible errors do not apply to calculated net values when a preset tare device is in operation.
>
> A minimum capacity (Min) is specified to indicate that use of the instrument below this value is likely to give rise to considerable relative errors.

In R76, the issue of instrument accuracy is focused on Class, Max and e, parallel to HB44. Absolute accuracy in terms of e and relative accuracy in terms of n. When the load is very small, i.e. less than Min, it might appear that R76 is addressing the large relative errors resulting in 1 e tolerance for some small number of e in load. However, this is not the case. The distinction is that Min applies to use of the instrument and not to testing of the instrument.

In testing under R76 tolerances, rounding errors are eliminated (see 3.5.3.2.). In practice this usually means error weights are used to resolve the instrument errors to at least 0.2 e (NTEP generally uses 0.1 e). In addition, R76 expects that instrument divisions are relatively uniform throughout the series. In order to get a +1 e error at 1 e load and still meet the requirement that the zero division be +/- 0.5 division wide, would require the 1 e divisions be 0 e wide (i.e. be skipped). To visualize in analog, imagine an indicator that starts at zero and jumps immediately to the 2 graduation. A load of 1 e would indicate 2 e. Likewise a load of 2 e would indicate 3 e and this pattern would repeat until the tolerance breakpoint, a load of 500 e would indicate 501 e. Then the second graduation after the break point would be skipped, i.e. the 502 e graduation. A load of 501 e would indicate 503 e with a +2 e error. All the loads up to 20,000 e would now show a +2 e error. Instruments obviously should not, and DO NOT, operate that way.

If we assume instrument divisions are uniform, as R76 does, then the divisions should be accurate to about the relative % of the accuracy class. For Class II in the first step this is 0.02%. Thus at 20 e load the maximum expected error (after eliminating rounding) should be in the order of 0.004 e, and not the 1 e permitted in the tolerance structure. So, what relative error can R76 be addressing when dealing with Min?

When an instrument is used in commerce, it is the rounding of the indication to ½ scale division that results in large relative errors. Consider a cannabis sale of 1.05 g when the division size is 0.1 g. The instrument must round off to either 1.0 g or 1.1 g. Either one produces an error in the weighment of 0.05 g. That's 4.8% relative error in the weighment (0.05 g / 1.05 g) with an instrument that's supposed to be accurate to 0.02%. It is this rounding error "in use" that produces the large relative errors addressed in Min in R76 and the minimum load in HB44. This rounding error is a function of d, the displayed scale division, and not e. It is not a tolerance issue.

The confusion comes from the presentation of Min in terms of e in the last column of R76 Table 3. The table in R76 has an additional column for Min not found in HB44. In HB44 it has been relocated to Table 8. Looking closely at Table 8, you will find that the first two columns correspond to the first two columns in Table 3 in HB44. So why does R76 express this column in e instead of d? I suspect they did it because all other values in Table 3 are in e. For instruments where e = d, the issue is moot. Note however, that R76 reveals the ties to d for the Class I and II instruments with an auxiliary indicating device (differentiated least significant digit). In 3.4.3. R76 directs that d replace e in the Min column of Table 3 for instruments with an auxiliary indicating device.

On an instrument where e = 10 d, we can create the same scenario as before but now with a load of 1.005 g. The instrument must now round to either 1.00 g or 1.01 g. The rounding error is now 0.50% of the weighment (0.005 / 1.005). That is 10 times smaller at the same 20 e load.

Returning to the four types of instruments from revised S.1.2.2. and applying revised Table 8.:

1. Graduated without an auxiliary indicating device: minimum load in d
2. Graduated with an auxiliary indicating device: minimum load in d
3. Graduated and marked for special use (weight classifier): minimum load 5 e
4. Ungraduated (equal arm scales): minimum load in e

<u>Group 6. Changes to correctly reference to e or d as appropriate.</u>

S.1.1.1. Digital Indicating Elements.

(a) A digital zero indication shall represent a balance condition that is within ± ½ the value of the <u>verification</u> scale division.

(b) A digital indicating device shall either automatically maintain a "center-of-zero" condition to ± ¼ <u>verification</u> scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± ¼ of a <u>verification</u> scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).
[Nonretroactive as of January 1, 1993]

(c) For electronic cash registers (ECRs) and point-of-sale systems (POS systems) the display of measurement units shall be a minimum of 9.5 mm (3/8 inch) in height.
[Nonretroactive as of January 1, 2021]

(Added 2019)

(Amended 1992, 2008, ~~and~~ 2019<u>, and 20XX</u>)

The changes correctly reference e in this section as this is an issue of ensuring the zero indication is accurate to ¼ e. Hence it is a tolerance properly expressed in terms of e.

T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed one <u>verification</u> scale division ~~(d)~~ <u>(e)</u>; or the equipment shall:

(a) blank the indication; or

(b) provide an error message; or

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

The tolerance in T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility is to be applied independently of other tolerances. For example, if indications are at allowable basic tolerance error limits when the disturbance occurs, then it is acceptable for the indication to exceed the applicable basic tolerances during the disturbance.

(Amended 1997 and 20XX)

This is a tolerance for reaction to a disturbance and is properly expressed in e.

Group 7. Identify appropriate application of code sections (in order of appearance)

When the paragraph references d it is referring to the actual scale division and the concern is how the instrument operates. When the paragraph references e it is referring to the verification scale division and the concern is in classification of the instrument or in accuracy of the displayed values.

The sections in the table below currently correctly reference e or d as appropriate. The text of each section is not included for brevity. The justification may help explain the general rules above.

Code Section	Applies to	Justification
G-S.5.2.2.(c)	d	Rounding is a function of instrument operation not accuracy
G-S.5.2.2.(d)	d	Requires "d" to be an indicated zero and all digits to the left of "d" to be zero when d<1. Requires "d" to be an indicated zero and all digits to the right of "d" to be zero when d>5.
S.1.2.	d	1, 2, or 5 refers to d which is rounded. When e ≠ d refer to section S.1.2.2. for value of e.
S.1.2.1	d	Refers to rounded values of d.
S.1.2.3.	e	This is a classification issue. It ensures accuracy of the piece counts.
S.1.7.(b)	e	This is a classification issue addressing maximum indication above capacity.
S.2.1.2.	d	They must be in terms of d since stability of zero setting applies to d.
S.2.1.3.(all)	d	These limit the window for action of AZT. They must be in terms of d since zero setting applies to d.
S.2.3.	d	Tare division must equal smallest increment displayed.
T.N.7.	d	Discrimination requires an instrument to discriminate to the displayed scale division (zone of uncertainty). This relates to the rounding of the smallest increment.
UR.3.7.	d	Minimum load is correctly expressed in d. (see Group 5 above)
UR.3.10.	e	As written, this is clearly e. (See issues for additional study)

PART 3. Issues Identified as Requiring Additional Study (outside the scope of this workgroup)

A. The workgroup was in consensus that we should expand requirements in S.2.1.2. relating to semi-automatic zero to apply to all scales and not just scales used in direct sale. In first place, suitability is a User Requirement and not a specification. Second, correct operation to set zero should be applicable to all digital instruments as it is in R76.

B. The application of tolerances to net loads has always been assumed, even before the Scales Code adoption in 1984. Comparing T.2. for unmarked scales and T.N.2.1. for marked scales reveals important differences particularly regarding net loads. As written, T.N.2.1. exempts calculated net, but it appears to apply to both semi-automatic tare and preset tare. A comparison to R76 shows that OIML limits applicability of tolerances. Their MPE's do not apply to calculated net values or when preset tare (keyboard or programmed tare) is in operation (section 2.2). It appears net loads have MPE's applied only when the net zero is set in compliance with S.1.1.1.(b) which requires accuracy of zero to ¼ division.

This cannot be assured with preset tare or when net is based on two gross values. This has further ramifications to any case where all three (gross, tare and net) values are indicated/recorded for a transaction. OIML requires the gross and net weights be accurate but does not apparently require that the equation gross – tare = net be in mathematical agreement due to rounding issues. Note that in most transactions, the customer only gets one or two of the gross, tare or net values. Rounding issues do not arise for this reason. This may impact a current issue before NCWM dealing with printing tare on POS transaction receipts. Consider a POS transaction where the customer saw 1.02 lb on the weight display and sees 1.00 lb net and 0.03 lb tare. These are all accurate weights (and correct per R76) but the numbers don't' add up. The customer will claim they were overcharged by 0.01 lb since 1.02 lb – 0.03 lb = 0.99 lb.

C. The resolution of errors in testing scales was identified as an issue. The original proposal included a revision requiring resolution of error to at least 0.2 e. R76 specifically declares that errors be resolved to at least 0.2 e to eliminate rounding error. HB44 has no such provision and it might appear that rounding error is included in the tolerance. Instead of tolerance steps of 1, 2, etc., it could be argued that the tolerances are 1.5, 2.5, etc. as the result of direct reading. NTEP uses the R76 approach exclusively in testing, but it has no technical basis in the Code. There are obvious issues involved in using error weights in the field. The challenge is that you either eliminate rounding in determining tolerances or you don't. We have two standards at play at present. In addition, it can be argued that Class IIIL instruments are already high resolution somewhat similar to Class I and II instrument with e >d. Class IIIL devices have enough resolution to read errors to 0.2 e or 0.1 e of the equivalent Class III instrument without using error weight.

D. The UR.3.10. requirement that transactions from dynamic monorail scales be based on e raises issues. It was discussed since it involves both e and d. The displayed scale divisions equal to e (i.e. 10 d) are not normally rounded. If e = 10 d then the rounding point is not 5 up/4 down, as it is for d, but rather 9.5 up/0.5 down. Does this requirement mean the scale design has to produce a properly rounded value for the transaction that may be different from the display, e.g. 943.7 lb to d of 0.1 lb now must be recorded for the transaction as 944 lb? In addition, in brief discussion, it seemed there were many ways this could be interpreted. The workgroup concluded it would be beneficial to open some discussions with USDA and the manufacturers to explores some of these questions. This also addresses similar issues to the proposal to delete S.1.2.2.2. where questions of using e or d are impacting high precision scales in cannabis and jeweler's sales.