

SWMA Specifications and Tolerances (S&T) Committee 2023 Annual Meeting Report

Mr. Mark Lovisa, Committee Chair
Louisiana

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

Handbook 44 – General Code.....	GEN Series
Scales.....	SCL Series
Belt-Conveyor Scale Systems	BCS Series
Automatic Bulk Weighing Systems	ABW Series
Weights.....	WTS Series
Automatic Weighing Systems	AWS Series
Weigh-In-Motion Systems used for Vehicle Enforcement Screening.....	WIM Series
Liquid-Measuring Devices	LMD Series
Vehicle-Tank Meters	VTM Series
Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices	LPG Series
Hydrocarbon Gas Vapor-Measuring Devices.....	HGV Series
Cryogenic Liquid-Measuring Devices.....	CLM Series
Milk Meters	MLK Series
Water Meters	WTR Series
Mass Flow Meters	MFM Series
Carbon Dioxide Liquid-Measuring Devices.....	CDL Series
Hydrogen Gas-Metering Devices	HGM Series
Electric Vehicle Refueling Systems	EVF Series
Vehicle Tanks Used as Measures	VTU Series
Liquid Measures	LQM Series
Farm Milk Tanks	FMT Series
Measure-Containers.....	MRC Series
Graduates.....	GDT Series
Dry Measures	DRY Series
Berry Baskets and Boxes.....	BBB Series
Fabric-Measuring Devices.....	FAB Series
Wire-and Cordage-Measuring Devices	WAC Series
Linear Measures	LIN Series
Odometers	ODO Series
Taximeters.....	TXI Series
Timing Devices	TIM Series
Grain Moisture Meters (a).....	GMA Series
Grain Moisture Meters (b).....	GMB Series
Near-Infrared Grain Analyzers.....	NIR Series
Multiple Dimension Measuring Devices	MDM Series
Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices.....	LVS Series
Transportation Network Measuring Systems	TNS Series
Other Items	OTH Series

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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
FHWA	Federal Highway Administration	S&T	Specifications and Tolerances
GMM	Grain Moisture Meter	SD	Secure Digital
GPS	Global Positioning System	SI	International System of Units
HB	Handbook	SMA	Scale Manufacturers Association
LMD	Liquid Measuring Devices	SWMA	Southern Weights and Measures Association
LNG	Liquefied Natural Gas	TC	Technical Committee
LPG	Liquefied Petroleum Gas	USNWG	U.S. National Work Group
MMA	Meter Manufacturers Association	VTM	Vehicle Tank Meter
MDMD	Multiple Dimension Measuring Device	WIM	Weigh-in-Motion
NCWM	National Conference on Weights and Measures	WWMA	Western Weights and Measures Association

Details of All Items
(In order by Reference Key)

1 **SCL – SCALES**

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

3
4 **Source:**
5 Rice Lake Weighing Systems

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

9 **Item under Consideration:**
10 Amend Handbook 44 Scales Code as follows:

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

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

15 (b) **Capacity Indication.** – ~~Electronic computing scales~~ **Retail scales, POS, and ECR** *(excluding postal*
16 *scales and weight classifiers) shall neither display nor record a gross or net weight in excess of scale*
17 *capacity plus 9 d.*
18 *[Nonretroactive as of January 1, 1993] **(Amended in 20XX)***

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

21 This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped
22 with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically
23 derived totalized values.
24 (Amended 1990, 1992, and 1995)

25 **Previous Status:**
26 2024: New Proposal

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

30 The submitter requested Voting status for 2024.

31 **Comments in Favor:**

32 **Regulatory:**
33 •

1 **Industry:**

- 2 •

3 **Advisory:**

- 4 •

5 **Comments Against:**

6 **Regulatory:**

- 7 •

8 **Industry:**

- 9 •

10 **Advisory:**

- 11 •

12 **Neutral Comments:**

13 **Regulatory:**

- 14 •

15 **Industry:**

- 16 •

17 **Advisory:**

- 18 •

19 **Item Development:**

20 New Proposal

21 **Regional Associations' Comments:**

22 New Proposal

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

SCL-24.1	
Regional recommendation to NCWM on item status:	
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda	
<input type="checkbox"/> Recommend as an Information Item on the NCWM agenda	
<input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i>	
<input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i>	
<input checked="" type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i>	
<input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>	
Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i>	
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.	

1

2 **SCL-24.2 Multiple Sections Regarding Tare**

3

4 **Source:**

5 Ross Andersen, New York, Retired

6 **Purpose:**

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

9 **Item under Consideration:**

10 Amend Handbook 44 Scales Code and Appendix D, Definitions as follows:

11 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 $\pm \frac{1}{2}$ 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 $\pm 0.25 e$. [Nonretroactive as of January 1, 20XX] (Added 20XX)

~~(c) A digital indicating device shall either automatically maintain a “center-of-zero” condition to $\pm \frac{1}{4}$ scale division or less, or have an auxiliary or supplemental “center-of-zero” indicator that defines a zero-balance condition to $\pm \frac{1}{4}$ 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]

(e) (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 weights ~~indications and recorded representations~~ that are calculated from gross and tare weights (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)
–	Tare Weight (WR1 d = 2 kg)	–	Tare Weight (WS1 d = 0.02 lb)
<u>4 kg</u>		<u>0.06 lb</u>	
=	Net Weight (Mathematically	=	Net Weight (Mathematically
51 kg	Correct)	9.99 lb	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.

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

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

5 ...

6 **S.2.3. Tare Mechanism and Preset Tare Mechanism, General.** – *On any scale (except a monorail scale*
 7 *equipped with digital indications and multi-interval scales or multiple range scales when the ~~value of tare weight~~*
 8 *is determined in a lower weighing range or weighing segment), the value of the tare division shall be equal to the*
 9 *value of the scale division.* The tare mechanism or the preset tare mechanism shall operate only in a backward*
 10 *direction (that is, in a direction of underregistration) with respect to the zero-load balance condition of the scale.*
 11 *A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing*
 12 *of tare until a complete transaction has been indicated. **

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

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

15 *Note: On a computing scale, this requires the input of a unit price, the display of the unit price, and a computed*
 16 *positive total price at a readable equilibrium. Other devices require a complete weighing operation, including*
 17 *tare, net, and gross weight determination.**

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

19 **S.2.3.1. Tare Mechanism.** – *A tare mechanism shall permit setting the indication to zero accurate to*
 20 *$\pm 0.25 e$. On a multi-interval device e shall be replaced by e_1 .*
 21 *(Added 20XX) (Nonretroactive as of January 1, 20XX)*

22 **S.2.3.2. Preset Tare Mechanism.** – *Regardless of how a preset tare value is introduced, its scale division*
 23 *shall be equal to or automatically rounded to the scale division of the device. On a multiple range device,*
 24 *a preset tare value may only be transferred from one weighing range to another one with a larger*
 25 *verification scale division but shall then be rounded to the latter. For a multi-interval device, the preset*
 26 *tare value shall be rounded to the smallest verification scale division, e_1 , of the device, and the maximum*
 27 *preset tare value shall not be greater than Max_1 . The displayed or printed calculated net value shall be*
 28 *rounded to the scale interval of the device for the same net weight value.*
 29 *(Added 20XX) (Nonretroactive as of January 1, 20XX)*

30 ...

1 **S.1.15. Marking of Weight Indications.**

- 2 **(a) A single display used only for gross indications need not be designated. The display may be**
3 **designated by the term “gross.”**
4 **(b) A single display used for both gross and net values shall be designated “net” when displaying the**
5 **net value while a tare mechanism or preset tare mechanism is in operation. The display may be**
6 **designated “gross” when no tare mechanism is in operation, or when the gross weight is**
7 **temporarily indicated while a tare mechanism is in operation.**
8 **(c) If an instrument simultaneously displays two or more of the net, gross, or tare indications, each**
9 **display shall be designated by the appropriate term “net,” “gross,” or “tare.”**
10 **(d) However, it is permitted to replace the terms net, gross, and tare with the appropriate designations**
11 **“N” for net, “G” for gross and “T” for tare displayed to the right of the weight values, e.g., 4.48 lb**
12 **N, 4.52 lb G, or 0.04 lb T.**

13 **(Added 20XX) (Nonretroactive as of January 1, 20XX)**

14
15 **S.1.16. Printing of Weighing Results.**

- 16 **(a) Gross weights may be printed without any designation. For a designation by the symbol, only “G”**
17 **is permitted.**
18 **(b) If only net weight is printed without corresponding gross or tare values, it may be printed without**
19 **any designation. A symbol for designation shall be “N”.**
20 **(c) Gross, net, or tare weights determined by a multiple range instrument or by a multi-interval**
21 **instrument need not be marked by a special designation referring to the (partial) weighing range.**
22 **(see also S.1.2.1.)**
23 **(d) If net weights are printed together with the corresponding gross and/or tare weights, the net and**
24 **tare weights shall at least be identified by the corresponding symbols “N” and “T”. If the gross**
25 **weight is identified, the symbol “G” shall be used.**
26 **(e) However, it is permitted to replace “G”, “N” and “T” by complete words in English.**

27 **(Added 20XX) (Nonretroactive as of January 1, 20XX)**

28 **S.1.17. Mathematical Agreement of Net, Gross and Tare Values. When a device simultaneously indicates (or**
29 **records) net, gross and tare indications, the values shall be in mathematical agreement based on the formula**
30 **Net Weight = Gross Weight – Tare Weight whenever one of the three values is calculated from two measured**
31 **weight values, e.g., calculated Net = weighed Gross – weighed Tare. Mathematical agreement is not required**
32 **due to potential rounding errors when all three values are independently measured. (Added 20XX)**
33 **(Nonretroactive as of January 1, 20XX)**

34 Alternative proposal.

35 **S.1.17. Mathematical Agreement of Net, Gross and Tare Values. When a device simultaneously indicates (or**
36 **records) net, gross and tare indications, the values shall be in mathematical agreement based on the formula**
37 **Net Weight = Gross Weight – Tare Weight, whenever one of the three values is calculated from two measured**
38 **weight values, e.g., calculated Net = weighed Gross – weighed Tare. This also applies to calculated net weights**
39 **when a preset tare mechanism is in operation. Mathematical agreement is not required due to potential**
40 **rounding errors when a tare mechanism is in operation, as all three values are independently measured.**
41 **(Added 20XX) (Nonretroactive as of January 1, 20XX)**

42 ...

1 **T.N.2.1. General.** – The tolerance values ~~are positive (+) and negative (–)~~ herein prescribed shall be
 2 applied to errors of overregistration and underregistration, with the weighing device adjusted to zero at
 3 no load. When tare is in use, the tolerance values are applied from the tare zero reference (zero net weight
 4 indication); the tolerance values apply to the net weight indication for any possible tare load using certified
 5 test loads. The tolerances apply to 1) errors in gross indications (starting at gross load zero), 2) errors in
 6 net indications (starting at net load zero) when a tare mechanism is in operation, 3) errors in tare
 7 indications on a dedicated tare display when a tare mechanism is in operation, and 4) errors in net
 8 indications on a dynamic monorail scale (using a preset tare mechanism). Tolerances do not apply to errors
 9 in net indications for scales other than on dynamic monorail scales, when a preset tare mechanism is in
 10 operation.
 11 (Amended 2008 and 20XX)

12 **Previous Status:**
 13 2024: New Proposal

14 **Original Justification:**
 15 This proposal recommends changes to the Scales Code to address:

- 16 (1) issues of poor terminology that lead to confusion in discussion of net weight (and tare) issues, and
 17 (2) absence of specifics in the regulation of net weight that leads to ambiguity in enforcement.

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

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

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

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

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

31 Net weight = Gross indication - Gross indication
 32 Net load = Gross load - Tare load
 33 Commodity = Commodity + Tare - Tare

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

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

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

5 Issue 2. – There are only a few specifications governing tare operations in the Scales Code. I am not including user
 6 requirements that don't apply to the instrument. A word search of the terms "tare" and "net weight" point us to only
 7 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

8
 9 The number of requirements is an assessment of the number of requirements requiring a distinct test to verify
 10 compliance. In total, there are 11 tests required to verify the literal requirements in the Code. Yet the NTEP checklist
 11 for an electronic scale has pages of tests governing tare operations. I concede that many of those can also be derived
 12 from General Code requirements, but general also comes with a lack of specificity. This is no suggestion that Pub 14
 13 is wrong in any way. There has always been this challenge to ensure NTEP is following HB44, and not the other way
 14 around. There is another challenge to not over-regulate. It is generally better to have fewer, but clearer, requirements.

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

- 17 1. What is meant in T.N.2.1. by "the net weight indication of any possible tare load using certified test weights." If
 18 you ask different people, you might get many different answers.
- 19 2. Can you point to any guidance in the Notes section to help answer question 1 or conduct the test in order to
 20 apply the tolerances?
- 21 3. Must keyboard tare, pre-programmed tare, and pushbutton tare all result in the same net weight?
 22 If you say yes, on what code requirement do you base your decision? Different weighing procedures can
 23 produce different results by one scale division.
- 24 4. If the instrument simultaneously indicates the Net, Gross, and Tare weights (or prints them), do the values have
 25 to be in mathematical agreement?
 26 If you say yes, on what code requirement do you base your decision? Under some circumstances mathematical
 27 agreement cannot be mandated due to rounding issues.
- 28 5. If an instrument has a dedicated tare weight display, do tolerances apply to that indication?
- 29 6. If an instrument records multiple values, e.g., net weight, gross weight, and tare weight, how must the values be
 30 identified either on the display or the printed record?

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

3 **Regarding the Proposed Definitions:**

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

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

- 12 • Weights may be assigned by the operator or by the instrument. Examples: 1) A gross indication when the
13 commodity is the only load on the load receptor is designated the net weight by the operator. 2) A weigh-
14 in/weigh-out system employs two gross indications that are used to calculate a net weight. If the operator
15 calculates the net weight, the operator is also responsible to identify the respective net, gross and tare
16 weights. If the instrument calculates the net weight, it must identify the respective net, gross, and tare
17 weights.
- 18 • Requirements applicable to indications are also applicable to recorded representations (values printed or
19 transmitted by the instrument) as per G-S.5.6. Note that some code requirements emphasize the recorded
20 representations (redundantly), and some do not. This does not apply to actions of an operator such as
21 manually computing net values from two measured weight values for gross and tare.
- 22 • The term “gross load” unavoidably has two meanings, but this is acceptable since the operator (or the
23 official) clearly knows which applies based on how the scale is used.
24 Example 1: a candy store may have a scoop that is sometimes used in the weighing operation. For the
25 purposes of S.1.7. Capacity Indications, the scoop is part of the gross load placed on the load receptor and
26 the weighing range of the scale is reduced by the scoop weight. However, for the purposes of the
27 transaction, the scoop becomes part of the load receptor after a zero operation and is not part of the gross
28 load (commodity and tare). A possible exception is the scale with a combined zero/tare key. However,
29 these are not permitted in direct sale and the net weighing essentially begins at gross zero that is accurate to
30 at least $\frac{1}{4}$ e.
31 Example 2: if the commodity alone is placed on the load receptor, it is a gross load (by the first meaning)
32 and a net load. This is the case when candy in the scoop is weighed for the transaction after including the
33 scoop in the gross zero as in example 1. The net load is introduced into the packaging (tare) after the
34 weighing operation.
35 Example 3: if the tare alone is placed on the load receptor it is thus a gross load (by the first meaning) and a
36 tare load. However, there are nuances to the meaning of tare load (next bullet).
- 37 • The term “tare load” is used only once in the current Scales Code in T.N.2.1. The proposed revision to that
38 section would remove it. In practice, a tare load results in either a non-zero gross indication, or a zero net
39 indication. Both are consistent with the new definitions of gross and net loads. There is also the possibility
40 that a tare weighing mechanism is in use that displays or prints the tare weight. However, the value
41 displayed on the tare weighing mechanism does not necessarily correspond to the current loading, since the
42 tare weighing mechanism will remain at the tare indication when either the tare is removed from or the
43 gross load (commodity and tare) are placed on the load receptor.
- 44 • The term “tare indication” is necessary as tolerances are applicable to a dedicated tare display in the revised
45 T.N.2.1.

1 To further help explain the terminology, consider four basic weighing procedures. Instrument in all examples is
 2 Class III Max 30 lb d = 0.01 lb
 3 (Net, gross and tare descriptors in parentheses are optional as per proposed S.1.15.)

4 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

5

6 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

7

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

8 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

9

10 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

11

12 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

1

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

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

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

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

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

8 **Regarding S.1.1.1. Digital Indicating Elements.**

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

13 **Regarding S.1.2.1. Digital Indicating Scales, Units.**

14 Justification: In the current text it may be unclear that the second paragraph and the examples address multi-interval
15 and multiple range scales weighing by difference, i.e., using two measured gross indications with no tare or preset tare
16 in operation. The changes make this clear. Using the terminology of weights, indications and loads, the 1, 2 or 5
17 requirement for the scale division applies to 1) the gross indications for the gross and tare loads, and 2) the gross and
18 tare weights recorded for the transaction. The 1, 2, or 5 requirement does not apply to the calculated net weight, which
19 may be displayed and/or printed. More on the mathematical agreement issue can be found in proposed S.1.17. below.
20 As this is only a clarification, it does not alter the nonretroactive status of the section.

21 This section does not apply to tare operations using tare or preset tare mechanisms. If either a tare mechanism or a
22 preset tare mechanism is in operation, then the net weights in the examples would necessarily be displayed and printed
23 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
24 weighing range before being displayed. It seems highly unlikely that any multi-interval scale would print all three
25 values, if equipped with a tare or preset tare mechanism.

26 **Regardnig S.1.7. Capacity Indication, Weights Ranges, and Unit Weights.**

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

1 **Regarding S.2.3. Tare Mechanism and Preset Tare Mechanism, General.**

2 Justification: The changes to S.2.3. are a cleanup of language consistent with the terms tare mechanism and preset tare
 3 mechanism. This backward application of tare has consistently been applied to both tare and preset tare in the past.
 4 As this is only a clarification, it does not alter the retroactive status of the affected section.

5 The new specifications, S.2.3.1. and S.2.3.2., clarify the difference between the two kinds of tare mechanisms. Because
 6 these changes may be significant, they are proposed to be nonretroactive. With a tare mechanism, the net zero setting
 7 is required to be accurate to $\frac{1}{4} e$, parallel to the setting of gross zero in S.1.1.1.(b). With a preset tare mechanism, the
 8 net zero value is rounded off to the scale division d. This means net weights are simple calculations of rounded gross
 9 weight minus rounded tare weight. For more explanation see justification for changes to T.N.2.1. below.

10 For a multi-interval scale this means having full access to the entire lower weighing range in net mode. Consider a 0
 11 - 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
 12 weights will coincide with gross loads between 14 lb to 29 lb. The upper range for net weights will coincide with gross
 13 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
 14 the lower weighing range.

15 **Regarding S.1.15, Marking of Weight Indications and S.1.16. Printing of Weighing Results.**

16 Justification: These new sections provide clear specifications for net weight and the use of tare mechanisms. Because
 17 these changes may be significant, they are proposed as nonretroactive. Without these sections, the decisions regarding
 18 appropriate markings are arbitrary. Note that NTEP relies heavily on G-S.6. (marking of controls and indications), but
 19 Pub 14 has no legal standing. What is clear to one person may not be clear to another when viewing the Scales Code.
 20 In S.1.15. the specifications governing marking of the weight displays are added. In S.1.16. the specifications
 21 governing printed records are added. This section comes largely from R76 section 4.6.11.

22 **Regarding S.1.17. Mathematical Agreement of Net, Gross and Tare Values.**

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

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

34	Load	Internal Value	Rounded Value
35	Gross	4.317 lb	4.32 lb
36	Tare	0.034 lb	0.03 lb
37	Net	4.283 lb	4.28 lb (No agreement as $G - T = 4.29$ lb)

38 In this case the gross weight is rounded up and the tare weight is rounded down, resulting in a measured net weight
 39 0.01 lb (1 d) smaller than the calculated net value. Similarly, if the gross weight is rounded up and the tare weight
 40 rounded down, the measured net weight is 0.01 lb (1 d) greater than the calculated net weight. Because these changes
 41 may be significant, they are proposed as nonretroactive.

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

5 **Regarding T.N.2.1. General.**

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

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

131. Errors in gross indications, beginning at gross load zero. – This has always been the case. These weighings begin at
 14 dead load zero. Note that the zero setting is covered by proposed S.1.1.1.(b) which requires setting zero accurate to $\frac{1}{4}$
 15 e.

162. Errors in net indications, beginning at net load zero when using a tare mechanism. – This also has traditionally been
 17 the practice even in the Scales Code pre-1984. This net zero setting is also accurate to $\frac{1}{4}$ e per proposed S.1.1.1.(b).
 18 The current wording is ambiguous.

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

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



1 The graphic highlights the difference between tare and preset tare devices. The values are in d. In the example, the
2 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 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
4 gross divisions since the tare may not be a whole number of d.

5 With a preset tare mechanism, the rounded value of the tare entry is subtracted from the gross weight. This results in
6 a net scale that aligns with the gross scale but is offset by the rounded value of the tare. With keyboard tare, the tare
7 is entered at gross zero, resulting in an indication of -3 d. With a programmed tare like a POS system, the rounded
8 gross weight is displayed and the 3 d tare associated with the PLU is subtracted before the net weight is printed. The
9 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
10 instrument gets added to this rounding error. By not applying tolerances you do not penalize the instrument for these
11 two errors. Remember that the user may be cited for misrepresentation of the quantity (UWML §15, if the wrong
12 preset tare is entered. Also, you can use the tare mechanism to test the instrument accuracy in net mode. This is what
13 was intended in the current language of T.N.2.1. referring to “any possible tare load using certified weights.” That is,
14 applying a known weight and using the semi-automatic tare to set the net zero. In the R76 test in net mode, the applied
15 tare load is chosen near the break point between divisions to verify that the net zero is set accurate to $\frac{1}{4}$ e.

16 **Comments in Favor:**

17 **Regulatory:**

- 18 •

19 **Industry:**

- 20 •

21 **Advisory:**

- 22 •

23 **Comments Against:**

24 **Regulatory:**

- 25 •

26 **Industry:**

- 27 •

28 **Advisory:**

- 29 •

30 **Neutral Comments:**

31 **Regulatory:**

- 32 •

33 **Industry:**

- 34 •

35 **Advisory:**

- 36 •

37 **Item Development:**

38 [Explain any changes made to the original proposal and committee recommendations]

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

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

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

8 And

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

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

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

22 **(Added 20XX)**

23 Renumber existing paragraphs UR.3.4 through UR.3.12.

24 **Previous Action:**

25 2022: Developing

26 **Original Justification:**

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

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

33 The submitter requested voting status for these items in 2022.

34 **Comments in Favor:**

35 **Regulatory:**

- 36 • 2022 Interim: Supported the language alignment of GEN 22.1 with L&R Block 2. Support for separating
37 the blocked items.
38 • 2023 Interim: A regulator supports the proposed changes submitted by the SMA but believes the block
39 should remain developing.
40

1 **Industry:**

- 2 • 2022 Interim: SMA provided written comments and open hearing testimony that the items should be
3 separated. Supports each item, but recommends changes to SCL 22.1.
4 • 2023 Interim: An industry member commented that they support SCL-22.1 as voting with the changes
5 supplied by the SMA, but agrees that SCL-22.3 should remain developing.
6

7 **Advisory:**

- 8 • 2022 Interim: NIST (submitter) recommended that GEN 22.1 be separated and given voting status.
9 Asked that remainder of block remain developing.
10 • 2023 Interim: NIST (the submitter) agrees with the SMA changes and recommends voting. They also
11 agree that SCL-22.3 should remain developing.
12 • 2023 Annual: NIST (the submitter) stated they had worked with SMA to incorporate their suggested
13 changes and included those changes in the NIST Analysis of the item.
14

15 **Comments Against:**

16 **Regulatory:**

- 17 • None
18

19 **Industry:**

- 20 • None
21

22 **Advisory:**

- 23 • None
24

25 **Neutral Comments:**

26 **Regulatory:**

- 27 • 2022 Interim: SCL code sections could be reworded for easier understanding and comprehension of
28 commercial vs. non-commercial.
29

30 **Industry:**

- 31 • 2022 Interim: Recommended that tickets should have identification of axle groups.
32

33 **Advisory:**

- 34 • None

35 **Item Development:**

36 NCWM 2022 Interim Meeting: During the S&T Committee work session, the committee agreed to remove item GEN
37 22.1 from Block 6. The committee recommendations pertain to the remainder of the block only (SCL 22.1 & SCL
38 22.3). The committee received updated language from the submitter for item SCL 22.1.

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

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

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

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

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

5 **Regional Associations' Comments:**

6 WWMA 2022 Annual Meeting: Mr. Jan Konijnenburg (NIST Associate) – Stated that information is available on the
7 website.

8 During open hearings the Committee received an update from NIST OWM indicating that new language for this
9 proposal was submitted to NCWM. This language was not available for review at the time of open hearings by the
10 committee or membership. The WWMA S&T Committee recommends that this item should remain developing to
11 allow membership to review the updated proposal.

12 SWMA 2022 Annual Meeting: Mr. Huff, State of Delaware, questioned whether this would allow law enforcement
13 officials to split weigh.

14 The SWMA S&T Committee asks how legal split weighing would be initiated, how it would be recorded on the ticket,
15 would scale operators be required to mark the tickets where split weighing had taken place, or would that be
16 automatically done?

17 The SWMA S&T Committee recommends this item remain as a Developing Item.

18 CWMA 2022 Interim Meeting: No comments from the floor.

19 The CWMA S&T Committee recommends this remains as a Developing item.

20 NEWMA 2022 Interim Meeting: Mr. Rick Harshman (NIST-OWM) gave updates on a NIST analysis for SCL-22.1.
21 He noted that SCL-22.3 has changed from what is in the agenda, which was shared with the body. Mr. Lou Sakin
22 (Holliston, MA), Mr. Walt Remert (PA), Mr. John McGuire (NJ), Mr. Jim Willis (NY), Mr. James Cassidy (MA), and
23 Ms. Cheryl Ayer (NH) recommended that this item be assigned a voting status.

24 After hearing comments from the floor, the Committee believes this item has merit and is fully developed. The
25 Committee recommends that this item be give a Voting status.

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

SCL-22.3

Regional recommendation to NCWM on item status:

- Recommend as a Voting Item on the NCWM agenda
- Recommend as an Information Item on the NCWM agenda
- Recommend as an Assigned Item on the NCWM agenda
(To be developed by an NCWM Task Group or Subcommittee)
- Recommend as a Developing Item on the NCWM agenda
(To be developed by source of the proposal)
- Recommend Withdrawal of the Item from the NCWM agenda
(In the case of new proposals, do not forward this item to NCWM)
- No recommendation from the region to NCWM
(If this is a new proposal, it will not be forwarded to the national committee by this region)

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)

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

$$n = \text{Capacity} / e$$

(Added 20XX)

Table 6. Maintenance Tolerances (All values in this table are in <u>verification</u> scale divisions (e))				
Tolerance in Scale Divisions				
	1	2	3	5
Class	Test Load <u>Applied (e)</u>			
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 +
III	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1 e for each additional 500 e or fraction thereof)	

(Amended 20XX)

T.N.3. Tolerance Values.

T.N.3.1. Maintenance Tolerance Values. – The maintenance tolerance values are as specified in Table 6. Maintenance Tolerances.

T.N.3.2. Acceptance Tolerance Values. – The acceptance tolerance values shall be one-half the maintenance tolerance values.

T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class III. – The tolerance values are two times the values specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values.

(Amended 1986)

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 or 0.1 % of the scale capacity, whichever is less.

(Amended 1986 **and 20XX**)

T.N.4. Agreement of Indications.

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

5 (Amended 1986 **and 20XX**)

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

7 **T.N.6.1. Test Load.**

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

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

13 **(Amended 20XX)**

14 **T.N.8. Influence Factors.** – The following factors are applicable to tests conducted under controlled conditions
 15 only, provided that:

16 (a) types of devices approved prior to January 1, 1986, and manufactured prior to January 1, 1988, need not meet
 17 the requirements of this section;

18 (b) new types of devices submitted for approval after January 1, 1986, shall comply with the requirements of
 19 this section; and

20 (c) all devices manufactured after January 1, 1988, shall comply with the requirements of this section.

21 (Amended 1985)

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

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

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

26 (Amended 1990 **and 20XX**)

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

30 (a) blank the indication; or

31 (b) provide an error message; or

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

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

38 (Amended 1997 **and 20XX**)

1 **T.1. Tolerance Values.**

2 **T.1.1. General.** – The tolerances applicable to devices not marked with an accuracy class shall have the
3 tolerances applied as specified in Table T.1.1. Tolerances for Unmarked Scales.
4 (~~Amended 1990~~)

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

7 (~~Amended 1990~~ **and 20XX**)

8 **S.1.1.1. Digital Indicating Elements.**

9 (a) A digital zero indication shall represent a balance condition that is within $\pm \frac{1}{2}$ the value of the scale
10 division **d**.

11 **(b) After zero setting (gross zero or net zero after a tare operation) the effect of zero deviation on the**
12 **result of the weighing shall be not more than $\pm 0.25 e$.**

13 **[Nonretroactive as of January 1, 20XX]**

14 ~~(b)(c) A digital indicating device shall either automatically maintain a “center-of-zero” condition to~~
15 ~~$\pm \frac{1}{4}$ scale division or less, or have an auxiliary or supplemental “center of zero” indicator that~~
16 ~~defines a zero balance condition to $\pm \frac{1}{4}$ of a scale division or less. A “center of zero” indication may~~
17 ~~operate when zero is indicated for gross and/or net mode(s). **A digital indicating device shall have a**~~
18 ~~**“center-of-zero” indicator that indicates a zero balance condition when the deviation from zero is**~~
19 ~~**not more than $\pm 0.25 e$. A “center-of-zero” indicator may operate when zero is indicated for gross**~~
20 ~~**and/or net mode(s). The “center-of-zero” indicator is not mandatory on a device equipped with an**~~
21 ~~**auxiliary indicating device or equipped with a zero tracking mechanism.**~~

22 [~~Nonretroactive as of January 1, 1993~~]

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

25 [~~Nonretroactive as of January 1, 2021~~]

26 (~~Added 2019~~)

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

28 **Part 2. Amendment of T.N.1.2. and related sections**

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

31 **(Amended 20XX)**

1

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 CC¹	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 <u>Verification Scale Division</u> , “e” (3)(4)	X	X			
Temperature Limits (5)	X	X	X	X	

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

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

1 Amend Table S.6.3.(b) as follows:

2

Table S.6.3.b. Notes for Table S.6.3.a. Marking Requirements	
3.	<p>The device shall be marked with the nominal capacity. <u>The nominal capacity may be prefaced by the terms “capacity” or “Max.”</u></p> <p><i>The <u>For any scale where the value of “e” is equal the value of “d” (see S.1.2.2.), the nominal capacity shall be shown together with the value of the scale division “d” or “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)</u> 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 scale division value “d” or “e” or weight unit <u>with its associated nominal capacity</u> shall be marked on multiple range or multi-interval scales. <u>For any scale that has no “d” or any scale where “e” does not equal “d” refer to Note 4.</u></i></p> <p><i>[Nonretroactive as of January 1, 1983]</i></p> <p>(Amended 2005 <u>and 20XX</u>)</p>
4.	<p><i>Required only if different from “d.” <u>Exceptions to Note 3 regarding marking of “e” and “d.”</u></i></p> <p><i>(a) <u>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 division “e” (e.g. capacity 1,000 g e = 0.1 g, or Max 1,000 g e = 0.1 g). These devices have no “d.”</u></i></p> <p><i>(b) <u>For a scale where e does not equal d, such as a scale equipped with an auxiliary indicating device or a weight classifier marked for special use, the nominal capacity shall be shown together with the scale division “d” and the verification scale division “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).</u></i></p> <p><i>[Nonretroactive as of January 1, 1986]</i></p> <p><i>(Amended 20XX)</i></p>

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

4 **Appendix D. Definitions**

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

8 (Added 20XX)

9 extended displaying device. – a means to temporarily change the scale division (d) to a value less than the
 10 verification scale division (e), following a manual command. [2.20]

11 (Added 20XX)

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

14 (Added 1987) (Amended 20XX)

15 **S.1.2.2. Verification Scale ~~Interval~~ Division “e”.**

16 (Added 20XX)

17 **S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales.** – If $e \neq d$, the verification scale interval “e”
 18 shall be determined by the expression:

1
$$d < e \leq 10 d$$

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

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

9 (Added 1999)

10 **Scales Equipped with an Auxiliary Indicating Device. – Only a Class I or II scale or a dynamic monorail**
11 **may be equipped with an auxiliary indicating device. A multi-interval scale or a multiple range scale shall**
12 **not be equipped with an auxiliary indicating device. The auxiliary indicating device may be either a rider**
13 **or vernier on an analog device, or a scale division "d" to the right of the decimal point on a digital device**
14 **that is differentiated in size or color.**

15 **A scale with an auxiliary indicating device shall not be equipped with an extended displaying device.**

16 **The verification scale division "e" on a scale equipped with an auxiliary indicating device shall be**
17 **determined as follows:**

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

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

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

23 **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**

24 **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.**

25 (Added 1999) (Amended 20XX)

26 **S.1.2.2.3. Deactivation of a "d" Resolution. – It shall not be possible to deactivate the "d" resolution on**
27 **a Class I or II scale equipped with an auxiliary indicating device if such action affects the scale's ability to**
28 **round digital values to the nearest minimum unit that can be indicated or recorded as required by**
29 **paragraph G-S.5.2.2. Digital Indication and Representation.**

30 (Added 20XX)

31 **S.1.2.2.4. Weight Classifiers. – On a weight classifier, such as a postal or shipping scale that rounds up**
32 **and is marked for special use, the value of "e" shall be equal to or less than "d."**

33 (Added 20XX)

34 **S.1.2.2.5. Extended Displaying Device. – When a scale is equipped with an extended displaying device,**
35 **displaying an indication with a scale division "d" smaller than "e" shall be possible only:**

36 **(a) while pressing a key; or**

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

38 **Printing or transferring data via interface shall not be possible while the extended displaying device is in**
39 **operation.**

1 **(Added 20XX)**

2

Table 3. Parameters for Accuracy Classes			
Class	Value of the Verification Scale Division (d or <i>e</i>¹)	Number of <u>Verification</u> Scale⁴ Divisions (<i>n</i>)	
		Minimum	Maximum
SI Units			
<i>I</i>	<i>equal to or greater than 1 mg</i>	50 000	--
<i>II</i>	<i>1 to 50 mg, inclusive</i>	100	100 000
<i>III</i> ^{2,5}	<i>equal to or greater than 100 mg</i>	5 000	100 000
	<i>0.1 to 2 g, inclusive</i>	100	10 000
<i>III L</i> ³	<i>equal to or greater than 5 g</i>	500	10 000
	<i>equal to or greater than 2 kg</i>	2 000	10 000
<i>IIIH</i>	<i>equal to or greater than 5 g</i>	100	1 200

3 The middle section of the table is omitted for brevity.

4 [Nonretroactive as of January 1, 1986]

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

6 Amend Footnotes 1 and 3 to Table 3. As follows:

7 ¹ For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant
8 decimal differentiated by size, shape, or color), the value of the verification scale division “e” is the value of the
9 scale division immediately preceding the auxiliary means. **The verification scale division e does not always equal**
10 **the displayed scale division d. To ensure the correct value for e is used, refer to required markings on the device**
11 **(see also notes 3 and 4 in Table S.6.3.b.).**

12 ² A Class III scale marked “For prescription weighing only” may have a verification scale division (e) not less than
13 0.01 g.

14 (Added 1986) (Amended 2003)

15 ³ The value of a **verification** scale division (**e**) for crane and hopper (other than grain hopper) scales shall be not
16 less than 0.2 kg (0.5 lb). The minimum number of **verification** scale divisions (**n**) shall be not less than 1000.

17 **S.5.4. Relationship of Minimum Load Cell Verification Interval Value to the Verification Scale Division.** – The
18 relationship of the value for the minimum load cell verification scale interval, *v_{min}*, to the **verification** scale division, ~~d~~
19 **e**, for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the
20 following formulae where *N* is the number of load cells in a single independent¹ weighing/load-receiving element
21 (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):

22

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

24

25

1 (b) $v_{min} \leq \frac{d^* e}{\sqrt{N} \times (\text{scale multiple})}$ for scales with lever systems.
 2
 3

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

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

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

10 *-the complete weighing/load-receiving element or scale has been evaluated for*
 11 *compliance with T.N.8.1. Temperature under the NTEP;*

12 *-the complete weighing/load-receiving element or scale has received an NTEP*
 13 *Certificate of Conformance; and*

14 *-the complete weighing/load-receiving element or scale is equipped with an automatic*
 15 *zero-tracking mechanism which cannot be made inoperative in the normal weighing*
 16 *mode. (A test mode which permits the disabling of the automatic zero-tracking*
 17 *mechanism is permissible, provided the scale cannot function normally while in this*
 18 *mode.*

19 *[Nonretroactive as of January 1, 1994]*

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

1

Table 8. Recommended Minimum Load		
Class	Value of Verification Scale Division <u>e</u> (d or e[*])	Recommended Minimum Load <u>in</u> scale divisions <u>d</u> (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
IIIH	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 IIIH 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.~~

2 (Amended 1990 **and 20XX**)

3 **Previous Action:**

4 2023: New Item

5 **Original Justification:**

6 The Verification Scale Division e Task Group has recommended a significant number of changes to the Scale Code.
7 Those changes are reflected below. Before addressing the changes though, it is important to identify the problem that
8 the changes are trying to fix.

9 The Task Group identified two significant flaws in the current Code after comparison with R76. The changes are
10 proposed to ensure Handbook 44 uses correct measurement principles. They are not proposed for the purpose of
11 harmony with R76. Those two flaws are found in the following paragraphs from the current Scales Code.

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

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

1 The flaws arise from the use of the scale division d in these paragraphs. The first paragraph deals with accuracy class
 2 (classification) and the second with tolerances (accuracy measurement). The correct principle is to only use e in both
 3 paragraphs since accuracy is correctly expressed in e. Notice also that in T.N.1.3. the Code specifies both e and d
 4 without any clarity on when to use one or the other. We might think we know when to use e or d from our training.
 5 However, the confusion that arises in enforcement should indicate that maybe it is not as clear as we think. Using e,
 6 which follows correct measurement principles, should eliminate the confusion.

7 In R76, the sections dealing with classification and tolerances are found in the Metrological Requirements. This is
 8 closest to the Notes and Tolerances sections of the Scales Code. There are a number of paragraphs in the Scales Code
 9 dealing with d. In R76 these are Technical Requirements. This is closest to specifications in the Handbook 44. This
 10 should indicate that d serves a purpose that is not dependent on accuracy in e. This is the age-old issue of accuracy vs
 11 resolution. Accuracy is measured in e and resolution is measured in d. Many misunderstand resolution as a measure
 12 of accuracy.

13 While it might seem easy to fix T.N.1.2. (classification) and T.N.1.3. (accuracy/tolerances), the fixes to these two
 14 sections have ripple effects with related paragraphs throughout the Code. To maintain the connection the proposed
 15 changes will be presented in two parts. Part 1 will deal with accuracy/tolerances and part 2 will deal with classification.

16 **Other Issues Discussed by the Task Group:**

17 1. 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.5.2.3.	d	Divisions shall be uniform in size and character.
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.	d	1, 2, or 5 refers to d which is rounded. When $e \neq d$ refer to section S.1.2.2. for value of e
S.1.2.1	d	Refers to rounded values of d in gross and tare modes.
S.1.7.(b)	d	Restricted to computing scales, in most cases $e = d$.
S.2.1.2.	d	Motion detection issue for setting zero.
S.2.1.3.(all)	d	These limit the window for action of AZT. They must be in terms of d since zero setting is 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 with exceptions for ungraduated scales with no d and weight classifiers.

- 1
2 2. The following specifications, tolerances, and user requirements are specific to the verification scale division (e).
3 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.
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
5 3. The Task Group also observed that method of referencing the scale division and verification scale division is
6 inconsistent throughout the Code. In some cases the paragraph only uses the abbreviation d or e, in other cases
7 the name is stated without the abbreviation and in other cases the name is included with the abbreviation d or e
8 in quotes or parentheses. Because the proposal only considers sections that needed change this issue is not
9 addressed formally in the proposal. The Task Group believes the change to a consistent method could be made
10 editorially by OWM.
11
12 4. The Task Group believes additional work is required to fully understand the application of e and d to dynamic
13 monorail scales. The recommendations presented do not include dynamic monorail systems in the discussion of
14 the auxiliary indicating device.

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

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

19 **Comments in Favor:**

20 **Regulatory:**

- 21 • 2023 Interim: Doug Musick (State of Kansas - Task Group Chairman) asked for this item to replace
22 Block 2 items. Asking for informational status as wordsmithing efforts are ongoing.

23 **Industry:**

- 24 • 2023 Interim: Russ Vires (SMA) supports the further development of this item although he questions
25 the moving from block 2 items to SCL 23.3, SMA has provided written comments for block 2.

26 **Advisory:**

- 27 • None

28 **Comments Against:**

29 **Regulatory:**

- 30 • None

31 **Industry:**

- 32 • None

33 **Advisory:**

- 34 • None

1 **Neutral Comments:**

2 **Regulatory:**

- 3 • 2023 Interim: Kevin Schnepf (State of California) commented that item was not reviewed due to late
 4 submittal and is neutral to block 2 vs SCL-23.3.

5 **Industry:**

- 6 • None

7 **Advisory:**

- 8 • None

9 **Item Development:**

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

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

15 **Regional Associations' Comments:**

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

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

SCL-23.3
<p>Regional recommendation to NCWM on item status:</p> <p><input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Information Item on the NCWM agenda</p> <p><input checked="" type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i></p> <p><input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i></p> <p><input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i></p> <p><input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i></p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>The committee heard no comments on this item during Open Hearings.</p> <p>The committee recommends this item remain an Assigned item.</p>

19

1 **SCL-22.2 A UR.1. Selection Requirements, UR.1.X. Cannabis**

2 **Source:**

3 NCWM Cannabis Task Group

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

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

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

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

17 **Purpose:**

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

19 **Item Under Consideration:**

20 Amend Handbook 44, Scales Code as follows:

21 **UR.1.1. General.**

22 (a) For devices marked with a class designation, the typical class or type of device for particular weighing
 23 applications is shown in Table 7a. Typical Class or Type of Device for Weighing Applications.
 24

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

Table 7a.	
Typical Class or Type of Device for Weighing Applications	
Class	Weighing Application or Scale Type
I	Precision laboratory weighing <u>and weighing of all Cannabis products</u>
II	Laboratory weighing, precious metals and gem weighing, grain test scales, <u>and weighing of all Cannabis products</u>
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, <u>and weighing of all Cannabis products</u>

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
III	Wheel-load weighers and portable axle-load weighers used for highway weight enforcement
<p>Notes: A scale with a higher accuracy class than that specified as “typical” may be used. <u>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.</u></p>	

1 (Amended 1985, 1986, 1987, 1988, 1992, 1995, 2012, and 2021)

2 **UR.3.1.2. Required Minimum Loads for Cannabis products. - The recommended minimum loads specified**
 3 **in Table 8 shall be considered required minimum loads for scales used to weigh Cannabis and Cannabis-**
 4 **containing products.**
 5 **[Nonretroactive as of January 1, 20XX]**
 6 **(Added 20XX)**

7 **Previous Action:**
 8 2022: Assigned to the Cannabis Task Group.

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

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

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

18 The submitter requested that this item be a Developing Item.

19 **Comments in Favor:**

20 **Regulatory:**
 21 • 2022 Interim: Several regulatory officials voiced support of continuing to develop this item. The State
 22 of Kansas noted that HB44 scale code Table 8 contains “recommended” minimum loads and cannot be
 23 used for enforcement. A suggestion was made to use e verification interval (instead of d) for the code
 24 application.

25 **Industry:**
 26 • 2022 Interim: The Scale Manufacturers Association supports developing the item and recommended
 27 aligning the item with HB44 Table 8, Recommended Minimum Load.
 28 • 2023 Interim: Charlie Rutherford (Task Group Co-Chairman) asked for assigned status.
 29 • 2023 Interim: Russ Vires (SMA) commented that user requirements do not typically apply to a
 30 particular commodity. Also supported further development and the additions to Table 7A.

- 1 • 2023 Annual: Charlie Rutherford, CPR Squared, Inc & Cannabis TG Co-Chair-waiting on items from
2 e vs d TG to progress before making further modifications to this item.

3 **Advisory:**

- 4 • None

5 **Comments Against:**

6 **Regulatory:**

- 7 • None

8 **Industry:**

- 9 • 2022 Interim: The Committee heard comments from industry members that do not support this item.
10 An industry member indicated that this proposal is an unprecedented requirement for devices for a
11 specific industry. A&D noted that if the item progresses, they would suggest a minimum scale
12 division of 0.01 g for weighments up to 100 g.

13 **Advisory:**

- 14 • 2022 Interim: NIST OWM reiterated their written analysis of this item and recommends it being
15 considered as a guidance document only. The full analysis can be found on the NCWM website.

16 **Neutral Comments:**

17 **Regulatory:**

- 18 • 2022 Interim: Some regulators voiced concern that this item should apply not only to cannabis but to
19 all commodities that are of high cost.

20 **Industry:**

- 21 • None

22 **Advisory:**

- 23 • None

24 **Item Development:**

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

29 Vince Wolpert
30 NCWM Cannabis Task Group
31 vwolpert@azda.gov

 Charles Rutherford
 NCWM Cannabis Task Group
 charlie@cprsquaredinc.com

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

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

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

3 **Regional Associations' Comments:**

4 WWMA 2022 Annual Meeting: Mr. Charles Rutherford (NCWM Cannabis Task Group) – Mr. Rutherford stated that
5 everything in this book isn't updated. They have added "and Cannabis" to Table 7. He also clarified that Cannabis
6 talks about Cannabis and Hemp. The Task Group expects to finish soon. He said that what is in the book is old and
7 no longer applies.

8 During open hearings, due to timing constraints, the Committee did not take comments on assigned items. The
9 Committee did allow the source to provide updates on these items. An update from the NCWM Cannabis Task Group
10 co-chair Charlie Rutherford was provided. The WWMA S&T Committee recommends that this item remain assigned.

11 SWMA 2022 Annual Meeting: Mr. Charlie Rutherford, Cannabis Task Group, stated that Table 1A has been updated
12 in the item.

13 The SWMA S&T Committee recommends this item remain as an Assigned Item.

14 CWMA 2022 Interim Meeting: Charlie Rutherford – ASTM International, Old version is still listed in today's agenda.
15 Pushing the suitable scales discussion to a later date.

16 The submitter provided updates to Table 7a. which add *Cannabis* verbiage to the weighing application column for
17 Classes I, II, and III.

18 The CWMA S&T Committee recommends this item remain Assigned with the NCWM Cannabis Task Group.

19 NEWMA 2022 Interim Meeting: The Committee recognizes comments received from Cannabis Task Group from
20 the CTG Scales Focus Group Chair, Mr. Lou Sakin. Mr. Charlie Rutherford (NCWM CTG Co-Chair) commented
21 that the scales focus group is under new leadership and the Chair is Lou Sakin. Mr. Rutherford pointed out that the
22 item under consideration is not current and current language was sent to the NEWMA. Mr. Rutherford requests a
23 voting status for this item. Mr. Lou Sakin (Holliston, MA) indicated that the new language was submitted to SWMA
24 and NEWMA. The Task Group chose to modify tables instead of changing the entire code. He believes that the item
25 is fully developed and ready for a voting status. Mr. James Cassidy (MA) requested that this item move forward as
26 voting with changes as proposed in the submitted documentation.

27 After hearing comments from the floor, the Committee agrees that the item has merit. The Committee agrees that the
28 item, with recommended changes below, is ready for a Voting status.

29 **Section 2.20 UR.3.1.2 Required Minimum Loads for Cannabis products.**

30 **The recommended minimum loads specified in Table 8 shall be considered required minimum loads for**
31 **scales used to weigh Cannabis and Cannabis-containing products.**
32 **[Non Retroactive as of January 1, 20XX]**

33 And

Table 7a. Typical Class or Type of Device for Weighing Applications	
Class	Weighing Application or Scale Type
I	Precision laboratory weighing <u>and weighing of all <i>Cannabis</i> products</u>
II	Laboratory weighing, precious metals and gem weighing, grain test scales, <u>and weighing of all <i>Cannabis</i> products</u>
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, <u>and weighing of all <i>Cannabis</i> products</u>
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
<p>Notes:</p> <p>A scale with a higher accuracy class than that specified as “typical” may be used.</p> <p><u>The use of italicized text in the references to “<i>Cannabis</i>” 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.</u></p>	

(Amended 1985, 1986, 1987, 1988, 1992, 1995, 2012, and 2021)

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

SCL-22.2
<p>Regional recommendation to NCWM on item status:</p> <p> <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input checked="" type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i> </p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>The committee heard no comments on this item during Open Hearings.</p> <p>The committee recommends this item remain an Assigned item.</p>

1

2 **AWS – AUTOMATIC WEIGHING SYSTEMS CODE**

3 **AWS-24.1 N.1.5. Test Loads,**

4 **Source:**

5 Marel Ltd.

6 **Purpose:**

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

8 **Item under Consideration:**

9 Amend Handbook 44 Automatic Weighing Systems Code as follows:

10 N.1.5. Test loads. - A performance test shall consist of at least four ~~separate test runs conducted at~~ different
 11 test loads according to Table N.1.5. Test Loads, **each load being run a minimum of ten consecutive times.**

12 **Previous Status:**

13 2024: New Proposal

14 **Original Justification:**

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

19

20 *HB 44 AWS, N.2.2.2. Automatic Tests. - The device shall be tested at the normal operating speed using packages.*
 21 *Test runs should be conducted using at least two test loads distributed over its normal weighing range (e.g., near*
 22 *the lowest and highest ranges in which the device is typically operated.) Each test load should be run a minimum*
 23 *of ten consecutive times.*

24

1 *Pub 14 AWS, 35.1.7. Dynamic tests: The device shall be tested at the highest speed for each weight range using*
 2 *standardized test pucks or packages. Test runs shall be conducted using four test loads as described in Table N.3.2.*
 3 *Each test load shall be run a minimum of 10 consecutive times.*

4
 5 Checkweighers have similar requirements but must be run the number of times as described in N.4.2 (copied
 6 below). All those numbers are 10 or greater so “minimum of 10 consecutive times” still works fine for
 7 checkweighers.

8
 9 **Table N.4.2 Number of Sample Weights per Test for Automatic Checkweighers**

<i>Weighing Range m = mass of test load</i>	<i>Number of Sample Weights per Test</i>
<i>20 divisions < m < 10 kg 20 divisions < m < 22 lb</i>	<i>60</i>
<i>10 kg < m < 25 kg 22 lb < m < 55 lb</i>	<i>32</i>
<i>25 kg < m < 100 kg 55 lb < m < 220 lb</i>	<i>20</i>
<i>100 kg (220 lb) < m</i>	<i>10</i>

10
 11 The submitter acknowledged the following potential arguments: The intention is for only four consecutive test runs
 12 per test loads. The openness of the wording allows laboratories and inspectors leeway to vary testing as they see fit
 13 for that application.

14 The submitter requested Voting status in 2024.

15 **Comments in Favor:**

16 **Regulatory:**

- 17 •

18 **Industry:**

- 19 •

20 **Advisory:**

- 21 •

22 **Comments Against:**

23 **Regulatory:**

- 24 •

25 **Industry:**

- 26 •

27 **Advisory:**

- 28 •

29 **Neutral Comments:**

1 **Regulatory:**

- 2 •

3 **Industry:**

- 4 •

5 **Advisory:**

- 6 •

7 **Item Development:**

8 New Proposal

9 **Regional Associations' Comments:**

10 New Proposal

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

AWS-24.1	
Regional recommendation to NCWM on item status:	
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>	
Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)	
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.	

13

14 **AWS-24.2** **N.1.6. Influence Factor Testing.**

15
 16 **Source:**
 17 Marel Ltd.

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

1 **Item under Consideration:**

2 Amend Handbook 44 Automatic Weighing Systems Code as follows:

3 ~~N.1.6. Influence Factor Testing. — Influence factor testing shall be conducted statically.~~

4 **Previous Status:**

5 2024: New Proposal

6 **Original Justification:**

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

10

11 *HB 44 AWS N.2*

12 *Note: If the device is designed for only automatic weighing, it shall only be tested in the automatic weighing mode.*
13 *(Amended 2004)*

14

15 *HB 44 AWS*

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

19

20 *Pub 14 AWS 36*

21 *Influence factor testing shall be conducted:*

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

25 The submitter acknowledged the following potential arguments: Influence factors should be tested statically (more
26 repeatable results not dependent on vibrations, conveyor belt transfers, etc.) and the other sections, for example HB
27 44 AWS N.2. and Pub 14 AWS 36, should be changed or removed.

28 The submitter requested Voting status in 2024.

29 **Comments in Favor:**

30 **Regulatory:**

- 31 •

32 **Industry:**

- 33 •

34 **Advisory:**

- 35 •

36 **Comments Against:**

37 **Regulatory:**

- 38 •

1 **Industry:**

- 2 •

3 **Advisory:**

- 4 •

5 **Neutral Comments:**

6 **Regulatory:**

- 7 •

8 **Industry:**

- 9 •

10 **Advisory:**

- 11 •

12 **Item Development:**

13 New Proposal

14 **Regional Associations' Comments:**

15 New Proposal

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

AWS-24.2
<p>Regional recommendation to NCWM on item status:</p> <p><input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Information Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i></p> <p><input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i></p> <p><input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i></p> <p><input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i></p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>Cory Hainy, SMA, state they have not met to develop a position on this item.</p> <p>The committee feels that this item has merit.</p> <p>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.</p>

18

1 **AWS-24.3** **N.22.3. Shift Test (Dynamic)**

2
3 **Source:**
4 Marel Ltd.

5 **Purpose:**
6 Introduce dynamic shift test for automatic weigh labelers.

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

9 **N.2.2.3. Shift Test (Dynamic).** - **The device shall be tested at the normal operating speed. A test load equal**
10 **to one-third (1/3) maximum capacity shall be passed over the load receiver or transport belt (1) halfway**
11 **between the center and front edge a minimum of 10 consecutive times, and (2) halfway between the center**
12 **and back edge a minimum of 10 consecutive times.**

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

14 **Previous Status:**
15 2024: New Proposal

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

20
21 Publication 14 AWS §35.1.8. (copied below for convenience) already describes an automatic/dynamic shift test
22 that has been used many times and is clearly understood by laboratories, inspectors, and manufacturers. By copying
23 this over to HB 44 and adapting the wording slightly, we can better align HB 44 and Pub 14 and reduce confusion
24 and misunderstandings.

25
26 *Pub 14 AWS*

27 *35.1. Static Tests*

28 **35.1.1. Increasing-load test...**

29 **35.1.2. Decreasing-load test...**

30 **35.1.3. Shift test...**

31 **35.1.4. Discrimination test...**

32 **35.1.5. Zero-load balance change...**

33 **35.1.6. Influence factor testing...**

34 *35.1.7. Dynamic tests: The device shall be tested at the highest speed for each weight range using*
35 *standardized test pucks or packages. Test runs shall be conducted using four test loads as described in*
36 *Table N.3.2. Each test load shall be run a minimum of 10 consecutive times.*

37 *35.1.8. Shift Test: To determine the effect of eccentric loading, for devices without a means to align packages,*
38 *a test load equal to one-third (1/3) maximum capacity shall be passed over the load receiver or*
39 *transport belt (1) halfway between the center and front edge, and (2) halfway between the center and back*
40 *edge.*

1

<i>(1)</i>
<i>(2)</i>

2

3

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.

6

7

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.

8

9

The submitter requested Voting status in 2024.

10

Comments in Favor:

11

Regulatory:

12

-

13

Industry:

14

-

15

Advisory:

16

-

17

Comments Against:

18

Regulatory:

19

-

20

Industry:

21

-

22

Advisory:

23

-

24

Neutral Comments:

25

Regulatory:

26

-

27

Industry:

28

-

29

Advisory:

30

-

31

Item Development:

32

New Proposal

33

Regional Associations’ Comments:

34

New Proposal

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

AWS-24.3
Regional recommendation to NCWM on item status: <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i> 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.

3

4 **WIM – WEIGH-IN-MOTION SYSTEMS – TENTATIVE CODE**

5 **WIM-23.1 I Remove Tentative Status and Amend Numerous Sections Throughout**

6 **Source:**

7 New York City DOT, C2SMART, Kistler, and Maryland DOT

8 **Purpose:**

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

11 **Item under Consideration:**

12 Amend Handbook 44 Weigh-In-Motions Systems Code as follows:

13 **Section 2.25. Weigh-In-Motion Systems** 14 **Used for Vehicle Screening and Enforcement – Tentative Code**

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

18 **A. Application**

1 **A.1. General.** – This code applies to **fixed (not portable)** systems used to weigh vehicles, while in motion, for
 2 the purpose of screening and sorting the vehicles based on the vehicle weight to determine if a static weightment is
 3 necessary **(Class A), and enforcing the weight limit of road vehicles (Class E).**

4 **A.2. Exception.** – This code does not apply to weighing systems intended for the collection of statistical traffic
 5 data.

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

8 **S. Specifications**

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

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

12 **S.1.2. Value of System Division Units.** – The value of a system division “d” expressed in a unit of weight
 13 shall be equal to:

14 (a) 1, 2, or 5; or

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

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

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

18 **S.1.3. Maximum Value of Division.** – The value of the system division “d” for ~~a Class A, weigh-in-motion~~
 19 **and Class E weigh-in-motion** systems shall not be greater than 50 kg (100 lb).

20 **S.1.4. Value of Other Units of Measure.**

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

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

24 (a) meters and decimal submultiples of a meter;

25 (b) feet and inches; or

26 (c) feet and decimal submultiples of a foot.

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

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

31 **S.1.6. Identification of a Fault.** – Fault conditions shall be presented to the operator in a clear and
 32 unambiguous means. The following fault conditions shall be identified:

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

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

- 1 ~~(e)~~(b) A change in vehicle speed greater than that specified has been detected.
- 2 (c) **Imbalanced weight between the left and right wheels has exceeded the specified values.**
- 3 (d) **Vehicle changing lanes between or in the proximity of the first and the last sensors.**
- 4 (e) **Any axle or wheel not on the load receiving element of the sensors.**

5 **S.1.7. Recorded Representations.**

6 **S.1.7.1. Values to be Recorded.** – At a minimum, the following values shall be printed and/or stored
7 electronically for each vehicle weighment. **Consult the specific jurisdictional legislation for additional**
8 **values that may be required to issue enforcement violations. All gross vehicle, axle, and axle group**
9 **weights must be printed and/or stored with the corrected values that include any necessary reductions**
10 **due to the system tolerance and adopted violation thresholds.**

- 11 (a) transaction identification number;
- 12 (b) **station ID;**
- 13 ~~(b)~~(c) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in
14 motion);
- 15 ~~(e)~~(d) vehicle speed;
- 16 ~~(d)~~(e) number of axles;
- 17 ~~(e)~~(f) weight of each axle;
- 18 ~~(f)~~(g) identification and weight of axle groups;
- 19 ~~(g)~~(h) axle spacing;
- 20 ~~(h)~~(i) total vehicle weight;
- 21 (j) **weight limits as specified in paragraph S.2.1;**
- 22 (k) **total vehicle length;**
- 23 ~~(i)~~(l) all fault conditions that occurred during the weighing of the vehicle, **as identified in paragraph**
24 **S.1.6.;**
- 25 ~~(j)~~(m) violations, as identified in paragraph S.2.1. Violation Parameters, which occurred during the
26 weighing of the vehicle; and
- 27 ~~(k)~~(n) time and date.

28 **S.1.8. Value of the Indicated and Recorded System Division.** – The value of the system’s division “(d),” as
29 recorded, shall be the same as the division value indicated.

30 **S.2. System Design Requirements.**

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

- 33 (a) single axle weight limit;
- 34 (b) axle group weight limit;
- 35 (c) gross vehicle weight limit; and
- 36 (d) bridge formula maximum.

1 The instrument shall display and/or record violation conditions when these parameters have been exceeded.
 2 **Jurisdiction-defined bridge formula can be used to determine the bridge formula maximum.**

3 **S.3. Design of Weighing Elements.**

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

9 **S.4. Design of Weighing Devices, Accuracy Class.**

10 **S.4.1. Designation of Accuracy.** – Weigh-in-motion systems meeting the requirements of this code shall be
 11 designated as accuracy Class A **or Class E.**

12 **Note:** This does not preclude higher accuracy classes from being proposed and added to this Code in the future
 13 when it can be demonstrated that weigh-in-motion systems grouped within those accuracy classes can achieve the
 14 higher level of accuracy specified for those devices.

15 **S.5. Marking Requirements.** – In addition to the marking requirements in G-S.1. Identification (except
 16 G.S.1.(e)), the system shall be marked with the following information:

- 17 (a) accuracy class;
- 18 (b) value of the system division “d”;
- 19 (c) operational temperature limits;
- 20 (d) number of instrumented lanes (not required if only one lane is instrumented);
- 21 (e) minimum and maximum vehicle speed;
- 22 (f) maximum number of axles per vehicle;
- 23 (g) maximum change in vehicle speed during weighment; and
- 24 (h) minimum and maximum load.

25 **S.5.1. Location of Marking Information.** – The marking information required in Section 1.10. General Code,
 26 G-S.1. Identification and Section 2.25. Weigh-in-Motion Systems, S.5. Marking Requirements shall be visible
 27 after installation. The information shall be marked on the system or recalled from an information screen.

28 **N. Notes**

29 **N.1. Test Procedures.**

30 **N.1.1. Selection of Test Vehicles.** – All dynamic testing associated with the procedures described in each
 31 of the subparagraphs of N.1.5 shall be performed with ~~a minimum of two~~ **the following** test vehicles **for each**
 32 **Class A and Class E system.**

33 **N.1.1.1. Selection of Test Vehicles for Class A – A minimum of two vehicles below shall be used.**

- 34 (a) The first test vehicle may be a two-axle, six-tire, single-unit truck; that is, a vehicle with two axles
 35 with the rear axle having dual wheels. The vehicle shall have a maximum gross vehicle weight of
 36 10 000 lb.

(b) The second test vehicle shall be a five-axle, single-trailer truck with a maximum gross vehicle weight of 80 000 lb.

N.1.1.2. Selection of Test Vehicles for Class E – A minimum of three vehicles below shall be used.

(a) The first test vehicle may be 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) The second test vehicle shall be a five-axle, single-trailer truck or FHWA Class 9 3S2 Type.

(c) The third test vehicle shall be a three-axle, single-unit truck or FHWA Class 6.

(d) The gross vehicle weights shall be as stated in N.1.2.3.

Note 1: Consideration should be made for testing the systems using vehicles which are typical to the system’s daily operation.

Note 2: Vehicles with liquid loads to be excluded from the testing and from enforcement.

N.1.1.1-3. Weighing of Test Vehicles. – All test vehicles shall be weighed on a reference scale, **meeting the requirements of Appendix A,** before being used to conduct the dynamic tests.

N.1.1.2-4. Determining Reference Weights for Axle, 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 for Class A. – Test vehicles used for dynamic testing shall be loaded to 85 % to 95 % of their legal maximum Gross Vehicle Weight **for a minimum of 20 runs per test vehicle type.** The “load” shall be non-shifting and shall be positioned to present as close as possible, an equal side-to-side load.

N.1.2.3. Dynamic Test Loads for Class E. – **Test vehicles used for dynamic testing shall be loaded in two (2) different load conditions. The “load” shall be non-shifting and shall be positioned to present as close as possible, an equal side-to-side load.**

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

(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

N.1.3. Reference Scale. – Each reference vehicle shall be weighed statically on **a vehicle scale, either multi-platform or single-platform.**

N.1.3.1. Multi-Platform Vehicle Scale – A multiple-platform vehicle scale comprised of three individual weighing/load-receiving elements, each an independent scale. 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;

- 1 (a) the simultaneous weighing of each single axle and axle group of the reference test vehicles on
 2 different individual elements of the scale; and
 3 (b) gross vehicle weight determined by summing the values of the different reference axle and reference
 4 axle groups of a test vehicle.

5 **N.1.3.2. Single Platform Vehicle Scale – Each individual axle or axle group of the reference test**
 6 **vehicles shall be measured on the single platform vehicle scale. Only the single axle or axle group for**
 7 **measurement shall be on the single platform, while other single axles or axle groups shall be off the**
 8 **platform. The GVW shall be determined by summing all the single axles and axle groups.**

9 The scale shall be tested immediately prior to using it to establish reference test loads and in no case more than
 10 24 hours prior. To qualify for use as a suitable reference scale, it must meet NIST Handbook 44, Class III L
 11 maintenance tolerances.

12 **N.1.3.3. Location of a Reference Scale.** – The location of the reference scale must be considered since
 13 vehicle weights will change due to fuel consumption.

14 **N.1.4. Test Speeds.** – All dynamic tests shall be conducted ~~within 20 % below or at the posted speed limit~~
 15 **at the designated speed(s).**

16 **N.1.4.1. Test Speeds for Class A – Speed shall be within 20% below or at the posted speed limit.**

17 **N.1.4.2. Test Speeds for Class E – Two speeds shall be used.**

18 **(a) high speed –**

19 **(1) within 10 mph below the maximum posted speed limit; or**

20 **(2) operational speed given traffic conditions if high speed cannot be met.**

21 **(b) low speed – site-specific minimum speed, but not below manufacturer’s specifications.**

22 **N.1.5. Test Procedures.**

23 **N.1.5.1. Dynamic Load Test for Class A.** – The dynamic test shall be conducted using the test vehicles
 24 defined in N.1.1.1. Selection of Test Vehicles **for Class A.** The test shall consist of a minimum of 20 runs
 25 for each test vehicle at the speed as stated in N.1.4.1. Test Speeds **for Class A.**

26 At the conclusion of the dynamic test, there will be a minimum of 20 weight readings for each single axle,
 27 axle group, and gross vehicle weight of ~~the each~~ test vehicle. The tolerance for each weight reading shall be
 28 based on the percentage values specified in Table T.2.2 Tolerances ~~for Accuracy Class A.~~

29 **N.1.5.2. Vehicle Position Test for Class A.** – During the conduct of the dynamic testing, ensure the
 30 vehicle stays within the defined roadway along the width of the sensor. The test shall be conducted with
 31 10 runs with the vehicle centered along the width of the sensor; 5 runs with the vehicle on the right side along
 32 the width of the sensor; and 5 runs with the vehicle on the left side along the width of the sensor. Only gross
 33 vehicle weight is used for this test and the tolerance for each weighment shall be based on the tolerance value
 34 specified in T.2.3. Tolerance Value for Vehicle Position Test.

35 **N.1.5.3. Dynamic Load Test for Class E. – The dynamic test shall be conducted using the test**
 36 **vehicles defined in N.1.1.2. Selection of Test Vehicles for Class E. The test shall consist of a minimum**
 37 **of 30 runs for each test vehicle. A minimum of 10 runs at partial load condition and a minimum of 20**
 38 **runs at full load condition.**

At the conclusion of the dynamic test, there will be a minimum of 30 weight readings or 15 weight readings at each speed for each single axle, axle group, and gross vehicle weight. The tolerance for each weight reading shall be based on the percentage values specified in Table T.2.2. Tolerances at 100% compliance.

See Table N.1.5. below to summarize all the test runs for Class E.

<u>Table N.1.5.</u>	
<u>Number of Test per Each Test Vehicle for Class E</u>	
<u>Load Condition</u>	<u>Speed</u>
<u>Full Load (20 runs)</u>	<u>High Speed* (10 runs)</u>
	<u>Low Speed (10 runs)</u>
<u>Partial Load (10 runs)</u>	<u>High Speed* (5 runs)</u>
	<u>Low Speed (5 runs)</u>
<u>*High Speed as defined in N.1.4.2.(a).</u>	

N.1.6. Axle Spacing Test Procedures.

N.1.6.1. Reference Axle Spacing – Before measuring the reference axle spacing, the test vehicle shall be positioned straight, and the driving axle shall also be straight. A steel tape measure shall be used to determine the reference axle spacing. Both left and right axle spacing shall be measured, and the average of two measurements shall be recorded to the nearest centimeter or inch. Each axle spacing shall be individually made by a single measurement.

N.1.5.3.6.2. 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 Class A.

T.2.1. Tests Involving Digital Indications or Representations. – To the tolerances that would otherwise be applied in paragraphs T.2.2. Tolerance Value for Dynamic Load Test and T.2.3. Tolerance Value for Vehicle Position Test, there shall be added an amount equal to one-half the value of the scale division to account for the uncertainty of digital rounding.

T.2.2. Tolerance Values for Dynamic Load Test. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.2.

Table T.2.2. Tolerances for Accuracy Class A	
Load Description*	Tolerance as a Percentage of Applied Test Load
Axle Load	± 20 %
Axle Group Load (including bridge formula)	± 15 %
Gross Vehicle Weight	± 10 %
<p>* Class A for Screening Purposes: No more than 5 % of the weighments in each of the load description subgroups shown in this table shall exceed the applicable tolerance.</p> <p>Class E for Enforcement Purposes: All weighments shall be 100% compliant.</p> <p><u>Any weighments with any fault as identified in paragraph S.1.6. shall not be included in determining tolerances for accuracy.</u></p>	

1
2 **T.2.3. Tolerance Value for Vehicle Position Test for Class A.** – The tolerance value applied to each gross
3 vehicle weighment is ± 10 % of the applied test load.

4 **T.2.4. Tolerance Value for Axle Spacing.** – The tolerance value applied to each axle spacing measurement
5 shall be ± ~~0.15 m~~ **15 cm (0.5 ft)** ~~6 inches~~ **at 100% compliance.**

6 **T.3. Influence Factors.** – The following factor is applicable to tests conducted under controlled conditions only.

7 **T.3.1. Temperature.** – Systems shall satisfy the tolerance requirements under all operating temperature unless
8 a limited operating temperature range is specified by the manufacturer.

9 **T.4. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility.** – The
10 difference between the weight indication due to the disturbance and the weight indication without the disturbance shall
11 not exceed the tolerance value as stated in Table T.2.2 Tolerances ~~for Accuracy Class A.~~

12 **UR. User Requirements**

13 **UR.1. Selection Requirements.** – Equipment shall be suitable for the service in which it is used with respect to
14 elements of its design, including but not limited to, its capacity, number of scale divisions, value of the scale division,
15 or verification scale division and minimum capacity.

16 **UR.1.1. General.** – The typical class or type of device for particular weighing applications is shown in
17 Table 1. Typical Class or Type of Device for Weighing Applications.

Table 1.	
Typical Class or Type of Device for Weighing Applications	
Class	Weighing Application
A	Screening and sorting of vehicles based on axle, axle group, and gross vehicle weight.
<u>E</u>	<u>Enforcing of vehicles based on axle, axle group, and gross vehicle weight</u>
Note: A WIM system with a higher accuracy class than that specified as “typical” may be used.	

1 **UR.2. User Location Conditions and Maintenance.** – The system shall be installed and maintained as defined in
 2 the manufacturer’s recommendation.

3 **UR.2.1. System Modification.** – The dimensions (e.g., length, width, thickness, etc.) of the load receiving
 4 element of a system shall not be changed beyond the manufacturer’s specifications, nor shall the capacity of a
 5 scale be increased beyond its design capacity by replacing or modifying the original primary indicating or
 6 recording element with one of a higher capacity, except when the modification has been approved by a competent
 7 engineering authority, preferably that of the engineering department of the manufacturer of the system, and by
 8 the weights and measures authority having jurisdiction over the system.

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

11 On load-receiving elements, which use moving parts for determining the load value, clearance shall be provided
 12 around all live parts to the extent that no contacts may result when the load-receiving element is empty, nor
 13 throughout the weighing range of the system.

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

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

18 **UR.4. Enforcement Considerations.** – **Prior to the issuance of an enforcement violation, the user shall consult**
 19 **the specific jurisdictional legislation and/or protocol for additional criteria to determine vehicle compliance.**
 20 **All gross vehicle, axle, and axle group weights must be printed and/or stored with the corrected values that**
 21 **include any necessary reductions due to the system tolerance and adopted violation thresholds.**

22 **Appendix D. Definitions**

23 The specific code to which the definition applies is shown in the [brackets] at the end of the definition. Definitions
 24 for the General Code [1.10] apply to all codes in NIST Handbook 44.

25 **A**

26 **axle.** – The axis oriented transversely to the nominal direction of vehicle motion, and extending the full width of the
 27 vehicle, about which the wheel(s) at both ends rotate. [2.25]

28 **axle-group load.** – The sum of all tire loads of the wheels on a group of adjacent axles; a portion of the gross-vehicle
 29 weight. [2.25]

1 **axle load.** – The sum of all tire loads of the wheels on an axle; a portion of the gross-vehicle weight. [2.25]

2 **axle spacing.** – The distance between the centers of any two axles. When specifying axle spacing, the axels used also
3 need to be identified. [2.25]

4 **S**

5 **single-axle load.** – The load transmitted to the road surface by the tires lying on the same longitudinal axis (that axis
6 transverse to the movement of the vehicle and about which the wheels rotate). [2.25]

7 **T**

8 **tandem-axle load.** – The load transmitted to the road surface by the tires of two single-axles lying on the same
9 longitudinal axis (that axis transverse to the movement of the vehicle and about which the wheels rotate). [2.25]

10 **triple-axle load.** – The load transmitted to the road surface by the tires of three single-axles lying on the same
11 longitudinal axis (that axis transverse to the movement of the vehicle and about which the wheels rotate). [2.25]

12 **W**

13 **weigh-in-motion (WIM).** – A process of estimating a moving vehicle’s gross weight and the portion of that weight
14 that is carried by each wheel, axle, or axle group, or combination thereof, by measurement and analysis of dynamic
15 vehicle tire forces. [2.25]

16 **weigh-in-motion screening scale.** – A weigh-in-motion system used to identify potentially overweight vehicles.
17 [2.25]

18 **wheel weight.** – The weight value of any single or set of wheels on one side of a vehicle on a single axle. [2.25]

19 **WIM System.** – A set of sensors and supporting instruments that measure the presence of a moving vehicle and the
20 related dynamic tire forces at specified locations with respect to time; estimate tire loads; calculate speed, axle spacing,
21 vehicle class according to axle arrangement, and other parameters concerning the vehicle; and process, display, store,
22 and transmit this information. This standard applies only to highway vehicles. [2.25]

23 **Previous Action:**

24 2023: New Item

25 **Original Justification:**

26 **1. INTRODUCTION**

27 The Brooklyn-Queens Expressway (BQE) is an aging and deteriorating 6-lane highway which comprises a
28 critical link of I-278 - the sole Interstate highway in Brooklyn, connecting it to Manhattan, Staten Island, and
29 Queens in New York. Constructed in 1954 and comprised of varying and complex structure types, the segment
30 of the BQE between Atlantic Ave. Interchange to the South and Sands St. to the North is nearing the end of its
31 design life. Urgent repairs are underway, while roughly 110 spans may be in need of intervention by 2028, and
32 another 75 spans may be in need of intervention within the next decade. Weigh in Motion (WIM) sensors,
33 installed in October 2019, have revealed overweight vehicles, excessively exceeding FHWA legal load limits,
34 with gross vehicle weights (GVW) that range from just over 80,000 lbs to as high as 200,000. The continued
35 presence of overweight vehicles on the BQE contributes to the continued structural deterioration of this aging
36 piece of infrastructure. The New York State legislature recently authorized the New York City Department of
37 Transportation to conduct automated overweight vehicle enforcement through a WIM demonstration program;
38 however, a universal standard has not yet been established that specifically defines a protocol for calibration
39 and certification by the New York State local Division of Weights and Measures.

40
41 In response to this challenge, this proposal seeks an amendment of Section 2.25 of NIST Handbook 44 to allow

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

7
8 The combined interstate data presented here stresses the national importance of establishing protocols for
9 automated vehicle weight enforcement using WIM, citing:

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

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

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

28
29 Its aging characteristics are evidenced by a number of factors, including:

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

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

1
2 The New York City Mayoral Executive Order 51, executed in January 2020, mandated the formation of the
3 New York City Police Department (NYPD) BQE Truck Enforcement Task Force, whose purpose is to ensure
4 that all existing weight restrictions on the BQE are strictly enforced. However, the lack of roadway shoulders
5 on this stretch of the BQE means that there is insufficient space for the New York City Department of
6 Transportation (NYCDOT) to introduce stationary weighing stations, or for NYPD enforcement officers to pull
7 over overweight vehicles and use portable scales to screen and enforce legal weight limits.

8
9 Urgent repairs are currently underway for two spans within this complex network, while structural assessments
10 show that roughly 110 spans may be in need of intervention by 2028, and roughly 75 spans may be in need of
11 intervention within the next decade.

12
13 In response to this challenge, NYCDOT has initiated aggressive efforts to develop and implement a plan that
14 maintains the operational safety of the BQE, as well as protects its structural integrity, including the pursuit of
15 automated weight enforcement using WIM on this segment of corridor. It has combined its efforts with other
16 local and State agencies in order to demonstrate that this is not an isolated local problem, but a national need.

17 3. AUTOMATED TRUCK ENFORCEMENT USING WIM: THE NATIONAL NEED

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

25
26 Vehicles on Interstate highways must conform to the Federal Bridge Formula (FBF), designed to protect bridges
27 from vehicle overloads beyond the legal limits. To date, the enforcement regulations have been executed at
28 stationary weighing stations across the nation, especially at the borders between states. However, the stationary
29 stations have limited resources for effective enforcement because: (1) the number of stationary weighing
30 stations is not spatially well distributed across the nation; (2) the operation hours are limited; and (3) the number
31 of enforcement officers is insufficient.

32
33 Though each state allows a certain number of permitted vehicles to exceed the FHWA weight limits on
34 Interstate Highways, the number of permit overweight vehicles is typically a small fraction of the total.
35 According to a previous study (Nassif et al., 2016)¹, the number of permit overweight vehicles is only 4% of the
36 total overweight vehicles observed at NJ WIM stations. In New Jersey, it was also noticed that the overweight
37 vehicles cited at the stationary weighing stations were only a small fraction (6.4%) of the *actual* overweight
38 populations recorded by the WIM sensors on the main lanes, and this is, in turn, 0.142% of the total number of
39 vehicles (Nassif et al., 2021)². In New York City, enforcement officers have been able to cite only 14.7% of the
40 *actual* number of overweight vehicles on and near Interstate Highway I-278 between February and December of
41 2021. Therefore, the overweight enforcement practices at the stationary weighing stations, combined with
42 using mobile enforcement units, are ineffective in substantially reducing the percentage of overweight vehicles.

43
44 The figure below summarizes the percent of overweight vehicles, relative to the ADTT for each US State. The
45 overall overweight percentage out of ADTT is 13.2%, based on the data in the figure below.

¹ Nassif, H., K. Ozbay, H. Wang, R. Noland, P. Lou, S. Demiroglu, 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

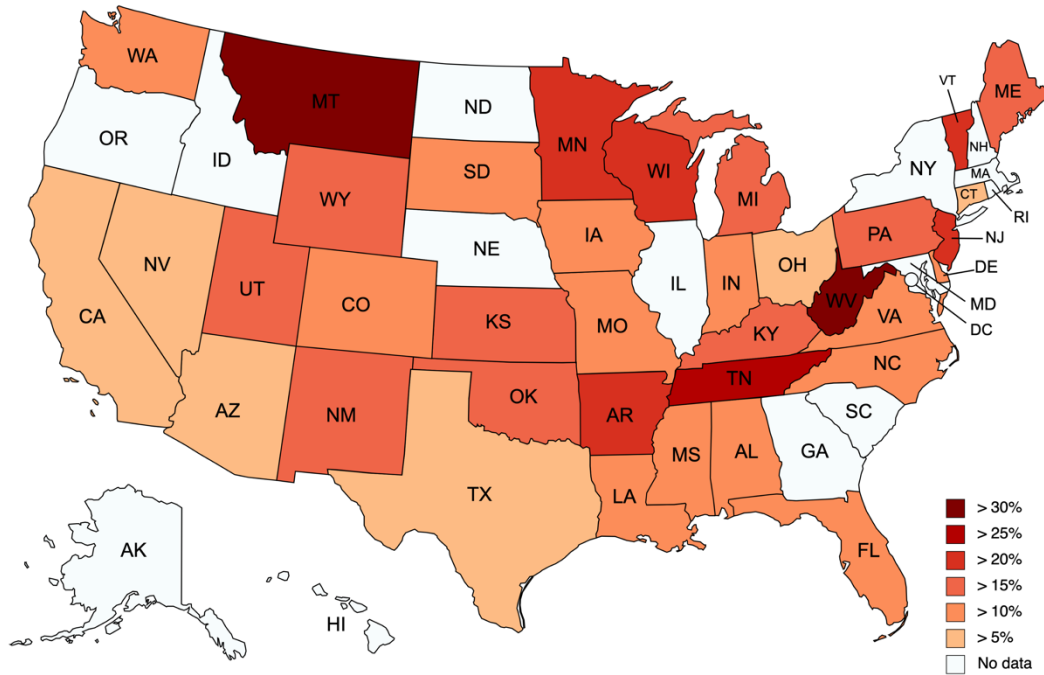


Figure 1. Overweight percentage per State

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.

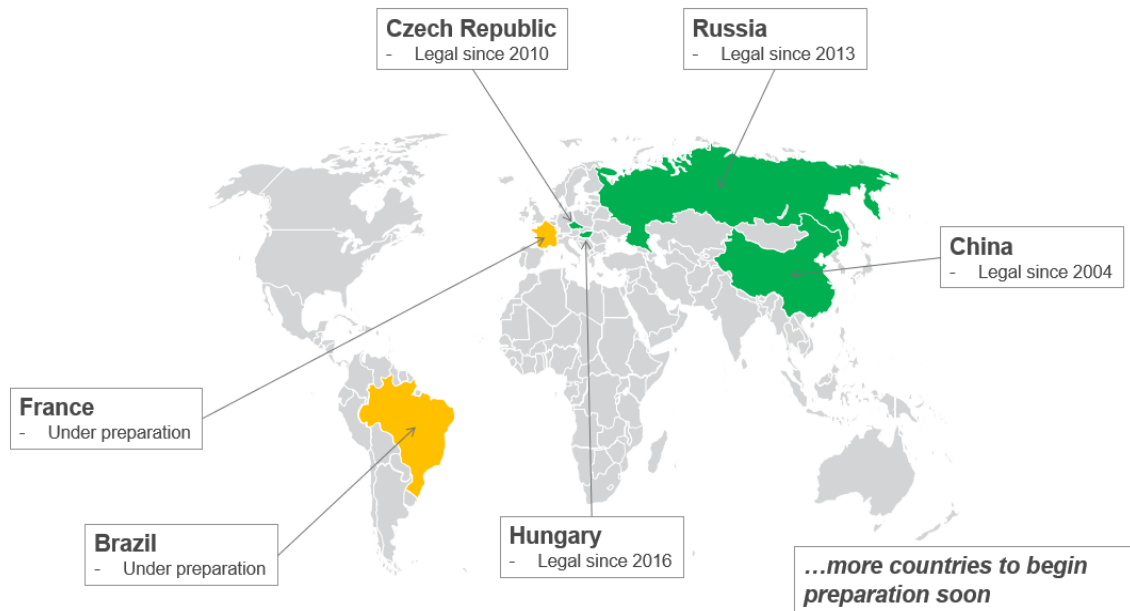
Attachment A includes data from New York, Indiana, and Maryland, proving the accuracy of their WIM technology. Additionally, Wisconsin, and two other States have expressed interest in sharing data from their sites which meet these accuracy requirements.

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.

1 **5. CONCLUSIONS**

2 Across the nation, the deterioration of aging infrastructure is exacerbated by the presence of overweight
 3 vehicles in excess of the Federal Bridge Formula (FBF). Though several states have implemented vehicle
 4 weight enforcement measures using a screening protocol that includes the use of mobile enforcement officers
 5 and stationary scales, these measures have been insufficient in significantly reducing the volumes of overweight
 6 vehicles on the nation’s infrastructure. The use of WIM for the purposes of automated vehicle weight
 7 enforcement would both alleviate this problem and free up local and state resources to address other safety
 8 concerns. However, to date, no unified national standard specifically paves the way for the certification of
 9 WIM technology to be used for the purposes of automated vehicle weight enforcement. The amendment of
 10 Section 2.25 of NIST Handbook 44 will provide such a standard. With several states evidencing the proven
 11 accuracy of current WIM technology, the amendment of Section 2.25 to expand its screening provisions to
 12 include automated vehicle weight enforcement using WIM is both prudent and justified.
 13

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



20 Figure 2. Automated enforcement around the world

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

22 **Comments in Favor:**

23 **Regulatory:**

- 24 • Interim 2023: Doug Musick (State of Kansas) commented as to the original intent was for screening
 25 and now to become enforcement. Supports developmental status as the tolerances are not fully
 26 understood.

- 1 • Interim 2023: Tim Chesser (State of Arkansas) commented that he supports removing the tentative
2 status for screening and that a set procedure for testing is missing from the proposal. This cannot be
3 guesswork. Recommended Developmental status.
4 • Annual 2023: The State of New York commented they had attended a demonstration of the WIM
5 system in Wisconsin and was confident with the resulting test data.

6 **Industry:**

- 7 • Interim 2023: Tanvi Pandya (NYC DOT- Submitter) gave a brief overview of the deteriorating
8 infrastructure issue on the Bronx Queens Expressway in NYC and this proposal seeks to remove the
9 tentative status of the WIM proposal and establish testing standards for the automated enforcement of
10 weight infractions.
11 • Interim 2023: Jess Helmlinger from Kistler gave a brief presentation. Commented also that this
12 application is to increase efficiency vs accuracy and the tolerances proposed allow for the tolerance to
13 be taken into account.
14 • Interim 2023: Russ Vires (SMA) recommended to remove the tentative status and use this code as
15 originally intended for screening.
16 • Annual 2023: The submitters of the proposal gave a presentation with the July 2023 updates to their
17 proposal that appeared on the NCWM website.

18 **Advisory:**

- 19 • Interim 2023: Jan Konijnenburg (NIST OWM) supports this item, but item is not ready for a vote yet.
20 This application is for situations that do not allow for static scales.
21 • Annual 2023: NIST OWM commented that this proposal has come a long way in a short amount of
22 time. NIST does not share the concerns of the SMA. This system is a law enforcement application,
23 not commercial, and they can't be compared.

24 **Comments Against:**

25 **Regulatory:**

- 26 • Interim 2023: Vince (State of Arizona) commented that the notes are confusing and needs work.
27 • Annual 2023: The State of California commented that the newest version of the submitters proposal
28 that appeared on the NCWM website had not been reviewed as of this meeting, however, there could
29 be issues with creating a wider tolerance for dynamic scales.

30 **Industry:**

- 31 • Annual 2023: The SMA commented that they oppose this item as highway enforcement scales are
32 currently listed as Class III and dynamic scales should not have a greater tolerance.

33 **Advisory:**

- 34 • None

35 **Neutral Comments:**

36 **Regulatory:**

- 37 • None

38 **Industry:**

- 39 • None

1 **Advisory:**

- 2 • None

3 **Item Development:**

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

12 NCWM 2023 Annual Meeting: The committee used the updated (7/11/23) proposal from the submitters as a basis for
13 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),
14 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
15 needs to better clarify the use of “single platform vehicle scale”. As written, it currently promotes split weighing, or
16 could be confused with the use of axle-load scales. The committee encourages the submitters to continue to work
17 with the committee, NIST OWM and other stakeholders to further develop this item.

18 **Regional Associations’ Comments:**

19 WWMA 2022 Annual Meeting: Ms. Tanvi Pandya (New York City DOT) – Ms. Pandya stated technologies have
20 moved on. Ms. Pandya noted New York City DOT has data since 2019 showing that accuracy can be met on the
21 devices. Ms. Pandya added the Handbook is outdated and needs to be updated to provide a way to enforce and it
22 cannot be overstated the number of overweight vehicles that need to be regulated. Ms. Pandya recommended a voting
23 status.

24 Mr. Chaekuk Na (Rutgers University) – Mr. Chaekuk stated the submitters of the item tried to meet the standard and
25 got less than 6% error with 100% compliance. Mr. Chaekuk stated Indiana DOT conducted an independent test and
26 received results within 5% error.

27 Mr. Jess Helmlinger (Kistler Group) – Mr. Helmlinger clarified Mr. Chaekuk’s comments regarding test loads with
28 testing occurring with both loaded and unloaded vehicles in live traffic and static weights for fairness. Mr. Helmlinger
29 noted changing the test procedure on live traffic and status weights had no impact. Mr. Helmlinger made reference to
30 the current tentative code for the tolerances are wide and questioned how to test currently – use live trucks and a
31 reference scale. Mr. Helmlinger confirmed this is for law enforcement and not commercial weighing. Mr. Helmlinger
32 stated the submitters have worked with NIST and a multitude of states. Mr. Helmlinger stated the item is intended for
33 states that want to use automated enforcement and would not force any jurisdiction to use it. Mr. Helmlinger
34 recommended a voting status.

35 Mr. Matt Douglas (State of California, Division of Measurement Standards on behalf of S&T Committee) – Mr.
36 Douglas sought clarification about the line inside the proposed tolerance table and what the purpose of the second
37 statement. On the last line in the table, it says that the gross vehicle weight shall be +/- 10% but it also says +/- 6%.

38 Mr. Jess Helmlinger (Kistler Group) – Mr. Helmlinger addressed Mr. Douglas comments and clarified the 6% is for
39 gross vehicle weight with a 95% compliance. Mr. Helmlinger referred to the proposed tolerance table and noted the
40 outcome cannot have more than 5% of the values outside the tolerance. Mr. Helmlinger stated if any value is outside
41 of 10% accuracy, then it fails the test. 95% of the values must be within the values.

42 Mr. Jan Konijnenburg (NIST Associate) – Mr. Konijnenburg confirmed NIST has been involved with this item but
43 has not reviewed the proposal in detail to come to a conclusion. Mr. Konijnenburg made reference the WIM code that
44 currently exists is idle and obsolete. Mr. Konijnenburg acknowledged this is a method of a WIM system enforcement.

SWMA S&T 2023 Annual Meeting Report

- 1 Mr. Konijnenburg stated he is looking forward to how this will develop. Mr. Konijnenburg made no recommendation
2 at this time for the status of this item.
- 3 Mr. Raymond Johnson (Fairbanks Scales, Inc., representing the Scale Manufacturers Association) – Mr. Johnson
4 commented the SMA has not met and has not formulated a position on this item. Mr. Johnson commented the SMA
5 is scheduled to meet in November 2022.
- 6 Mr. Matt Douglas (State of California, Division of Measurement Standards) – Mr. Douglas commented he believes
7 that there is some merit to some of the item. Mr. Douglas recommended keeping the accuracy class “A” and add
8 accuracy class “E”.
- 9 Mr. Kenn Burt (San Luis Obispo County, California on behalf of S&T Committee) – Mr. Burt sought clarification if
10 industry has seen this proposal and understand what they might be dealing with regard to how the WIM system will
11 be used and applied for enforcement?
- 12 Ms. Tanvi Pandya (New York City DOT) – Ms. Pandya addressed Mr. Burt’s question regarding industry reviewing
13 this item. Ms. Pandya commented the submitters have met regularly and developed a task force. Ms. Pandya
14 commented the task force has discussed this for the past several months. Ms. Pandya commented they have not directly
15 engaged with the trucking industry but have spoken with some freight industry in general.
- 16 Mr. Jess Helmlinger (Kistler Group) – Mr. Helmlinger commented the Commercial Vehicle Safety Alliance (CVSA)
17 has been made aware of this item.
- 18 During open hearings there was testimony that neither the SMA nor NIST has evaluated this proposal. The committee
19 looks forward to the analysis of this item by NIST and SMA. The committee asked the submitters questions about
20 the tolerance table “T.2.2. Tolerances for Accuracy Class E”, specifically the last line in the table. The submitter
21 clarified their statement made during open hearings in the committee work session. The committee recommended
22 that the submitter consult the Scales Code for similar applications to expressing tolerances.
- 23 The WWMA S&T Committee recommends that this item be assigned a developing status.
- 24 SWMA 2022 Annual Meeting: Dr. Hanni Nasif of Rutgers University, the submitter of this item, presented. During
25 the presentation he stated that the device currently operates within 6% of the Type III ASTM Standard. The submitter
26 stated that their intentions is for direct enforcement fines to not apply within 10 % of weight limit based on local
27 enforcement procedures.
- 28 Mr. Peter Fedechko, International Road Dynamics, stated that he supports this item.
- 29 Mr. Chesser, State of Arkansas, stated that he liked the language on page 167 lines 25-28. He asked why strike
30 paragraph B. He also cited some errors on page 170.
- 31 Mr. Paul Floyd, State of Louisiana, stated that he has concerns about the accuracy of this system. He stated that he
32 would support this item for screening purposes and recommends it moving forward as developing.
- 33 The SWMA S&T Committee asked about the speed and weight requirements used for testing in the proposal not
34 matching with what the devices will be used to regulate. The committee also questioned whether these devices would
35 receive a type evaluation from NTEP if specifications were added to the handbook. Additionally, the committee
36 questioned whether a direct enforcement procedure should be separated from the tentative screening code.
- 37 The SWMA S&T Committee recommends this item move forward as a Developing Item

1 CWMA 2022 Interim Meeting: Hani Nassif – Rutgers, Overweight percentages of trucks are impacting roadways
 2 and bridges. The screening process in the existing tentative code doesn't apply to enforcement of overweight
 3 commercial trucks.

4 Jess Helmlinger – Kistler Instruments, Tentative code has large tolerances and that's why it isn't being used by most
 5 states. The technology has improved to 4 % or 5 % tolerance capability since the tentative code was written. Tentative
 6 screening code doesn't hold up in court when overweight tickets are challenged. These changes are for law
 7 enforcement purposes; not necessarily commercial. The intent is not to require adoption, but to allow the use by states
 8 who wish to utilize it.

9 Doug Musick – Kansas, Question: 3 truck classes, 3 different loads, 3 different speeds.....is the intention that there are
 10 different classes of trucks which are all tested at all 3 different loads and speeds?

11 What does FHWA mean? Spell out the acronym. Is that in a C.F.R. which can be referenced?

12 Loren Minnich – Kansas, P 168, S.1.7.1. missing the lettering, but it's that way in the tentative code. Formatting needs
 13 fixed. Don't get rid of the current screening aspect of the tentative code. Supports this item moving on its own and not
 14 take away the ability of jurisdictions to use the tentative code for screening. Maybe add a second class?

15 The CWMA S&T Committee recommends this as a Developing item. The Committee would like more input from
 16 jurisdictions who would be affected by removing the screening aspect of the tentative code.

17 NEWMA 2022 Interim Meeting: A presentation was given from the submitters of this item. The submitters reminded
 18 the body that this item deals exclusively with law enforcement scales, and not commercial scales. Mr. John McGuire
 19 (NJ) inquired about a 10% leeway in gross weight and believes that if a law enforcement agency is writing summonses,
 20 the tolerance should be tighter. He also inquired if the SMA and NIST had a position on this proposal. Ms. Dawn
 21 Harrison (NYC-DOT) indicated that the 10% leeway was chosen as a local enforcement policy because they believe
 22 that percentage on gross vehicle weight falls within tolerances of WIM systems and wants to target heaviest offenders.
 23 Any violations written by law enforcement have to be reviewed prior to issuance. Mr. Jess Helmlinger (Kistler)
 24 indicated that the system will be tested to a 6% tolerance and fines would be issued at 10%. Mr. Jim Willis (NY) stated
 25 that his understanding is there is a concern with both axel weights and gross weights of the overweight vehicles. Ms.
 26 Diane Lee (NIST-OWM) inquired if this system will be used to provide official weight or estimation, and if weight is
 27 not correct are they going to weigh station to get official weight. Mr. Jess Helmlinger (Kistler) indicated that during
 28 testing, they will be tested with a certified field reference scale and vehicles. Mr. Jason Flint (NJ) pointed out that the
 29 10% leeway is a local enforcement decision and will not appear in the handbook as a tolerance. Mr. Jim Willis (NY)
 30 has concerns with the number of runs required to test the system. Mr. Roy Czinku (International Road Dynamics)
 31 stated that WIM is a mature technology and can provide reliable output and weighments. Mr. John McGuire (NJ)
 32 recommended the item as developing so a further look can be taken into the dynamics of WIM. Mr. Jason Flint (NJ)
 33 suggested that an on-site demonstration be made available so regulators can view the system being used.

34 After hearing comments from the floor, the Committee agrees that the item has merit. Considering the underlying
 35 questions about tolerances and test procedures, the Committee is recommending a Developing status.

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

WIM-23.1

Regional recommendation to NCWM on item status:

- Recommend as a Voting Item on the NCWM agenda
- Recommend as an Information Item on the NCWM agenda
- Recommend as an Assigned Item on the NCWM agenda
(To be developed by an NCWM Task Group or Subcommittee)
- Recommend as a Developing Item on the NCWM agenda
(To be developed by source of the proposal)
- Recommend Withdrawal of the Item from the NCWM agenda
(In the case of new proposals, do not forward this item to NCWM)
- No recommendation from the region to NCWM
(If this is a new proposal, it will not be forwarded to the national committee by this region)

Comments and justification for the regional recommendation to NCWM: *(This will appear in NCWM reports)*

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.

1

2 **VTM – VEHICLE TANK METERS**

3 **VTM-20.2 A Table T.2. Tolerances for Vehicle Mounted Milk Meters.**

4 *NOTE: This item was revised based on changes that were made by the Committee at the 2021 Interim Meeting. The*
 5 *item under consideration was removed from the voting consent calendar at the 2021 Annual Meeting and the S&T*
 6 *Committee made this a developing item.*

1 **Source:**
 2 POUL TARP A/S

3 **Purpose:**
 4 Change tolerances to accommodate more efficient milk-metering systems.

5 **Item Under Consideration:**
 6 Amend Handbook 44, Vehicle-Tank Meters Code as follows:

7 **T.2. Tolerance Values.** – Tolerances shall be as shown in Table 1. Accuracy Classes and Tolerances for Vehicle-
 8 Tank Meters Other Than Vehicle-Mounted Milk Meters and Table 2. Tolerances for Vehicle-Mounted Milk Meters.
 9 (Amended 1995, 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

10 (~~Added 1989~~)

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%

11 (**Amended 20XX**)

12 **Background/Discussion:**
 13 A Milk Meter Tolerance Task Group was formed and assigned to this item. Please contact the task group chair for
 14 more information:

15 To Be Determined
 16 Milk Meter Tolerance Task Group
 17 Phone, Email

18 Existing tolerances are based on the accuracy of the Flow meter itself. The proposed Tolerances are based on Milk
 19 Metering Systems where the magnetic flow meter is a part of the Milk Metering system handling milk containing air.

20 The accuracy of the Flow meter will always be influenced by the way it is used. The only way you can obtain the
 21 accuracy described by the manufacture is when the flow meter is operating as a “stand alone” unit and, equally
 22 important, only if the product passing through the flow meter is complete air-free.

1 The submitter provided the following:

2 During the past 20 years, the need for improved efficiency in the collection of milk has resulted in the use of milk
3 pumping equipment being installed on milk tankers.

4 One of the most obvious places for a modern Dairy to optimize is the amount of time that the milk tanker uses to make
5 a collection. If you can reduce the collection time at each farmer, the Dairy will be able to get a significant reduction
6 in collection and transport cost for the benefit of the Farmer, Consumer and the Dairy itself. At the same time, you
7 will get an environmental benefit as a result of reduced CO2 in the milk collection process.

8 The consequence of introducing pump systems on milk tankers is that it causes air to be mixed with the milk which
9 again will influence the accuracy of the magnetic flow-meter mounted in the system. Milk entrains air unlike
10 petroleum liquids which do not. As you know, the flow meter will count anything that passes through the meter –
11 liquid as well as air – and it is therefore essential that as much air as possible is removed from the milk before it
12 reaches the flow-meter. However, it is widely recognized that it is not possible to remove all the air from the milk,
13 which will result in an inaccuracy.

14 It is therefore essential that the tolerances for vehicle mounted milk pump systems using magnetic flow-meters for
15 determining milk volume reflects today's way of collecting milk. This means that existing Tolerance for milk meters
16 cannot be used when the milk meter is a part of a system where different system parts will influence the accuracy of
17 the count. Such milk metering systems will need to be classified with their own tolerances.

18 Based on our 25 years of experience as a manufacturer of these systems and more than 3000 installations on milk
19 trucks operating in more than 15 countries, we would like to propose that the Tolerance for Vehicle Mounted Milk
20 Metering Systems is changed from 0.3% to 0.5% and that the tolerances will be listed and classified separately and
21 not be associated with products from the oil industry. Our proposal is consistent with Weights & Measures tolerances
22 accepted around the world.



23 We hope that the NCWM will consider our proposal and we will be more than happy to meet with you and answer
24 any questions you may have. We believe that a change of Tolerance is necessary in order for the Handbook 44 to
25 reflect today's milk collection and the technical progress within milk collection.

26 Yours sincerely

27 Poul Tarp
28 President POUL TARP A/S

29 The POUL TARP milk pump system holds an MID approval which is recognized and in accordance with guidelines
30 and standards described in the **OIML - INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY**

1 FLOW COMPUTERS REGULATION IN THE US:

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)

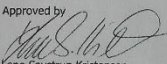
Type designation: PT LVMS - Poul Tarp Liquid Volume Measuring System

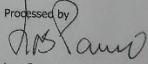
Type variants: type 2, type 3 and type 4

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 marking 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 (p 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.

Page 1 of 38

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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	GED	Qmax	Qmax	Qmin	Qmin	MMQ	Inlet
Type	Type	[m ³ /h]	[L/m]	[m ³ /h]	[L/m]	[L]	[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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FORCE Certification AS · Park Allé 345 · 2605 Brøndby · Denmark · Tel: +45 43 26 71 77 · Fax: +45 43 26 70 11 · cert@force-cert.dk · www.force-cert.dk

DK-0200-MI005-006

Applied documents

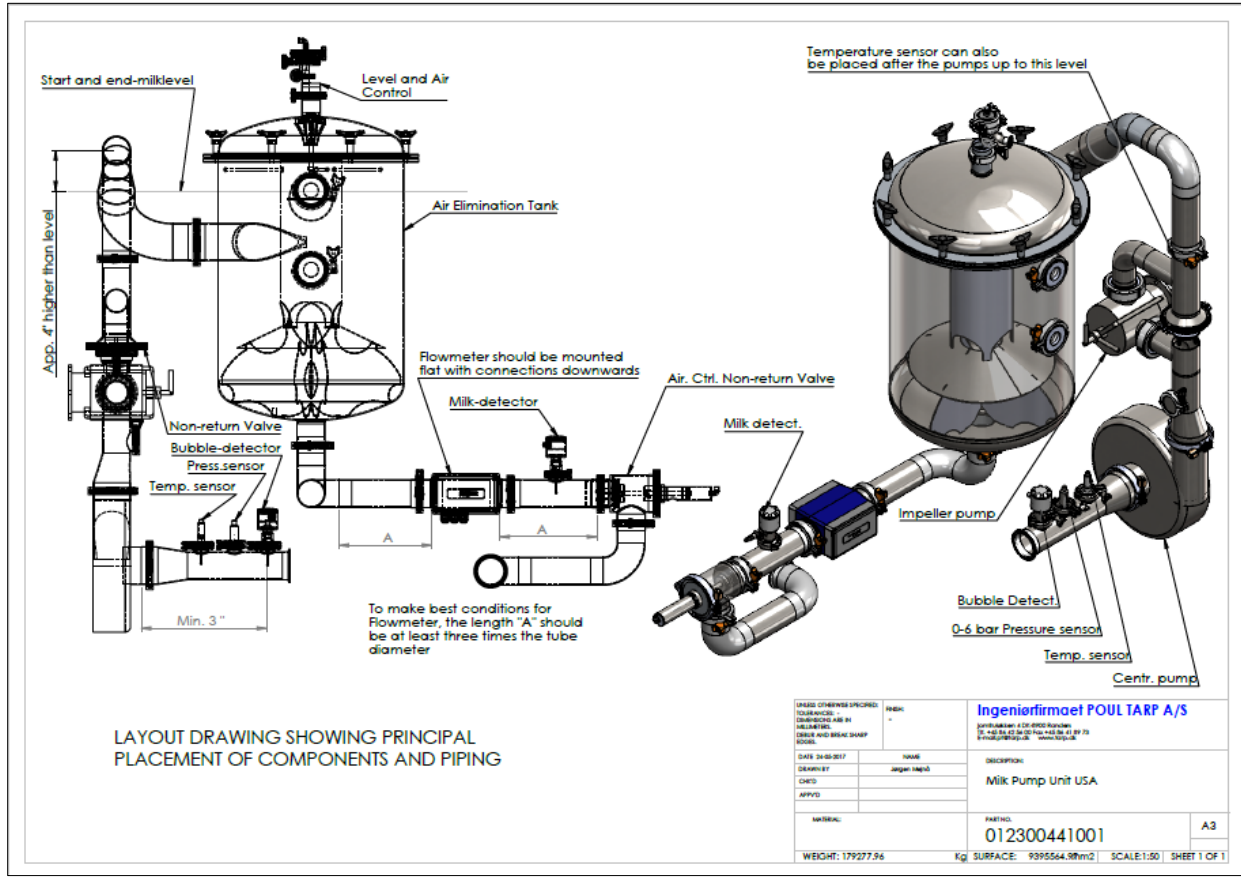
Recommendations	Guides
OIML R117 (1995)	WELMEC Guide 10.5 Marking of fuel dispensers (2006)
OIML R117-1 (2007)	WELMEC Guide 10.6 Sealing of fuel dispensers (2008)
OIML D11 (2004)	
OIML R117-2 Annex – E (CD2)	

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.

1 The standards related to metrological aspects come from OIML R117-1 for liquids (Dynamic measuring systems for
 2 liquids other than water, part 1: Metrological and technical requirements) and documents D11 (General requirements
 3 for electronic measuring instruments) and D31 (General requirements for software-controlled measuring instruments)
 4 from OIML.



5
 6 NCWM 2020 Interim Meeting: Mr. Carey McMahon (Poul Tarp) provided a presentation on his company’s VTM
 7 milk metering system advocating for expanding tolerances for these systems.

8 Ms. Leigh Hamilton (Piper) provided a presentation concerning the piper system and stated in her presentation that
 9 piper currently has an approved NTEP certificate for their device that is in service in the U.S. Ms. Leigh opposes this
 10 item to increase the tolerances for milk meters and noted in her presentation that there may not be a need to increase
 11 the tolerances in order to move forward in allowing innovation in milk measurements.

12 Mr. Charles Stutesman (KS) provided a presentation on research that KDA has done on the history of 3 HB 44 Codes
 13 (3.31. VTMs, 3.35. Milk Meters, and 4.42. Farm Milk Tanks) and the issue of Piper’s NTEP Certificate. Mr.
 14 Stutesman discussed complications involved in measurement of product using various methods and potential
 15 shortcomings of Piper’s NTEP Certificate.

16 Mr. Doug Musick (KS) stated that he does not believe there is enough information presented to change existing
 17 tolerances and noted that the Piper system was only evaluated for accuracy up to a measurement of 300 gallons. He
 18 also noted that he believes that Piper’s certificate should be amended to qualify the system for draft sizes up to 300
 19 gallons. Mr. Mike Keilty (Endress + Hauser) commented that he had concerns with Piper’s certificate. Ms. Hamilton
 20 noted that Piper followed and followed guidelines as provided during the NTEP evaluation. Ms. Diane Lee (NIST

1 OWM) stated that the committee may want to consider a developing status for this item and that more information is
2 needed concerning air elimination methods for milk metering systems.

3 A representative from the Dairy Farmers of America, stated that they oppose the increase in tolerance but supports the
4 use of VTM metering systems. Mr. Carey McMahon (Poul Tarp) pointed out that the Poul Tarp system can be accurate
5 for any size measurement, but the beginning and end of the measurement would not be accurate measures (within
6 tolerance) due to entrained air in the product when the flow is not uniform. Mr. Dmitri Karimov (MMA) stated that
7 the proposal should be further developed and pointed out that due to the tolerance structure becoming more stringent
8 as the volume of the measurement increases, the acceptance tolerance at 500 gallons is unreasonable. Mr. Hal Prince
9 (Florida) stated that he does not agree with expanding the tolerances. Mr. Prince believes that air elimination should
10 be the focus and that the proposal should be assigned to a task group. Mrs. Tina Butcher (NIST OWM) noted that
11 testing should be performed using multiple quantities and flowrates. Mr. Charles Stutesman (KS) pointed out that
12 confusion is generated by multiple HB 44 codes addressing the measurement of milk and that the proposal should be
13 assigned to a TG to sort this out. Mr. Stutesman also pointed out there is no requirements in HB 44 for air elimination
14 pertaining to milk metering in these codes. Mrs. Butcher noted that the current HB 44 requirements may not be
15 flexible enough for this new technology and that the existing codes may need to be reviewed and updated.

16 Ms. Leigh Hamilton (Piper) stated that this is not simply a consideration of only a change in tolerances. There are
17 other requirements (currently in the OIML standard) that should also be considered in making any changes to the
18 existing HB 44 requirements. Mr. Mike Keilty (Endress+Hauser) stated that air elimination is a difficult problem to
19 mitigate and noted that he is not sure if it is necessary to expand the existing tolerances or make other amendments.
20 Mr. Carey McMahon (Poul Tarp) stated that using the existing HB 44 tolerances in the VTM Code, at a draft of 5000
21 gallons, the tolerance value is highly unreasonable (KS) noted that the type evaluation performed on the Piper system
22 was limited to a draft of 300 gallons. If evaluation had included other draft sizes, the Piper system mat have failed
23 the testing.

24 Mr. Ken Ramsburg (MD) stated that the proposal should be given a developing status. Mr. Ramsburg agreed that
25 there is no existing requirement for this type of system addressing air elimination and stated that the flow meter, air
26 eliminator, plumbing, and pumps all need to be considered during evaluation and the evaluation should be conducted
27 on the system.

28 Mr. Tim Chesser (AR) questioned whether the flow meter used in the system is appropriate and noted that there are
29 many unanswered questions surrounding this issue. Mr. Jim Willis (NY) recommended a developing status for this
30 item. Mr. Kevin Schnepf (CA) stated that although he is opposed to relaxing existing tolerances, he supports the
31 development of this proposal by an assigned task group.

32 During the Committee's work session, the committee agreed that this item has merit and should be given an Assigned
33 status. The charge to the assigned task group will be to address three HB 44 codes (VTM, Farm Milk Tanks and Milk
34 meters) to review the requirements and tolerances found in these codes and assess the need for changes.

35 NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at
36 which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting
37 Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

38 NCWM 2021 Interim Meeting: The Committee heard from Mr. Charles Stutesman (KS, Char of the Milk Meter Task
39 Group) who gave an update on the task group activities. Mr. Stutesman reported that the Milk Meter Task group
40 worked via e-mail communication and reviewed and discussed the proposed Milk Meter Tolerances in Agenda item
41 VTM-20.2. The Milk Meter Task Group also discussed the tolerances that are included in NIST HB 44 for Milk
42 meters in various parts of HB 44 which include the VTM, Section 3.31, Farm Milk Tanks, Section 4.42., Mass Flow
43 Meters, Section 3.37, and Milk Meters, Section 3.35. Mr. Stutesman also reported that the task group reviewed OIML
44 tolerances for milk meters. Mr. Stutesman stated that after a review of the various tolerances, the task group agreed
45 that the OIML tolerances provide tolerances that encompassed the system of measuring milk and not just a tolerance
46 for the performance of the meter. The Milk Meter Task group agreed with proposing the use of the OIML milk meter
47 tolerance as the milk meter tolerances in the VTM code. Mr. Stutesman provided a copy of the proposed changes to

1 VTM-20.2. The proposed tolerances will align the tolerances in the VTM Code for Milk Meters with OIML Milk
 2 Meter Tolerances. Mr. Stutesman requested that this item move forward as a Voting item. The Committee also heard
 3 from Clark Cooney who noted that he supported the items as Developing because one company mentioned meeting
 4 the existing tolerances. It was mentioned that the company’s testing was only performed over a limited range of
 5 volumes.

6 During the committees work session the committee agreed with the proposal from the milk meter task group to adopt
 7 OIML tolerances for milk meters in the VTM code, that this item be given a voting status, and that the item under
 8 consideration be replaced with the work groups proposal to adopt OIML tolerances. The committee also agreed with
 9 expanding the task group to address other milk meter codes in HB 44. The Item Under Consideration above are the
 10 tolerances agreed to by the milk meter task group and that align with OIML tolerances.

11 NCWM 2021 Annual Meeting: Mr. Charlie Stutesman provided an update on the milk meter task group activities.
 12 Mr. Stutesman noted that there was a field trip to observe milk metering systems. He noted that the proposed
 13 tolerances will align the milk tolerances with the OIML tolerances for milk meters and Mr. Stutesman noted that the
 14 OIML tolerances provides one tolerance for the meter and another tolerance for a milk metering system. He also
 15 noted that it may be impractical to perform an air eliminator test on these devices due to comingling of product.

16 During the committees work session, the Committee agreed to a Voting Status for this item and added it to its voting
 17 consent calendar.

18 During the voting session, Mr. Charlie Stutesman asked that consideration be given to adding a non-retroactive date
 19 to the proposed tolerances. It was questioned during the discussion that if a non-retroactive date was added to the
 20 tolerances, then, what tolerances would apply to existing meters that had been manufactured and tested prior to the
 21 non-retroactive date. One of the concerns expressed with having a new tolerance table without a nonretroactive date
 22 was whether or not existing devices would be required to be reevaluated in the NTEP. The conference voted against
 23 adding the nonretroactive requirement to the proposed tolerance table and the item under consideration to change the
 24 tolerances failed to receive the 27 votes from the House of State Representatives, so the item failed and went back to
 25 the S&T committee. The S&T Committee agreed to a Developing status for this item.

26 **Note: For reference, the Item under Consideration that was included in the 2021 NCWM Interim Meeting**
 27 **Agenda is provided below:**

Table 2. Tolerances for Vehicle-Mounted Milk Meters		
Indication (gallons)	Maintenance Tolerance (gallons)	Acceptance Tolerance (gallons)
100	0.5 <u>0.6</u>	0.3 <u>0.5</u>
200	0.7 <u>1.2</u>	0.4 <u>1.0</u>
300	0.9 <u>1.8</u>	0.5 <u>1.5</u>
400	1.1 <u>2.4</u>	0.6 <u>2.0</u>
500	1.3 <u>3.0</u>	0.7 <u>2.5</u>
Over 500	Add 0.002 <u>0.006</u> gallons per indicated gallon over 500	Add 0.001 <u>0.005</u> gallons per indicated gallon over 500

28 NCWM 2022 Interim Meeting: Mr. Charlie Stutesman (KS) spoke as chairperson of the Milk Meter Task Group. He
 29 requested that this item be assigned back to the task group for further development. Mr. Stutesman provided an update
 30 on the task group meeting in January 2022 in which they discussed tolerances in both 3.31 Vehicle Tank Meters and
 31 3.35 Milk Meters and the need to have the tolerance be applied to both vehicle mounted and station meters as the

1 manufacturers are developing meters that will be capable of being installed in either application. The tolerance tables
2 can be found in the supporting documents. Mr. Stutesman also renewed the task groups request to expand its scope
3 to include possibly creating a new code that contains requirements of both vehicle mounted and stationary milk meters
4 and metering systems due to the unique properties of milk as a liquid. Speaking on behalf of himself, Mr. Stutesman
5 (KS) stated that he has provided a document in the supporting documents that outlines the four active and five inactive
6 NTEP certified meters and metering systems in terms of test draft size and applicable tolerances. He noted that the
7 active four have a range of 0.12%-0.6%. He also noted that milk meters are the only liquid measuring device where
8 the volume tolerance decreases as the draft size increases and suggests percentages more in line with OIML tolerance
9 would be more appropriate. Mr. Ken Ramsburg (MD) suggested combining the two tolerances to be used for field
10 evaluations. Ms. Diane Lee (NIST OWM) commented that the task group should work toward making all test methods
11 uniform. Mr. Doug Musick (KS) and Mr. Matt Douglas (CA) supported assigning this item to the task group for
12 further development. During committee work sessions, the committee agreed to assign this item back to the milk
13 meter task group so they may continue to ascertain data. In addition, the committee agreed to request that NCWM
14 Chairman Ivan Hankins expand the scope of the task group to include all reference to milk meters, meter systems and
15 related test methods, specifications and tolerance in an effort to harmonize the codes.

16 NCWM 2022 Annual Meeting: The Milk Meter Task Group Chair, Mr. Charles Stutesman (KS) provided an update
17 on the task group's activity. Mr. Stutesman solicited comments and feedback from membership to continue efforts
18 towards development. He also stated the task group is seeking a representative from the Western regional to serve on
19 the task group and mentioned Mr. Aaron Yonkers of Colorado as a potential member. Mr. Stutesman mentioned he is
20 intending to submit a request to the Committee to expand the task group's scope, including the gathering of all milk
21 meter codes for consolidation into a single code.

22 NCWM 2023 Interim Meeting: Matt Curran (State of Florida) – appears that this item is lowering the tolerance to get
23 a device to fit. Supports as voting if that is the case. Tina Butcher (NIST OWM) commented in support of assigned
24 status and that the application systems and meter needs clarification. The committee decided to leave this item as
25 assigned status and hopes a new task group chair steps forward.

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

28 **Regional Associations' Comments:**

29 WWMA 2022 Annual Meeting: The submitter was not present; no comments were heard.

30 During open hearings, due to timing constraints, the Committee did not take comments on assigned items. The
31 Committee did allow the source to provide updates on these items. No update was provided. The WWMA S&T
32 Committee recommends that this item remain assigned.

33 SWMA 2022 Annual Meeting: Dr. Curran, State of Florida, stated he was concerned about increasing the tolerance
34 for new technology.

35 No comments were received from the Milk Meter Tolerance Task Group.

36 The SWMA S&T Committee recommends this item remain as an Assigned Item.

37 CWMA 2022 Interim Meeting: No comments from the floor.

38 The CWMA S&T Committee recommends this item to remain as Assigned status.

39 NEWMA 2022 Interim Meeting: No comments were heard from the floor, however the Committee recommends that
40 this item retain an Assigned status with the Milk Meter Tolerance Task Group.

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

VTM-20.2
<p>Regional recommendation to NCWM on item status:</p> <p><input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Information Item on the NCWM agenda</p> <p><input checked="" type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i></p> <p><input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i></p> <p><input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i></p> <p><input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i></p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>This is an assigned item however Dr. Matt Curran, Florida, recommended blocking this item with MLK-23.2.</p> <p>The committee recommends this item remain an Assigned item.</p>

3

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

6 **LPG-23.1 I S.2.5. Zero-Set-Back Interlock**

7 **Source:**
 8 National Propane Gas Association and U-Haul International

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

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

15 **S.2.5. Zero-Set-Back Interlock.**

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

21 *[Nonretroactive as January 1, 2021]*

22 *(Added 2019) (Amended 2021)*

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

1 **(Added 20XX)**

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

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

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

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

13 [Nonretroactive as of January 1, 2017]

14 (Added 2016)

15 **Previous Action:**

16 2023: New Item

17 **Original Justification:**

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

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

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

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

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

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

10 The submitter requested that this be a Voting item.

11 **Comments in Favor:**

12 **Regulatory:**

- 13 • 2023 Interim: Kevin Schnepf (California Division of Measurement Standards) supports item.
- 14 • 2023 Interim: Scott Simmons (Colorado Division of Oil and Public Safety) supports item with editorial
 15 changes recommended.
- 16 • 2023 Annual: Scott Simmons (CO): He supports the proposal and stated that RMFDs have a separate
 17 nozzle. Commented that “exclusive” devices are evident to the inspector.
- 18 • 2023 Annual: Scott Simmons (CO): Commented that Handbook 44 already has a prohibition on
 19 diverting into separate hoses.

20 **Industry:**

- 21 • 2023 Interim: Konrad Pilatowicz (U-Haul International, INC) asked for the item to be moved
 22 forwarded as voting.
- 23 • 2023 Interim: Mr. Bruce Swiecicki (National Propane Gas Association) asked for the item to be moved
 24 forwarded as voting.
- 25 • 2023 Interim: Mr. Wes Strawn (Red Seal Measurement) sent an amendment to the committee with
 26 updated wording.
- 27 • 2023 Interim: Dmitri Karimov (Advanced Flow Solutions dba Liquid Controls) supports as a voting
 28 item with proposed changes from Mr. Strawn.
- 29 • 2023 Annual: Konrad Pilatowicz (U-Haul): U-Haul submitted this item to create a balance and to have
 30 consistency among motor fuel dispensers. Feels the item makes sense and suggested it be made
 31 retroactive instead of non-retroactive.
- 32 • 2023 Annual: Scott Johnson (U-Haul): U-Haul supports the proposed changes and has approximately
 33 1200 locations that fill motor fuel and cylinders. He believes that at some point in the future, customers
 34 will be able to fill their own cylinders. Automotive applications are about 3% of U-Haul’s business.
 35 His opinion is the word “exclusive” suggests that it is a dedicated system. He also stated that the
 36 nozzles used do not allow cylinder to be filled.
- 37 • 2023 Annual: Bruce Swiecicki (National Propane Gas Association): Stated that he will forward some
 38 new verbiage to clarify the language. Stated that he is not aware of any instances of fraud and that this
 39 helps the industry move forward for alternative fuels.

40 **Advisory:**

- 41 • None

42 **Comments Against:**

1 **Regulatory:**

- 2 • 2023 Annual: Stephen Benjamin (NC): Is opposed to the item and agrees with NIST OWM that it
3 should be downgraded to Informational. Also stated that there are currently products on the market that
4 can meet requirements. This is a carve out for a specific product and has not gone through the NTEP
5 process. Agrees that the nozzle cannot be used to fill a cylinder currently but that could change in the
6 future.
7 • 2023 Annual: Matt Douglas (CA): Shares most of the concerns with NIST.
8 • 2023 Annual: Steve Timar (NY): Agrees with NIST OWM that the item should be downgraded to
9 informational.

10 **Industry:**

- 11 • 2023 Annual: Dmitri Karimov (MMA): Agrees with NIST OWM that the item should be downgraded
12 to informational.

13 **Advisory:**

- 14 • 2023 Annual: Loren Minnich (NIST OWM): NIST OWM believes this item should be downgraded to
15 informational to allow additional time for reviewing its impact. The term “used exclusively” does not
16 provide clarity. OWM is also not sure this item provides what the submitter is looking for. See NIST
17 OWM’s written analysis for more details.

18 **Neutral Comments:**

19 **Regulatory:**

- 20 • None

21 **Industry:**

- 22 • None

23 **Advisory:**

- 24 • 2023 Interim: Mrs. Tina Butcher (NIST) stated part of the problem is the look and feel of these
25 systems is different from that of the RMF dispensers.

26 **Item Development:**

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

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

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

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

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

1 The committee did not agree with striking “(Other than Stationary Retail Motor Fuel Dispensers)” from the title of
 2 S.2.5.1. and the title remains unchanged. With the modifications, the committee believes this item is fully developed
 3 and has assigned it a voting status.
 4

5 **Regional Associations’ Comments:**

6 WWMA 2022 Annual Meeting: Mr. Konrad Pilatowicz (U-Haul International, Inc.) – Stated that Section 2.5.1 gives
 7 the general rule regarding the zero set back interlocks and that allows for manual and electronic meters to not meet
 8 the same standard which makes perfect sense. Section 2.5.2 refers to motor fuel dispensing devices and the word
 9 electronic is missing from the title. The changes address NIST and industry concerns. He asked that this be a voting
 10 item at the National meeting.

11 Mr. Scott Simmons (Colorado Division of Oil and Public Safety) – Was in support of this item for voting.

12 During open hearings, comments were heard supporting a voting status. The WWMA S&T Committee believes that
 13 this item has merit, is fully developed, and recommends that this item be assigned a voting status.

14 SWMA 2022 Annual Meeting: No comments were received on this item during the 2022 SWMA Annual Meeting.

15 The SWMA S&T Committee recommends this item move forward as a Voting Item.

16 CWMA 2022 Interim Meeting: No comments from the floor.

17 The CWMA S&T Committee recommends this as a Developing item. The Committee has concerns regarding a
 18 consumer/customer starting a delivery when the device is not on zero.

19 NEWMA 2022 Interim Meeting: No comments. No comments were heard from the floor. The Committee does not
 20 have a recommendation as to the status of this item.

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

LPG-23.1
Regional recommendation to NCWM on item status:
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input checked="" type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)
Steve Benjamin, North Carolina, stated he opposed this item.
The committee recommends this item be Withdrawn.

1 **LPG-24.1** *S.1.5.7. Retail Motor Fuel Dispenser Liquefied Petroleum Gas Retail Motor*
2 *Fuel Device, S.2.6.1. Electronic Stationary (Other than Stationary Retail*
3 *Motor Fuel Dispensers Liquefied Petroleum Gas Retail Motor Fuel Device).*
4 *S.6.2. Automatic Timeout Pay-at-Pump Retail Motor Fuels Devices Liquefied*
5 *Petroleum Gas Retail Motor Fuel Device. and, S.4.3. Location of Marking*
6 *Information: Retail Motor Fuel Dispensers Liquefied Petroleum Gas Retail*
7 *Motor Fuel Device.*

8 **Source:**

9 National Propane Gas Association

10 **Purpose:**

11 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
12 definition of Liquefied Petroleum Gas Retail Motor-Fuel Device. The purpose of this proposal is to correlate the
13 terminology in 3.32 for LP-gas and use only the defined term as proposed in the companion proposal.

14 **Item under Consideration:**

15 Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as
16 follows:

17 *S.1.5.7. Totalizers for Retail Motor Fuel Dispensers Liquefied petroleum gas retail motor-fuel device. – Retail*
18 *motor-fuel dispensers Liquefied Petroleum Gas Retail Motor-Fuel Device* shall be equipped with a
19 nonresettable totalizer for the quantity delivered through the metering device.
20 [Nonretroactive as of January 1, 2017]
21 (Added 2016)

22 *S.2.6.1. Electronic Stationary (Other than Stationary Retail Motor Fuel Dispensers Liquefied Petroleum Gas*
23 *Retail Motor-Fuel Device).* – For individual deliveries, if there is no product flow for three minutes the
24 transaction must be completed before additional product flow is allowed. The three-minute timeout shall be a
25 sealable feature on an indicator.
26 [Nonretroactive as of January 1, 2021]
27 (Added 2021)

28
29 *S.2.6.2. Automatic Timeout Pay-at-Pump Retail Motor Fuel Devices Liquefied Petroleum Gas Retail Motor-*
30 *Fuel Device* – Once a device has been authorized, it must deauthorize within three minutes if not activated.
31 Reauthorization of the device must be performed before any product can be dispensed. If the time limit to
32 deauthorize the device is programmable, it shall not accept an entry greater than three minutes.
33 [Nonretroactive as of January 1, 2022]
34 (Added 2021)

35
36 *S.4.3. Location of Marking Information; Retail Motor Fuel Dispensers Liquefied Petroleum Gas Retail*
37 *Motor-Fuel Device.* – The marking information required in General Code, paragraph G-S.1. Identification
38 shall appear as follows:
39 (a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;
40 (b) either internally and/or externally provided the information is permanent and easily read; and
41 (c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access
42 panel).

43
44 The use of a dispenser key or tool to access internal marking information is permitted for ~~retail motor-fuel~~
45 *dispensers liquefied petroleum gas retail motor-fuel device.*
46 [Nonretroactive as of January 1, 2003]
47 (Added 2006)

1 **Previous Status:**
2 2024: New Proposal

3 **Original Justification:**
4 Opposition would most likely come from those opposed to the primary changes in S.2.5.1 and S.2.5.2.
5 Opposition may also come from those concerned about vehicles that do not have the K15 mating connection on the
6 fill valve of the vehicle. Rebuttal to that would be that propane industry sources indicate that older vehicles that do
7 not have the K15 connection are being retrofit at a high rate to incorporate the safety features of the K15 connection.

8 The submitter requested Voting status for these items n 2024.

9 **Comments in Favor:**

10 **Regulatory:**
11 •

12 **Industry:**
13 •

14 **Advisory:**
15 •

16 **Comments Against:**

17 **Regulatory:**
18 •

19 **Industry:**
20 •

21 **Advisory:**
22 •

23 **Neutral Comments:**

24 **Regulatory:**
25 •

26 **Industry:**
27 •

28 **Advisory:**
29 •

30 **Item Development:**
31 New Proposal

32 **Regional Associations' Comments:**
33 New Proposal

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

LPG-24.1
<p>Regional recommendation to NCWM on item status:</p> <p> <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i> </p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>Steve Benjamin, North Carolina, stated he sees this item as cleanup and that a follow up item will be needed next year.</p> <p>The committee recommends blocking this item with LPG-24.2 and OTH-24.1.</p> <p>The committee recommends this item move forward as a Developing item</p>

1

2 **LPG-24.2** ~~**S.2.5. Zero-Set-Back Interlock.**~~ **S.2.5. Zero-Set-Back Interlock.**

3 **Source:**
4 National Propane Gas Association

5 **Purpose:**
6 The proposal will address practical issues that propane retailers encounter when trying to comply with the zero setback
7 requirements for propane stationary meters in Handbook 44.

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

11 ~~**S.2.5. Zero-Set-Back Interlock.**~~

12 ~~**S.2.5.1. Zero-Set-Back Interlock, Electronic Stationary Meters (Other than Stationary Retail Motor-Fuel**~~
13 ~~**Dispensers Liquefied Petroleum Gas Retail Motor-Fuel Device) and Electronic Vehicle Mounted Meters.—A**~~
14 ~~**device shall be constructed so that after an individual delivery or multiple deliveries at one location have been**~~
15 ~~**completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating**~~
16 ~~**element and, if equipped, recording element have been returned to their zero positions.**~~
17 ~~**{Nonretroactive as January 1, 2021}**~~

18 ~~**S.2.5.2. Zero-Set-Back Interlock for Stationary Retail Motor-Fuel Devices Liquefied Petroleum Gas Retail**~~
19 ~~**Motor-Fuel Device.—A device shall be constructed so that:**~~

20 ~~**(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the**~~
21 ~~**device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording**~~
22 ~~**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~~

~~(e) 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]~~

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.

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.

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

1 S.2.5.1 only applies to electronic devices. Clearly, Handbook 44 recognizes this reality as S.2.5.1 does not require that
2 all LP-Gas dispensers have zero-set-back interlocks, only electronic devices. S2.5.1 is most appropriate because
3 currently there is no readily available technology that can be used to retrofit an analog device. When looked at from
4 a cost/benefit perspective, one has to question the expense of replacing an analog device with an electronic device at
5 a location that mostly serves portable cylinders and not motor vehicle tanks when LP-Gas's use is so limited in
6 transportation.

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

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

20 At its August 2022 meeting, the Central Weights and Measures Association recommended LPG-23.1 as a Developing
21 Item with the following comment: *"The Committee has concerns regarding a consumer/customer starting a deliver*
22 *when the device is not on zero."* In response, there are two points to make regarding the transfer of liquid propane into
23 a container. The first is that any transfer made into cylinders (not mounted on vehicles) would have to be done by
24 propane service personnel. The customer would not be permitted to transfer product into any cylinder, even if they
25 own that container.

26 Secondly, LPG-23.1 is intending to clarify that dispensers which are used *exclusively for retail motor fuel* will be
27 subject to the zero setback requirements. It is only these dispensers, which are installed at public retail motor vehicle
28 refueling stations, that are permitted to be operated by the general public to refuel vehicles. Therefore, because of the
29 zero setback and time-out provisions in Handbook 44, there really is no opportunity for the customer to "game" the
30 dispenser system.

31 **Comments in Favor:**

32 **Regulatory:**

- 33 •

34 **Industry:**

- 35 •

36 **Advisory:**

- 37 •

38 **Comments Against:**

39 **Regulatory:**

- 40 •

41 **Industry:**

- 42 •

1 **Advisory:**

- 2 •

3 **Neutral Comments:**

4 **Regulatory:**

- 5 •

6 **Industry:**

- 7 •

8 **Advisory:**

- 9 •

10 **Item Development:**

11 New Proposal

12 **Regional Associations' Comments:**

13 New Proposal

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

LPG-24.2
<p>Regional recommendation to NCWM on item status:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>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 items Form 15. This language is as follows:</p> <p>S.2.5. Zero-Set-Back Interlock.</p> <p>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. – <i>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.</i></p> <p><i>[Nonretroactive as January 1, 2021]</i></p>

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.

1

2 **MLK – MILK METERS**

3 **MLK-23.2 A Table T.1. Tolerances for Milk Meters**

4 **Source:**

5 Milk Meter Tolerances Task Group

6 **Purpose:**

7 Eliminate the current tolerance structure of a decreasing permissible tolerance allowance as the size of the test draft
8 increases.

9 **Item Under Consideration:**

10 Amend Handbook 44, Milk Meters Code, as follows:

11 **T.2. Tolerance Values.** – Tolerances shall be as shown in Table 1. Tolerances for Milk Meters.

12 (Amended 1989, **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

1 (Added 1989)

Table 1. Tolerances for Milk Meters		
	<u>Acceptance Tolerance</u>	<u>Maintenance Tolerance</u>
<u>Complete Measuring System</u>	<u>0.5%</u>	<u>0.5%</u>
<u>Meter Only</u>	<u>0.3%</u>	<u>0.3%</u>

2 **(Amended 20XX)**

3 **Previous Action:**

4 2023: New Item

5 **Original Justification:**

6 This is a companion item to VTM-20.2 [Vehicle Mounted Milk Meters] currently being considered. It would be logical
 7 to block these two items as the data and discussion for changes to both Handbook 44 sections will be identical. This
 8 proposal is being made to eliminate the current tolerance structure of a decreasing permissible tolerance allowance as
 9 the size of the test draft increases. The proposed changes are identical to the current tolerance structure in the
 10 international community that follow OIML R-117. Without the changes to the tolerances, it would be possible for a
 11 device to be within tolerance at small test drafts and be out of tolerance for larger test drafts that are more representative
 12 of a typical delivery.

13 If OIML tolerances are adopted, the tolerances that are currently in place may increase at larger test drafts.

14 **Requested Status by Submitter:** Voting Item

15 **Comments in Favor:**

16 **Regulatory:**

- 17 • 2023 Interim: Mr. Matt Curran (Florida Department of Agriculture and Consumer Services)
 18 recommended item be blocked with VTM 20.2.
- 19 • 2023 Interim: Mr. Kevin Schnepf (California Division of Measurement Standards) Agreed with Mr.
 20 Curran.

1 **Industry:**

- 2 • None

3 **Advisory:**

- 4 • 2023 Interim: Ms. Tina Butcher (OWM/NIST) saw no issues with blocking the item.

5 **Comments Against:**

6 **Regulatory:**

- 7 • None

8 **Industry:**

- 9 • None

10 **Advisory:**

- 11 • None

12 **Neutral Comments:**

13 **Regulatory:**

- 14 • None

15 **Industry:**

- 16 • None

17 **Advisory:**

- 18 • None

19 **Item Development:**

20 NCWM 2023 Interim Meeting: The committee decided to leave this item as assigned status and hopes a new task
21 group chair steps forward.

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

24 **Regional Associations' Comments:**

25 WWMA 2022 Annual Meeting: Mr. Michael Keilty (Endress+Hauser) – Wanted to alert the committee that the
26 Chairman of the Task Group no longer works for the State of Kansas, leaving a vacancy for the Chair position.

27 Mr. Matt Douglas (State of California, Division of Measurement Standards) – Recommended that this be combined
28 with VTM-20.2 and recommended assignment to the Milk Meter Tolerance Task Group.

29 In the original justification, the submitter recommended that this item be blocked with VTM-20.2. The WWMA S&T
30 Committee recommends that this item be assigned to the Milk Meter Tolerance Task Group and that this item be
31 blocked with VTM-20.2.

32 SWMA 2022 Annual Meeting: Dr. Curran, State of Florida, stated that he opposed raising the tolerances to
33 accommodate this new device.

34 No comments were received from the Milk Meter Tolerance Task Group.

35 The SWMA S&T Committee recommends this item be Assigned to the Milk Meter Tolerance Task Group.

- 1 CWMA 2022 Interim Meeting: Doug Musick – Kansas, The current tolerance table has a specified tolerance for a
 2 specified draft size. The percentage calculations for them do not match. The percentage tolerance changes for the same
 3 meter based on draft size. Updating the tolerance will make it uniform with other liquid tolerance tables.
- 4 Michael Keilty – Endress+Hauser, The sizes of provers for this testing are not common. They are difficult to find.
- 5 The CWMA S&T Committee believes this item is fully developed and recommends voting status.
- 6 NEWMA 2022 Interim Meeting: No comments were heard from the floor. The Committee does not have a
 7 recommendation as to the status of this item.
- 8 Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to
 9 www.newm.com/publication-15 to review these documents.

MLK-23.2
Regional recommendation to NCWM on item status:
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input checked="" type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i>
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.

10

11 **HGM – HYDROGEN GAS-MEASURING DEVICES**

12 **HGM-23.1 D UR.3.8. Safety Requirement**

13 **Source:**

14 Quong and Associates, Inc.

15 **Purpose:**

16 Add safety requirement for hydrogen gas measuring devices.

17 **Item under Consideration:**

18 Amend Handbook 44 Hydrogen Gas-Metering Devices Code as follows:

19 *UR 3.8 Safety Requirement –All hydrogen gas-measuring devices subject to this code shall maintain*
 20 *verification of testing demonstrating conformance with the latest version of SAE J2601 Fuel Protocols for*
 21 *Light Duty Gaseous Hydrogen Surface Vehicles, as determined by the latest version of ANSI/CSA HGV 4.3*
 22 *“Test Methods for Hydrogen Fueling Parameter Evaluation.*

1 *(Nonretroactive as of January 1, 10XX)*

2 **Previous Action:**

3 2023: New Item

4 **Original Justification:**

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

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

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

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

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

29 The submitter provided the following links:

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

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

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

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

37 EVSE Pre_Rule Wkshop Shared Deck.pdf

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

39 **Comments in Favor:**

- 1 **Regulatory:**
 2 • 2023 Interim: Mr. Kevin Schnepf (California Division of Measurement Standards) stated California
 3 has 68 stations that all require this standard and 33 private stations that do not have this requirement.
 4 Facilitates accurate and safe fueling. Supports item.
 5 • 2023 Interim: Mr. Kevin Schnepf (California Division of Measurement Standards) in response to Mr.
 6 Currans comment, “it’s a performance protocol as well”, not just for safety.

- 7 **Industry:**
 8 • 2023 Interim: Mr. Spencer Quong (QAI) gave a presentation during open hearings. Heat generated
 9 from filling can cause damage. This is important to protect the consumer. Requests informational
 10 status, so it can be continued to be developed.

- 11 **Advisory:**
 12 • None

13 **Comments Against:**

- 14 **Regulatory:**
 15 • None

- 16 **Industry:**
 17 • None

- 18 **Advisory:**
 19 • None

20 **Neutral Comments:**

- 21 **Regulatory:**
 22 • 2023 Interim: Mr. Matt Curran (Florida Dept of Agriculture and Consumer Services) echoed Mrs.
 23 Butcher’s comments.

- 24 **Industry:**
 25 • None

- 26 **Advisory:**
 27 • 2023 Interim: Mrs. Tina Butcher (NIST) stated, typically HB44 does not include safety requirements.
 28 That generally rests with non-WM agencies. She doesn’t question the need but does question if HB44
 29 is the right place for this.

30 **Item Development:**

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

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

34 **Regional Associations’ Comments:**

35 WWMA 2022 Annual Meeting: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Stated
 36 that he has worked with the submitter. J-2601 is a requirement for operating in the state of California. This is a safety
 37 protocol. This is both a standard and a test method. The design parameters for the equipment meet the standard. This
 38 is not a type evaluation requirement, it is a user requirement. He supported this item.

1 The WWMA S&T Committee feels that this item has merit and recommends that this item be assigned a developing
 2 status with consideration to the concerns identified during open hearings.

3 SWMA 2022 Annual Meeting: Dr. Curran, State of Florida, questioned whether this was the proper venue for this
 4 item.

5 Mr. Floyd, State of Louisiana, also commented that this was not the proper venue for this item.

6 This committee would like the NCWM S&T Committee to consider whether or not this type of item is within the
 7 scope of weights and measures.

8 The SWMA S&T Committee recommends this item move forward as a Developing Item.

9 CWMA 2022 Interim Meeting: No comments from the floor.

10 The CWMA S&T Committee recommends this as a Developing item. Clarification regarding the term
 11 “verification” is needed.

12 NEWMA 2022 Interim Meeting: Mr. Spencer Quong (Quong and Associates representing Toyota Motors North
 13 America) explained the requirements for validation of fueling protocol through SAE. Mr. Quong indicated that if
 14 hydrogen vehicles filled too quickly, it will overheat and if the fueling protocol is performed significantly different, it
 15 may affect accuracy. Ms. Juana Williams (NIST-OWM) noted that safety is first and foremost however, this proposal
 16 would require that the owner of the device be trained in fueling safety, which is not typical to put in HB44. Mr. Jason
 17 Flint (NJ) commented that the language in this item may be more suited for other standard setting organizations such
 18 as NFPA.

19 After hearing comments from the floor, the Committee recommends that this item be given a Developing status.

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

HGM-23.1
<p>Regional recommendation to NCWM on item status:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>Dr. Matt Curran, Florida, questioned if this is the proper venue for the safety requirements but supports safety concerns in the item.</p> <p>The committee recommends this item remains as a Developing item to allow time for the data to be collected.</p>

1 **EVF – ELECTRIC VEHICLE FUELING SYSTEMS**

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

3
4 **Source:**

5 Siemens Industry Inc., Smart Infrastructure eMobility

6 **Purpose:**

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

10 **Item under Consideration:**

11 Amend Handbook 44 Electric Vehicle Fueling Systems as follows:

12 **S.1.3. Mobile Device as Indicating Element for AC Chargers. – the indication requirements and elements**
13 **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**
14 **through either a display built into the EVSE or a display available via an application on a hand-held device**
15 **such as a smart phone or in the purchaser’s vehicle receiving the electrical energy, such device or vehicle**
16 **being in the immediate vicinity of the EVSE.**

17 **Previous Status:**

18 2024: New Proposal

19 **Original Justification:**

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

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

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

36 **Comments in Favor:**

37 **Regulatory:**

- 38
 -

39 **Industry:**

- 40
 -

1 **Advisory:**

- 2 •

3 **Comments Against:**

4 **Regulatory:**

- 5 •

6 **Industry:**

- 7 •

8 **Advisory:**

- 9 •

10 **Neutral Comments:**

11 **Regulatory:**

- 12 •

13 **Industry:**

- 14 •

15 **Advisory:**

- 16 •

17 **Item Development:**

18 New Proposal

19 **Regional Associations' Comments:**

20 New Proposal

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

EVF-24.1
Regional recommendation to NCWM on item status:
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda
<input type="checkbox"/> Recommend as an Information Item on the NCWM agenda
<input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i>
<input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i>
<input checked="" type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i>
<input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i>
Tim Chesser, Arkansas, recommended the item be withdrawn because he was not going to enforce indicating element requirements on cell phones of customers.

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

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

9 All DC EVSE are exempt from this requirement until January, ~~2028~~2025.
10 (Amended 2022 and 2025)

11 And

12 **T.2.1. EVSE Load Test Tolerances.** – The tolerances for EVSE load tests are:

13 (a) Acceptance Tolerance: 1.0 %; and

14 (b) Maintenance Tolerance: 2.0 %.

15 All DC EVSE are exempt from this requirement until January 1, ~~2028~~2025.
16 (Amended 2022 and 2025)

17 **Previous Status:**

18 2024: New Proposal

19 **Original Justification:**

20 The 2028 exemption was provided for DC EVFS due to the lack of available field test equipment that could accurately
21 test and verify conformance of DC EVFS to established tolerances. Testing equipment capable of testing DC EVFS
22 at the higher power levels of modern DC EVFS is now available and new manufactures of test equipment are entering
23 the market now. The justification for the exemption for DC EVFS is no longer valid as regulating jurisdictions have
24 access to test equipment that can properly evaluate installations of DC EVFS for conformance to the adopted
25 specifications and tolerances. The availability of DC EVFS test equipment has been verified by two test equipment
26 manufacturers and by research conducted by Argonne National Lab. With fully capable test equipment available in
27 2023 and 2024, establishing a 2025 effective is reasonable and provides a uniform, transparent, and equitable
28 marketplace for both consumers and competing businesses.

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

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

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

36 **Comments in Favor:**

37 **Regulatory:**

- 38 •

39 **Industry:**

- 40 •

1 **Advisory:**

- 2 •

3 **Comments Against:**

4 **Regulatory:**

- 5 •

6 **Industry:**

- 7 •

8 **Advisory:**

- 9 •

10 **Neutral Comments:**

11 **Regulatory:**

- 12 •

13 **Industry:**

- 14 •

15 **Advisory:**

- 16 •

17 **Item Development:**

18 New Proposal

19 **Regional Associations' Comments:**

20 New Proposal

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

EVF-24.2
<p>Regional recommendation to NCWM on item status:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>Perry Lawton, Tesco, was in support of this item.</p> <p>Tim Chesser, Arkansas, was in support of this item.</p> <p>Mauricio Mejia, Florida, was in support of this item.</p> <p>Gene Robertson, Mississippi, supports this item.</p> <p>ScheLeese Goudy, Electrify America, raised concerns what would happen with legacy equipment.</p> <p>Alex Beaton, EVgo, echoed the statements of ScheLeese.</p> <p>Patrick Bean, Tesla, agreed with Alex and ScheLeese’s comments and suggested waiting for test equipment to change the date.</p> <p>The committee recommends this item move forward as a Voting item.</p>

1

2 **EVF-23.4 D S.5.2. EVSE Identification and Marking Requirements, S.5.3. Abbreviations**
 3 **and Symbols, and N.5. Test of an EVSE System.**

4 **Source:**
 5 Power Measurements LLC

6 **Purpose:**
 7 Update the details of the recommended tests in HB44 3.40 to better conform to current practice and Pub 14
 8 instructions.

9 **Item under Consideration:**
 10 Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

11 **S.5. Markings.** – The following identification and marking requirements are in addition to the requirements
 12 of Section 1.10. General Code, paragraph G-S.1. Identification.

13 **S.5.1. Location of Marking Information; EVSE.** – The marking information required in General Code,
 14 paragraph G-S.1. Identification shall appear as follows:

- 1 (a) within 60 cm (24 in) to 150 cm (60 in) from ground level; and
- 2 (b) on a portion of the EVSE that cannot be readily removed or interchanged (e.g., not on a service
- 3 accesspanel).

4 **S.5.2. EVSE Identification and Marking Requirements.** – In addition to all the marking requirements
 5 of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following
 6 information conspicuously, legibly, and indelibly marked:

- 7 (a) voltage rating;
- 8 (b) maximum-~~current~~ deliverable amperes;
- 9 (c) type of current (AC or DC or, if capable of both, both shall be listed);
- 10 (d) minimum measured quantity (MMQ); and
- 11 (e) temperature limits, if narrower than and within – 40 °C to + 85 °C (– 40 °F to + 185
- 12 °F).(Amended 2021)

13 **S.5.3. Abbreviations and Symbols.** – The following abbreviations or symbols may appear on an EVSE
 14 system.

- 15 (a) VAC = volts alternating current;
- 16 (b) VDC = volts direct current;
- 17 (c) MDA = maximum deliverable amperes;
- 18 (d) ~~J=joule~~Wh – kilowatt hours.

19 And

20 **N.5. Test of an EVSE System.**

21 **N.5.12. Performance Verification in the Field.** – Testing in the field is intended to validate the
 22 transactional accuracy of the EVSE system. Provided the EVSE under test has a valid type approval
 23 certificate, then tThe following testing is deemed sufficient for a field validation.

24 **(1) For AC EVSE**

- 25 **(i) A point between 10 % and 20 % of the maximum deliverable amperes, but not exceeding 8 A;**
- 26
- 27 **(ii) A point between 45 % and 55 % of the maximum deliverable amperes; and**
- 28
- 29 **(iii) A point between 70 % and 100 % of the maximum deliverable amperes.**

30 **(2) For DC EVSE**

- 31 **(i) A point at less than 30 A**
- 32 **(ii) A point between 20 % and 100 % of the maximum deliverable amperes with guidance**
 33 **to test at the maximum power level that is possible using the test equipment available.**

1 **For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that**
2 **circumstance, testing at the load presented by the vehicle shall be sufficient provided that it is**
3 **greater than 20 % of the maximum deliverable amperes.**

4 **All DC EVSE are exempt from this requirement until January 1, 2028.**
5 **(Amended 2023)**

6 **N.5.21. Laboratory Accuracy Testing.** – The testing methodology compares the total energy delivered in a
7 transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement
8 standard. **Each test shall be performed for at least the minimum measured quantity (MMQ).**

9 (a) For AC systems:

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

15 **(i) A point between 10 % and 20 % of the maximum deliverable amperes, but not**
16 **exceeding 8A;**

17 **(ii) A point between 45 % and 55 % of the maximum deliverable amperes; and**

18 **(iii) A point between 70 % and 100 % of the maximum deliverable amperes.**

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

22 (b) For DC systems ~~(see note)~~ **tests shall be performed at two voltage points one between 350 VDC and**
23 **400 VDC and if supported by the EVSE a second at between 700 VDC and 800 VDC:**

24 (1) ~~Accuracy tests of the EVSE system at a load of not less than 85 % of the maximum deliverable~~
25 ~~amperes current (expressed as MDA) as determined from the digital communication message~~
26 ~~from the DC EVSE to the test standard for a total energy delivered of at least twice the~~
27 ~~minimum measured quantity (MMQ). shall be performed at the following current levels:~~

28 **(i) A point at less than 30A;**

29 **(ii) A point between 45 % and 55 % of the maximum deliverable amperes; and**

30 **(iii) A point between 70 % and 100 % of the maximum deliverable amperes.**

31
32 (2) ~~Accuracy test of the EVSE system at a load of not more than 10 % of the maximum deliverable~~
33 ~~amperes (expressed as MDA) as determined from the digital communication message from~~
34 ~~the DC EVSE to the test standard for a total energy delivered of at least the minimum~~
35 ~~measured quantity (MMQ). (2) Accuracy test of the EVSE system at a load of not more than~~
36 ~~10 % of the maximum deliverable amperes (expressed as MDA) as determined from the digital~~
37 ~~communication message from the DC EVSE to the test standard for a total energy delivered~~
38 ~~of at least the minimum measured quantity (MMQ).~~

39 All DC EVSE are exempt from this requirement until January 1, 2028.
40 (Amended 2022 **and 2023**)

~~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. Circumstance, testing at the load presented by the vehicle shall be sufficient~~

Previous Action:

2023: New Item

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:

1 Since HB44 3.40 was initially written a whole new generation of DC chargers have been developed. At that time the
2 maximum power delivery was approximately 100 kW at 400 VDC. Today we have 350 kW systems operating at both
3 400 VDC and 800 VDC. The CCS EVSE standards have already been updated to allow chargers up to 1000 VDC
4 and 800 A (800 kW). Because there are now two broad classes of DC EVSE; 400 VDC and 800VDC two voltage test
5 points are included. Both voltage classes are capable of charging at 400V so a point between 350 VDC and 400VDC
6 is required for both. For systems that can also operate at 800VDC a second point between 700 VDC and 800 VDC is
7 required. Current points are to be tested at both voltages if they are appropriate for the EVSE.

8 For DC systems three test points are proposed:

- 9 (i) A point at less than 30 A
- 10 (ii) A point between 45 % and 55 % of the maximum deliverable amperes
- 11 (iii) A point between 70 % and 100 % of the maximum deliverable amperes

12 This approach provides a test point at the lower end of the power transfer range where older vehicles may charge or
13 where more modern EVs charge when topping off. The other two points are intended to bracket the power levels
14 where most EV transfer most of their energy.

15 The power levels of DC EVSE are rapidly evolving to ever higher levels. For that reason, this change provides for
16 flexibility in field testing of DC EVSE at the high power point. The high current point is revised to 20% to 100% of
17 the maximum deliverable current **with guidance to test at the maximum power level that is possible using**
18 **the test equipment available. The new code also provides for using a vehicle as the test load providing**
19 **it meets the 20% of** maximum deliverable current requirement.

20 One objection might be the creation of a field testing regime for DC EVSE that is less rigorous than that applied in
21 the laboratory. For many decades ANSI C12 meter testing has applied testing over the full range of voltage and
22 current for meters during type testing but only done validation testing at two current values. For example, class 320
23 meters (320 A maximum current) are tested for accuracy at 11 points between 3 A and 320 A during type evaluation.
24 However, for verification typically only two current points are used 5 A and 50 A.

25 Another objection might be the requirement to test 800 VDC EVSE at both 400 VDC and 800 VDC. Only a very few
26 electric vehicles (three at this time) are capable of using 800 VDC charging. Therefore, even though an EVSE may be
27 capable of 800 VDC operation because most EV operate at 400 VDC testing at 400 VDC on an 800 VDC capable
28 system is appropriate.

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

30 **Comments in Favor:**

31 **Regulatory:**

- 32 • None

33 **Industry:**

- 34 • None

35 **Advisory:**

- 36 • None

37 **Comments Against:**

38 **Regulatory:**

- 39 • None

1 **Industry:**

- 2 • None

3 **Advisory:**

- 4 • None

5 **Neutral Comments:**

6 **Regulatory:**

- 7 • 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards)
8 recommends a developing status, recognizing the item has merit but needs more development. Mr.
9 Schnepf recommends working with the NIST USNWG EVFE Subgroup on item development.

10 **Industry:**

- 11 • 2023 Interim: Mr. Keith Bradley (Electrify America) commented to one of the challenges in testing
12 low current with the testing equipment. He expressed concerns with N.5.1.(b)(1)(i) and recommends a
13 Developing status to evaluate the Note section.
14 • 2023 Interim: Ms. Francesca Wahl (Tesla) commented the item needs further development and
15 recommends the submitter work with the NIST USNWG EVFE Subgroup on developing the item.
16 • 2023 Annual: Mr. Bill Hardy, Power Measurements, LLC-NIST USNWG SG is working on updated
17 language.

18 **Advisory:**

- 19 • 2023 Interim: Ms. Tina Butcher (NIST OWM) commented there was no consensus from the NIST
20 USNWG EVFE Subgroup on the item and encouraged the submitter to work with the Subgroup to
21 evaluate the merit of the proposed testing criteria.

22 **Item Development:**

23 NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and assigned a
24 Developing status to the item. The Committee recommends the submitter work with the NIST USNWG EVFE
25 Subgroup for item development. The Committee discussed and changed the title to clarify the intent of the proposal.

26 NCWM 2023 Annual Meeting: The Committee heard from Bill Hardy, Power Measurements, LLC-NIST USNWG
27 SG is working on updated language.

28 **Regional Associations' Comments:**

29 WWMA 2022 Annual Meeting: Ms. Scheleese Goudy (Electrify America) – Ms. Goudy stated Electrify America
30 opposes this proposal. Ms. Goudy suggested the 30 amps is too small and too low for the 10% accuracy testing. Ms.
31 Goudy recommend a withdrawal status.

32 Mr. Chris King (Siemens) – Mr. King stated Siemens supports and agrees with Electrify America's comments. Mr.
33 King proposed this item would add significantly to the expense of setting up and running an operation. Mr. King
34 recommended a withdrawal status.

35 Ms. Francesca Wahl (TESLA) – Ms. Wahl stated TESLA supports the previous comments by Electrify America and
36 Siemens. Ms. Wahl proposed the item can be developed, that there is merit, but is not consistent with the working
37 group. Ms. Wahl suggested the item is not fully developed.

38 Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf commented there is
39 some concern about the language for specifications and tolerances. Mr. Schnepf recommends this item be assigned to
40 a work group. Mr. Schnepf recommended a developing status.

1 During open hearings, comments were heard that contents in this item were previously discussed in the USNWG, but
 2 no official position has been taken by the USNWG. There were also comments during open hearing taking the position
 3 the item is not fully developed. The WWMA S&T Committee recommends the submitters work with USNWG to
 4 address the comments heard during open hearings and that they work to develop one proposal by combining language
 5 from EVF-23.7.

6 The WWMA S&T Committee recommends that this item be blocked with item EVF-23.7. The WWMA S&T
 7 Committee recommends the new blocked items be assigned a developing status.

8 SWMA 2022 Annual Meeting: Ms. Goudy of Electrify America stated that the test current is too low and
 9 recommended withdrawal.

10 Dr. Curran, State of Florida, stated that line 17 on page 238 should read N.5.1.

11 The SWMA S&T Committee recommends that this item be Withdrawn.

12 CWMA 2022 Interim Meeting: Scheleese Goudy – Electrify America, NIST USNWG discussed this and had consensus
 13 of doing the opposite of this proposal. This makes it unnecessarily difficult for testing.

14 Francesca Wahl – Tesla, Opposes. The high-end testing as written may be challenging for systems with higher power
 15 levels such as heavy- duty trucks and other high-power systems.

16 Craig VanBuren – Michigan, Request developing. Send to the NIST USNWG for consideration.

17 The CWMA S&T Committee has no recommendation for this item.

18 NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) addressed challenges in testing DC meters in
 19 that low current is the hardest and perhaps the least important thing to test in the system.

20 After hearing comments from the floor, the Committee believes this item has merit and requests that the EVSE
 21 Subgroup continue work on this item. The Committee recommends this item be given a Developing status.

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

EVF-23.4
<p>Regional recommendation to NCWM on item status:</p> <p><input checked="" type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i></p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i> ScheLeese Goudy, Electrify America, stated this was a joint proposal and will take the place of EVF-23.7.</p>

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.

1

2 **EVF-23.6 S.5.2. EVSE Identification and Marking Requirements., and T.2.**
 3 **Tolerances.**

4 **Source:**
 5 Florida Department of Agriculture and Consumer Services; Electrify America; Tesla; EVGo, Siemens

6 **Purpose:**
 7 The revised proposal would amend Handbook 44, Section 3.40 Tentative Code in the following ways:

- 8 1. Paragraph T.2.1 would be revised for DC chargers. The 1% (acceptance) / 2%
 9 (maintenance) tolerances would apply to devices installed after January 1, 2024. For
 10 devices installed before that date, the tolerances would be 5% (acceptance and
 11 maintenance).
- 12 2. For the sake of clarity and transparency for customers and inspectors, a device subject to the
 13 5% tolerance would have to be marked as such. The proposal would require specific language
 14 for the marking.
- 15 3. If a manufacturer has achieved 1%-capable chargers earlier than the January 2024 timeframe,
 16 users of those chargers might prefer not to mark the chargers as 5% chargers; and then those
 17 chargers would be subject to the 1%/2% tolerance. The proposal includes language to establish
 18 this treatment.
- 19 4. The 5% tolerance for pre-2024 chargers would end on January 1, 2034. After that date, all DC
 20 chargers would be subject to the 1% (acceptance) / 2% (maintenance) tolerance.

21 **Item under Consideration:**
 22 Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

23 **S.5.2. EVSE Identification and Marking Requirements.** – In addition to all the marking requirements of
 24 Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information
 25 conspicuously, legibly, and ~~indelibly~~ **permanently** marked:

- 26 (a) voltage rating;
- 27 (b) maximum current deliverable;
- 28 (c) type of current (AC or DC or, if capable of both, both shall be listed);
- 29 (d) minimum measured quantity (MMQ); and
- 30 (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 Limits, DC EVSEs Installed Prior to 2024. - A DC EVSE installed and placed into service prior to 2024 shall be marked with the following:

NOTICE:

“This charger operates at a tolerance of up to +/- 5 percent versus other chargers which operate at a maximum tolerance of up to +/- 2 percent.”

This 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 to display this notice, provided the notice is presented to the customer prior to the beginning of the transaction.

This marking requirement does not apply to DC EVSEs that are capable of meeting an acceptance tolerance of +/- 1 percent and a maintenance tolerance of +/- 2 percent.

(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 Load Accuracy Test Tolerances for DC Systems. -- The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For DC systems installed and placed in service prior to January 1, 2024, and that bear the notice specified in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs installed and placed in service prior to 2024, acceptance and maintenance tolerances are: 5.0 percent. 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 DC systems installed and placed in service on or after January 1, 2024, or that do not bear the notice specified in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs installed and placed in service prior to 2024 tolerances are:

- (1) Acceptance Tolerance: 1.0 percent; and**
- (2) Maintenance Tolerance: 2.0 percent.**

All DC EVSE are exempt from ~~this requirement~~ **paragraph T.2.2** until January 1, 2028.

Previous Action:

2023: New Item

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. But a 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.

1 The proposal would require a charger that is subject to the 5% tolerance to display a marking, with specified
 2 language, informing customers and inspectors of that fact. But the proposal leaves open the possibility that
 3 a given manufacturer might achieve the 1%/2% tolerance earlier, and then would specify that capability for
 4 a given model. Devices in that model would not have to be marked as 5% devices; but if they are not marked
 5 that way, they would of course be subject to the 1%/2% level as for new chargers.

6 **B. The basic justification**

7 DC and AC chargers are fundamentally different—in technology, in customer use, and in metering
 8 capabilities. AC charging technology, the older form, delivers energy in the same form—voltages and
 9 currents oscillating at 60 Hertz (in the United States) as utilities have provided it for a century. Because
 10 a vehicle has to convert AC energy to DC for charging the battery, AC charging stations operate at no more
 11 than 19.7 kW, and most no more than 6-7 kW. These charging rates will add 24-80 miles of range in an
 12 hour of charging a typical car, and consequently AC charging involves extended sessions—the median time
 13 that a customer uses an AC station is 22 hours.³ The voltages delivered are no more than 480 volts ac, and
 14 the current is no more than 50 amps ac (and more typically 30 amps ac). By contrast, DC chargers deliver
 15 energy in the same form that a battery ultimately needs it. Using voltages of 400 to 950 volts dc and
 16 currents up to 500 amps dc (higher levels are coming in the future for applications like charging heavy
 17 trucks), they are able to deliver 50 kW, 150 kW, 350 kW, or higher charging rates. These stations will add
 18 200-1400 miles of range in an hour of charging, or, more meaningfully, 400 miles of range in as little as
 19 20 minutes. A customer at a DC station will arrive, charge briefly, and then depart. Customers
 20 incorporate AC chargers into their regular routines, such as by driving to work and charging there. DC
 21 chargers are more commonly used to support long-distance trips.⁴

22 For AC charging, manufacturers have been able to utilize metering technology that has been developed
 23 over a century for electric utilities. When Handbook 44, section 3.40 was developed in 2015, that AC
 24 metering technology was well understood. There have been long-established standards for AC revenue
 25 meters—though those standards, in the utility sector, are not necessarily the same in every respect as how a
 26 weights and measures standard would work.

27 One indication of the relatively mature state of AC metering is that NIST has long provided ordinary-course
 28 calibration services for AC watt-hour meters that operate at 60 Hertz, within ranges of 69 to 480 volts and
 29 0.5 to 30 amps (sufficient to cover typical AC chargers).⁵ DC metering technology, by contrast, has been
 30 “in research and development.”⁶ When section 3.40 was adopted, the accuracy tolerances of 1.0%
 31 (acceptance) and 2.0% (maintenance) were predictive and aspirational for DC chargers. As of November
 32 2019, when California adopted its own regulation based on section 3.40, meters and chargers meeting that
 33 standard were not yet generally commercially available.⁷ Meanwhile, NIST calibration services for DC
 34 watt-hour meters are non-standard, and are available only up to 240 volts and 5 amps⁸—far below the levels
 35 needed for testing DC chargers.

36 Argonne National Lab has studied the availability of DC metering technology. Our understanding is that
 37 its draft report (not yet finalized, so far as we are aware) concludes that there are now on the market (at
 38 least in principle) meters for use in DC chargers that can meet a 1% acceptance / 2% maintenance
 39 tolerance. It is reasonable to conclude that the 1% / 2% tolerance will be achievable in general. The current
 40 proposal is focused on how to handle the chargers that are installed before that point. Previously installed

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/crz/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/crz/ProductDetails?sku=56110S&cclcl=en_US.

1 chargers will not in general be able to satisfy a 1% / 2% accuracy tolerance. To be clear, we do not suggest
2 that every existing charger would be more than 2% inaccurate. Indeed, it would not genuinely be possible
3 to make that assessment, given the lack of NIST-traceable measurement apparatus to test fast DC chargers
4 in the field.

5 There is presumably a distribution of potential deviations among devices in the field. Given whatmetering
6 technology has been commercially available, a 2% maintenance accuracy would lead to inspection
7 problems for a high proportion of devices.

8 The proposal would establish a tolerance of 5% for devices installed before January 1, 2024. The
9 justification for this particular choice of tolerance and timeline is as follows:

- 10 1. In 2019, California adopted a regulation that put a modified version of section 3.40 into force for
11 new devices. DC chargers installed before January 2023 are subject to no weights and measures
12 standards at all until 2033. DC chargers installed after January 2023 (and before January 2033) are
13 subject to a maintenance tolerance of 5.0% (and acceptance tolerance of 2.5%). Consequently, in
14 California, which represents roughly 30% of the currently-existing base of DC chargers, the
15 maintenance tolerance will be 5.0% for the coming decade. A maintenance tolerance of 5.0% for
16 legacy chargers in section 3.40 will be stricter overall than the California regulation (because it
17 will apply to all legacy chargers, whereas the California standard applies only to post-2023
18 chargers), but will align with the numerical tolerance used in California. Although a 5.0% tolerance
19 is among the larger tolerances used in Handbook 44, it is not unprecedented. And the fact that new
20 chargers in California will be subject to that standard will mean EV charging customers have
21 substantial experience with that chargers at that tolerance, and the 5.0% tolerance we propose would
22 be the same transactional experience as customers in California (the largest EV charging market in
23 the country) receive. It bears mention, too, that as Measurement Canada prepares to implement
24 standards for AC chargers, the tolerance (acceptance and maintenance) will be 3.0%, not the 1%
25 acceptance in Handbook 44. The cost of a typical charging session is \$15 to \$20. A 5.0% maintenance
26 standard would mean a variation, beyond that, of an additional plus or minus 40 cents. As with any
27 tolerance, that variation could at any given charger be for or against either side to the transaction.
- 28 2. The industry submitters have studied carefully their existing chargers, measurement devices and
29 existing models now available. They believe the 5% maintenance tolerance is achievable at a
30 manageable cost in the future, because it will generally not require extensive reconfiguring of
31 cabinets and the installation of four-wire cables.
- 32 3. The cost of bringing legacy chargers into line with the 1%/2% standard would be extreme. Although
33 equipment is not available to test DC fast chargers in the field, some operators have found in tests of
34 existing devices that they can be brought to a 5% tolerance, but cannot meet the 1%/2% standard
35 without replacing the meters or implementing an entirely new measurement system, which means a
36 physical reconfiguration at each station and/or replacing the cables for delivering the energy to
37 vehicles. Section 3.40 standards are based on the energy delivered at the connector to the car; in other
38 words, a charger must account for losses in the cables. The most straightforward way to account for
39 losses is to measure the voltage at the vehicle connector; that means the cable must have two
40 additional high-voltage leads, to carry that voltage back to the meter.⁹ In California's Initial
41 Statement of Reasons (ISOR) for adopting specifications and tolerances requirement for commercial
42 EVSE, California estimated that it costs approximately \$20,000 to retrofit an existing DC charger.¹⁰
43 We understand that cost to represent the cost (parts and labor) to replace the charging cable, and
44 possibly to replace the meter if that task is simple. This cost may be a significant underestimate for
45 some models of charger, because replacing the meter may not always be possible without physical

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.

1 reconfiguration of the space within the charger. Which charger models would require that sort of
 2 reconfiguration, and what proportion of the installed base they represent, is impossible to know
 3 without a detailed model-by-model study and detailed model-by-model installation data across
 4 manufacturers. The upper end of cost would be simply the cost of replacing a charger, which many
 5 operators would find preferable to physical reconfiguration of charger internals anyway. The
 6 International Council on Clean Transportation (“ICCT”) reported in 2019 that fast DC chargers cost
 7 between \$75,000 and \$140,000 per charger, for the charger itself.¹¹ Installation costs range from
 8 \$18,000 per charger (for six 150 kW chargers at a site) to \$65,000 per charger (for one 350 kW
 9 charger at a site).¹² The total cost (installation and equipment) for a 4-charger site would be roughly
 10 \$720,000. That said, some amount of the installation cost represents upgrades to electrical supply
 11 lines and basic site construction, costs that would not be incurred anew to replace equipment. So for
 12 a rough estimate, it is appropriate to use the lowest cost estimate from the ICCT, which is \$17,692
 13 (the cost per charger for a large site of 50 kW chargers). With that figure, replacing a 4-charger site
 14 of 350 kW chargers would cost roughly \$630,000, or \$157,000 per charger.

- 15 4. Based on data on the existing charge base from the National Renewable Energy Laboratory’s
 16 Alternative Fuels Data Center (“AFDC”), we can assume there will be about 36,000 “pre-2024” DC
 17 chargers.¹³ These are only a fraction of the overall chargers that will be installed nationwide over the
 18 coming decade, but bringing them into compliance with a 1%/2% tolerance will be highly costly.
 19 Taking out the 30% that are in California (which already has regulations with a 5.0% maintenance
 20 tolerance, for all post-2023 DC chargers), retrofitting all of those at the \$20,000 cost would total
 21 \$720 million. If meter replacement is not possible and those chargers must all be replaced, the total
 22 would be \$5.6 billion. The actual cost of bringing the pre-2024 chargers to compliance with a 2.0%
 23 maintenance tolerance would be somewhere between these numbers.¹⁴
- 24 5. The January 2024 date moves faster than the California regulation. Under the California regulation,
 25 the 1% / 2% tolerance would not come into force until 2033. It appears that meters capable of that
 26 tolerance are now available on the market. The submitters propose January 2024 as the date for
 27 distinguishing “legacy” from “new” chargers, because the existence of these meters on the market is
 28 not all that is needed. Manufacturers have to access the meters, design products incorporating them;
 29 revise production lines; test the new products to ensure they are safe and reliable; and obtain third-
 30 party certifications (such as from Underwriters Laboratory) of the revised products. After those steps,
 31 a manufacturer can begin delivering a revised product to operators. Installation of a charger is not
 32 simply a matter of placing it on a counter; charging sites involve construction work, leading to the
 33 secure attachment of a charger to a specially built concrete pad. In other words, from the first delivery
 34 of a new model of charger to the first installations of those chargers also takes time. The January
 35 2024 date is appropriate for expecting new chargers to incorporate meters that were available a few
 36 years before that date.
- 37 6. The proposal focuses on installation before January 2024, rather than using the concept of
 38 retroactive/non-retroactive that is more common in Handbook 44, because non-retroactive is

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.

1 ordinarily based on when a device is placed in service. Many states do not yet regulate EV chargers
2 and consequently have no placed-in-service process. In these states, “placed in service” would not
3 be a well-defined concept, and regulators might not have good ways to determine when a device
4 was placed in service. Installation is a reasonably well-defined process, and it should be possible to
5 identify when a given charger was installed. California’s regulation has differing status for pre-
6 2023 and post-2023 chargers, and it bases that line on installation.

7 7. The proposal also specifies 5.0% as the acceptance tolerance, not just the maintenance tolerance.
8 As a practical matter in field inspections, the acceptance tolerance for pre-2024 chargers will not be
9 important. Section 3.40 (as amended at the 2022 NCWM meeting) exempts DC chargers from
10 the accuracy tolerance until 2028. When they become subject to accuracy tolerances, no pre-
11 2024 charger will be at the point of acceptance. The proposal specifies an acceptance tolerance
12 for clarity in type evaluations, which ordinarily evaluate device models against the applicable
13 acceptance tolerance.

14 8. The exemption until 2028 adopted at the 2022 meeting does not eliminate the need for this proposal.
15 When DC chargers are subject to accuracy tolerance requirements, pre-2024 chargers will still need
16 to meet the applicable tolerance or be retrofitted or replaced. The 2028 time frame is unreasonably
17 soon to do that, given the cost estimates above. California estimated that chargers have an effective
18 10-year lifespan.¹⁵ This estimate is highly uncertain, in part because it was based in part on older
19 AC chargers. Newer DC chargers, using more advanced technology for significantly more
20 expensive equipment, are likely to have usable lifetimes greater than 10 years. The proposal
21 recognizes that, nonetheless, there is a tradeoff between the cost of retrofitting or replacing devices,
22 and the value of tighter tolerances. Some number of chargers will fail and need replacement earlier
23 than 10 years, thus reducing the number that eventually need to be retrofitted or replaced to comply
24 with tighter accuracy tolerances. Overall, the proposal uses the same 10- year period that several
25 states have already adopted.¹⁶ Notably, the effect is significantly more stringent than in the
26 California regulation. Under California’s rule, a charger installed before 2023 is subject to no
27 standards for 10 years, and then becomes subject to standards in 2033; a replacement of the charger
28 in 2032 would be subject to the 5.0% maintenance tolerance. A charger installed in 2023 (and that
29 hypothetical 2032 installation) would be subject to the 5.0% tolerance indefinitely, with no end
30 point. Our proposal, by contrast, would make a pre-2024 charger subject to the 5.0% tolerance once
31 the 2028 compliance dates kicks in but only until 2034, at which point the charger would have to
32 be retrofitted, replaced, or otherwise brought to the 1%/2% tolerance.

33 **C. Potential objections**

34 In response to the industry’s original proposal, some people commented that AC and DC chargers should be
35 treated the same. As explained above, they are not the same, not only because of technology differences but
36 also because customers use them and view them differently. California and NTEP have distinguished AC
37 and DC chargers since at least 2021, and NCWM has already recognized important differences between them,
38 in Handbook 44.

39 Some have also commented that there should not be parallel accuracy classes for a given application. But
40 this approach is not unprecedented. In 1986, NCWM required new scales to be marked with an accuracy
41 class. Pre-1986 scales could remain unmarked, and those unmarked scales were subject to various accuracy
42 tolerances (depending on application) that ranged up to 5.0%, compared to the largest tolerance for any
43 marked scale at 2.0%. For grain moisture meters, Handbook 44 has completely separate sections for pre-
44 1998 and post-1998 devices, with some different tolerance specifications for older and newer devices. For
45 both scales and grain moisture meters, there was no sunset date; the older devices have been allowed to
46 continue in use for as long as they operated. We do not suggest that the circumstances with EV chargers are

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).

1 the same. Each of those past examples was based on justifications particular to that situation. Nonetheless,
 2 these examples show that it has been done to maintain parallel tolerances for a given application. In
 3 addition, there are already parallel, differing tolerances for EV chargers. If the proposal is not adopted, pre-
 4 2023 chargers in California will have no tolerance at all until 2033; post-2023 chargers will have a 5.0%
 5 maintenance tolerance for the indefinite future; and chargers elsewhere in the country, including in states
 6 neighboring California, will have the existing Handbook 44 tolerances. The proposal shifts the line between
 7 differing tolerances, but the situation of differing tolerances for the same application is already in place
 8 without the proposal.

9 There have been claims that some manufacturers may be able to achieve 1% devices (DC chargers) before
 10 January 2024, and one or more may already have done so. Even so, the proposal is still warranted. Operators
 11 of EV chargers should not be forced to replace their existing chargers simply because they could not get
 12 access to chargers made by a given manufacturer. It is generally agreed that when section 3.40 was adopted,
 13 the equipment to satisfy it did not exist for DC chargers. Reaching that point has required research and
 14 development by meter manufacturers and charger manufacturers. The goal of regulation should be to handle
 15 the technology transition in a reasonable, fair manner, without prejudice to operators that have made diligent
 16 efforts in procurement and operation of their chargers.

17 This proposal arrives without the formal approval of the U.S. National Work Group subgroup on EV
 18 charging. But a similar proposal did have general consensus at the Work Group. NIST personnel solicited
 19 views on the proposal through an email ballot at the end of June 2022. The resulting votes were 11 in favor,
 20 and 1 opposed. As of this filing, NIST has not provided information on whether this vote was sufficient for
 21 the subgroup to formally endorse the proposal. The one person voting “no” said that the person would have
 22 voted yes if the proposal included a 10-year end date for the 5% tolerance. The current proposal has that
 23 feature and thus addresses the only concern expressed by the sole “no” vote.

24 **Comments in Favor:**

25 **Regulatory:**

- 26 • 2023 Interim: Mr. Craig VanBuren (Michigan Department of Agriculture) supports the item as voting
 27 with submitted edits.
- 28 • 2023 Interim: Mr. Hal Prince (Florida Department of Agriculture and Consumer Services) supports the
 29 item as Voting, adding the EVF-23.5 is not complete and is missing needed language. Mr. Prince
 30 expressed the item is critical and is willing to work with the NIST USNWG EVFE Subgroup to move
 31 the item forward.
- 32 • 2023 Interim: Mr. Mahesh Albuquerque (Colorado Division of Oil and Safety) supports developing the
 33 item with suggestive edits, striking language in T.2.2.(b).
- 34 • 2023 Annual: Craig VanBuren (Michigan) states that the item meets his state needs and supports the
 35 item.
- 36 • 2023 Annual: James Cassidy (Massachusetts) in support of the item and feels strongly about moving
 37 the 2028 date to 2024 or 2025.
- 38 • 2023 Annual: Daniel Walker (Ohio) supports the item with digital notification.
- 39 • 2023 Annual: Steve Timar (New York) supports the item.
- 40 • Mauricio Mejia (Florida) supports the item and pointed out that the 2028 date is current code already
 41 in Handbook 44 and can be changed as the testing equipment is developed.
- 42 • Jason Flint (New Jersey) supports the item with the modifications proposed by the CWMA that allows
 43 digital display of the notice.
- 44 • Walt Remmert (Pennsylvania) commented the dates make sense and are a reasonable solution.
- 45 • Stephen Benjamin (North Carolina) supports the item.

- 1 **Industry:**
2 • 2023 Interim: Mr. Keith Bradley (Electrify America) commented on the 5% tolerance proposed in the
3 item. Mr. Bradley referenced the October 15, 2022 letter submitted to the Committee and added the
4 item does not create a conflict with the tolerances and the 2028 date.
5 • 2023 Interim: Ms. Francesca Wahl (Tesla) agreed with Mr. Bradley’s comments and supports a Voting
6 status.
7 • 2023 Annual: Keith Bradley (Electrify America) commented that DC chargers are newer and are going
8 through constant change and updates with metrology capabilities supports the item.
9 • 2023 Annual: Francesca Wahl (Tesla) supports the item and noted that when the EV code was adopted
10 in 2022 it established that all EV charges would be compliant by 2034. Any legacy charger that does
11 not have the 5% statement would automatically have a 2% tolerance.
12 • 2023 Annual: Jared Ballew (ChargePoint) supports the language in the CWMA report and believes the
13 5% statement should be displayed digitally on the device.
14 • 2023 Annual: Alex Beaton (EVgo) supports the item and stated that if the device isn’t marked with the
15 5% statement, it gets the 2% tolerance.
16 • Tom Lawton (TESCO) supports the tolerances and thinks the industry should come to a consensus on
17 the dates. He commented TESCO is in the process of testing equipment and the 2028 date is not
18 necessary for his company.

- 19 **Advisory:**
20 • None

21 **Comments Against:**

- 22 **Regulatory:**
23 • 2023 Annual: Kevin Schnepf (California) does not see the benefit of having a 2024 and a 2028 date
24 and recommends withdrawal of the item.
25 • 2023 Annual: Stan Toy (Santa Clara County, CA) request making the item informational or
26 withdrawal.
27 • 2023 Annual: Paul Floyd (Louisiana) supports the tolerance but does not support putting the notice on
28 the item. Mr. Floyd stated he does not want to put a seal on a device that advertises a wider tolerance.

- 29 **Industry:**
30 • None

- 31 **Advisory:**
32 • None

33 **Neutral Comments:**

- 34 **Regulatory:**
35 • 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) suggests
36 replacing the word “installed” with “installed and placed in service” in paragraph T.2.2.(a) and
37 T.2.2.(b).
38 • 2023 Interim: Mr. Keith Bradley (Electrify America) responded to Mr. Schnepf’s comment, noting not
39 all jurisdictions have requirements for place in service.

- 40 **Industry:**
41 • None

Advisory:

- 2023 Interim: Ms. Tina Butcher (NIST OWM) referred to the written comments submitted by NIST OWM and commented on the formatting and dates in paragraph T.2.2. (b); adding the language in this paragraph should be made clearer. Ms. Butcher expressed support for EVF-23.5 and found EVF-23.6 confusing.
- 2023 Annual: Loren Minnich (NIST OWM) stated the item needed more work and should be informational. OWM has an issue with the three differing dates that appear in the proposal as they could be confusing and lead to enforcement issues.

Item Development:

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.

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.

Regional Associations' Comments:

WWMA 2022 Annual Meeting: Ms. Scheleese Goudy (Electrify America) – Ms. Goudy commented on the metering technology for DC chargers are now becoming available as technology develops. Ms. Goudy proposed previously installed devices will not be able to meet the 1 and 2% tolerances. Ms. Goudy commented the tolerances are being developed with separate tolerances for legacy devices that can't meet the proposed requirements. Ms. Goudy stated there was a vote of 11-1 in favor of the item in the assigned work group. The 1 no vote said that it would have been a yes if there was a 10-year sunset. Ms. Goudy stated the changes to the item incorporated the change to include a 10-year sunset of legacy devices. Ms. Goudy commented devices would be marked for the public and inspectors with the required tolerances. Ms. Goudy recommended voting status.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf commented this was discussed in the national workgroup. Mr. Schnepf recommends that a task group be assigned to verify which items were in a consensus and which were not. Mr. Schnepf proposed a hard stop date for legacy devices is necessary and that there isn't one with the current language. Mr. Schnepf commented on his disagreement with the "or" statement in the current language.

Ms. Francesca Wahl (TESLA) – Ms. Wahl commented TESLA agrees with the comments made by Electrify America. Ms. Wahl commented the language is to include a hard stop date of legacy devices supports the removal of "or" from the language.

Mr. Chris King (Siemens) – Mr. King commented Siemens agrees with TESLA's comments.

During open hearings, comments were heard that contents in this item were previously discussed in the USNWG, but no official position has been taken by the USNWG. There were also comments during open hearing taking the position the item is not fully developed. The WWMA S&T Committee recommends the submitters work with the USNWG to develop one proposal by combining language from EVF -23.5.

The WWMA S&T Committee recommends that this item be blocked with item EVF-23.5. The WWMA S&T Committee recommends the new blocked items be assigned a developing status.

SWMA 2022 Annual Meeting: Mr. Prince, State of Florida, spoke in favor of this item being a satisfactory compromise.

Mr. Floyd, State of Louisiana, stated that he would rather not have devices with warning labels for accuracy.

1 Ms. Goudy of Electrify America, the submitter of this item, recommended this move forward as a voting item.

2 Mr. Stokes, State of South Carolina, stated that he supported the use of warning labels for these devices, and supported
3 this item.

4 The SWMA S&T Committee recommends this item move forward as a Voting Item.

5 CWMA 2022 Interim Meeting: Scheleese Goudy – Electrify America, DC EVSE installed before 2024 will have 5 %
6 accuracy until 2034. When the tentative code was written in 2015, historical data for AC measurements were readily
7 available. DC metering technology was still in R&D. Tolerances could not be formulated. Legacy devices could
8 reasonably meet 5 % , but not 1% / 2 %. This could require complete replacement of many legacy devices.

9 Francesca Wahl – Tesla, Rework of two above. Does not modify the 2028 date but provides a pathway forward. This
10 proposal represents informal consensus of the NIST USNWG

11 Craig VanBuren – Michigan. Move forward as Voting. Possible change: P 244, line 39.which “may” operate.

12 The CWMA S&T Committee believes this item is fully developed and recommend voting status with the following
13 changes:

14 **S.5.2. EVSE Identification and Marking Requirements.** – In addition to all the marking requirements
15 of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information
16 conspicuously, legibly, and indelibly marked:

- 17 (a) voltage rating;
- 18 (b) maximum current deliverable;
- 19 (c) type of current (AC or DC or, if capable of both, both shall be listed);
- 20 (d) minimum measured quantity (MMQ); and
- 21 (e) temperature limits, if narrower than and within – 40 C to + 85 C (40 F to + 185 F).

22 **S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024. - A DC EVSE installed prior to**
23 **2024 shall be marked with the following unless it is certified to the tolerances of T.2.2(b):**

24 **NOTICE:**

25 **“This charger operates at a tolerance of up to +/- 5 percent versus other chargers which may operate at a**
26 **tolerance of up to +/- 2 percent.”**

27 **This marking shall be conspicuously and legibly displayed in a position plainly visible to a person**
28 **accessing a charging port of the EVSE.**

29 **(Added 202X)**

1 T.2. Test Tolerances.

2 T.2.1. EVSE Load **Accuracy** Test Tolerances for **AC Systems**. – The tolerances for EVSE load tests **for**
 3 **AC systems** are:

4 (a) Acceptance Tolerance: 1.0 %; and

5 (b) Maintenance Tolerance: 2.0 %.

6 **T.2.2. EVSE Load Accuracy Test Tolerances for DC Systems. -- The tolerances for EVSE load tests**
 7 **on DC systems shall be as follows:**

8 **For DC systems installed prior to January 1, 2024, and that bear the notice specified in paragraph**
 9 **S.5.2.1. Marking of Accuracy Limits. DC EVSEs Installed Prior to 2024, acceptance and maintenance**
 10 **tolerances are: 5.0 %. This paragraph T.2.2(a) shall expire on January 1, 2034; after that date, all**
 11 **DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).**

12 NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) recognizes that when the code was originally
 13 adopted there was questions about DC meters being able to meet a 1% and 2% tolerance. This item is to make sure
 14 devices are properly marked for the consumer as installed before 2024 and 5% tolerance. If devices are not marked
 15 this way, the 1% and 2% tolerances would apply. Installed devices would have the larger tolerance until 2034, then
 16 revert. Ms. Francesca Wahl (Tesla) recommends voting status. Ms. Juana Williams (NIST-OWM) notes that there
 17 is a letter from NIST to indicate that a status update on this item is forthcoming and has info to address marking and
 18 tolerances for DC systems. In a June meeting by the EVSE Subgroup, there was no 2028 retroactive date being
 19 considered and the proposal they reviewed included different sets of tolerances and marking requirements based on
 20 install date. Mr. Jason Flint (NJ) requested that this item be given a developing status as there is too much debate and
 21 too many questions. Mr. Flint suggested that the submitters of EVF-23.5 and EVF-23.6 work together to develop
 22 further.

23 After hearing comments from the floor, the Committee believes the item is not fully developed and several questions
 24 need to be answered. The Committee is recommending that this item be given a Developing status.

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

EVF-23.6

Regional recommendation to NCWM on item status:

- Recommend as a Voting Item on the NCWM agenda
- Recommend as an Information Item on the NCWM agenda
- Recommend as an Assigned Item on the NCWM agenda
(To be developed by an NCWM Task Group or Subcommittee)
- Recommend as a Developing Item on the NCWM agenda
(To be developed by source of the proposal)
- Recommend Withdrawal of the Item from the NCWM agenda
(In the case of new proposals, do not forward this item to NCWM)
- No recommendation from the region to NCWM
(If this is a new proposal, it will not be forwarded to the national committee by this region)

Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)

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.

1

2 **EVF-23.7 D N.1. No Load Test, N.2. Startin Load Test., N.5.2. Accuracy Testing, And**
 3 **Appendix D: maximum deliverable amperes.**

4 **Source:**
 5 Electrify America

6 **Purpose:**
 7 The proposal would have the testing conducted at the contemplated 10%. Because it is unlikely that tests would
 8 actually be at precisely 10%, the proposal would allow testing in a small range slightly above 10%.

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

11 ~~**N.1. — No Load Test. — A no load test may be conducted on an EVSE measuring system by**~~
 12 ~~**applying rated voltage to the system under test and no load applied.**~~

13 ~~**N.2. — Starting Load Test. — A system starting load test may be conducted by applying rated**~~
 14 ~~**voltage and 0.5 ampere load.**~~

1 **N.5.2. Accuracy Testing.** –The testing methodology compares the total energy delivered in a transaction
2 and the total cost charged as displayed/reported by the EVSE with that measured by the measurement
3 standard.

4 (a) For AC systems:

- 5 (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable
6 amperes (~~expressed as MDA) as determined from the pilot signal~~ for a total energy delivered
7 of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum
8 deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.
- 9 (2) Accuracy test of the EVSE system at a load ~~not greater than~~ **between** 10 % **and 20%** of the
10 maximum deliverable amperes (~~expressed as MDA) as determined from the pilot signal~~ for
11 a total energy delivered of at least the minimum measured quantity (MMQ).

12 (b) For DC systems (see note):

- 13 (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable
14 amperes ~~current (expressed as MDA) as determined from the digital communication~~
15 ~~message from the DC EVSE to the test standard~~ for a total energy delivered of at least twice
16 the minimum measured quantity (MMQ).
- 17 (2) Accuracy test of the EVSE system at a load ~~between not more than~~ **between** 10 % **and 20%** of the
18 maximum deliverable amperes (~~expressed as MDA) as determined from the digital~~
19 ~~communication message from the DC EVSE to the test standard~~ for a total energy delivered
20 of at least the minimum measured quantity (MMQ).

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

22 (Amended 2022)

23 Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that
24 circumstance, testing at the load presented by the vehicle shall be sufficient **provided that it is greater than**
25 **30% of the maximum deliverable amperes of the EVSE system.**

26 Appendix D:

27 **maximum deliverable amperes. - The value in amperes, marked on an EVSE pursuant to paragraph S.5.2.**
28 **EVSE Identification and Marking Requirements, of the maximum current that the EVSE can provide.**

29 **Previous Action:**

30 New item in 2023

31 **Original Justification:**

32 The accuracy tests in section 3.40 contemplate testing an EV charger at two points, one at relatively low current and
33 power, and the other at relatively high current and power. The low point was evidently intended to be at 10% of a
34 charger’s maximum current. It is likely that charger manufacturers have designed chargers with that 10% in mind as
35 the “low” point of accuracy tests. But the code does not actually state that testing should be *at* 10%. It says testing
36 can be at a current *less than* 10%. This formulation is problematic because it encompasses any current less than 10%.
37 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
38 charger to first register a load.

1 Even currents larger than these, but less than 10%, would be unnecessarily difficult for an accuracy test. The problem
2 is that low currents are an area where accuracy is particularly difficult. For example, one common metering
3 configuration is to measure the current being delivered by means of a shunt resistor, which generates a voltage from
4 the high current passing through it. These resistors necessarily have very low resistances, because they are necessarily
5 dissipating power in accordance with the resistance. A typical resistor in an EV charger metering setup might be 100
6 micro-ohms. For a 500 amps full-scale current in a DC charger, that resistor would be dissipating 25 watts of power
7 - thus, a much larger resistor is not a practical option. At, say, 10 amps of delivered current, the voltage generated
8 across the resistor would be 1 millivolt. A 1% measurement of that 1 millivolt would be 10 microvolts. At that level,
9 a range of noise sources become quite significant, such as thermal EMF in the resistor itself and induced EMFs from
10 the presence within the charger cabinet of voltages up to 480 volts ac or 950 volts dc, as well as any offsets or noise
11 in the circuitry measuring the transduced voltage. The net result is that it is very challenging to achieve high accuracy
12 at low currents in a device designed to handle and measure high currents. For reasons like these, the draft international
13 (OIML) standard specifies that an accuracy test should be conducted *at* a given minimum current, rather than (like
14 current Handbook 44) at any current *up to* that minimum.

15 Meanwhile, low currents are the levels least significant for transactional accuracy. At low current, a charger is
16 delivering energy at a relatively low rate. As a practical matter, an EV will charge at the maximum rate possible in
17 the circumstances. As the battery reaches a higher state of charge, it will draw less power from the EV, but only a
18 small proportion of the overall energy will be delivered at low rates, precisely because the rates are low. Suppose, as
19 a simplified example, an EV charges for 30 minutes at 300 amps and 30 minutes at 15 amps (at a voltage of 400 volts).
20 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
21 period of charging contributes relatively little to the accuracy/inaccuracy of the overall transaction.

22 Thus, it is important for Handbook 44 to set a minimum current for accuracy tests. Because the point of 10% of the
23 maximum deliverable amperes is already in the code and has probably been used as a design basis for chargers, the
24 proposal would keep that as the low-current point. The overall concept would be for testing to occur *at* 10% of
25 maximum deliverable amperes, rather than *up to* 10%. But it is impractical to specify a single point. An inspection
26 that does not achieve a test at precisely the 10% should not, as a consequence, be an invalid inspection. To make this
27 practical, the proposal would have the low-end test occur in a range of currents, namely 10% to 20% of the charger's
28 maximum.

29 The code presents a similar problem for DC chargers tested using EVs as loads. The code allows an EV to be used as
30 the load, rather than using a controlled load that draws the loads specified in the code. But the code provides no
31 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
32 95% state of charge in the battery, and that would arrive at the charger and draw very low levels of current (sometimes
33 called a "trickle charge"). For the reasons discussed above, that sort of test would not be a productive test of the
34 meaningful accuracy of the charger. The code should set a minimum current for an EV-based test to be usable. The
35 proposal would have that minimum be 30% of the charger's maximum. It is set at more than 10% because the EV-
36 based test uses a single test point, which should therefore be somewhere in the middle of the charger's range.

37 The proposal would also add a definition of "maximum deliverable amperes." This quantity is the same as used in
38 the existing code as the basis for the 10% figure, but it is not currently defined. The definition would state that
39 maximum deliverable amperes means the amount marked on the charger. (The code already requires that amount to
40 be marked.) This amount might be less than the manufacturer's specification for the potential maximum of the device,
41 if for example the installation limits the charger to a particular amount, or the installer has selected a configuration
42 with a lower maximum. But the maximum deliverable amount is a quantity that is fixed at installation, and marked
43 on the charger. The current code suggests that maximum deliverable amperes is the amount that the charger
44 communicates to a vehicle or test apparatus. That approach is confusingly ambiguous, because the charger might for
45 various reasons sometimes communicate a lower available current than its marked maximum. The proposal clarifies
46 that for accuracy tests based on a percentage of maximum current, the "maximum" being used is the maximum marked
47 on the device.

48 These concepts have been discussed in the U.S. National Work Group's subgroup on EV charging. There is general
49 consensus in favor of the proposal, but there has not been a quorum to vote formally in favor of it.

1 Finally, the proposal would eliminate the no-load and starting-load tests. These tests take unnecessary time, because
2 an inspector has to wait to verify that a load of zero genuinely produces no response and a starting load of just 0.5
3 amps produces a response. Meanwhile, these tests are not meaningful for the transactional accuracy of an EV charger.
4 In the process of establishing a handshake that the EV charger is connected to a vehicle, the charger might provide
5 minute test amounts of current, so that a truly zero load is not pertinent to any real transaction; and these minute test
6 currents may well be above 0.5 amps, so that this threshold is also not pertinent to transactions. It would be possible
7 to verify that a charger does not register an energy delivery when no transaction is started, but that test would be
8 redundant of verifying that the charger starts at zero. Meanwhile, 0.001 kWh (the minimum resolution under
9 Handbook 44) corresponds to roughly 3 to 5 hundredths of a cent, so that verifying the registration of such tiny
10 amounts given a tiny current is not helpful for the overall transactional accuracy.

11 The submitter is not aware of objections that would be raised to this proposal. The concept is consistent with the
12 discussions at the U.S. National Work Group based on information from testing over the past six years, and input from
13 regulators and industry.

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

15 **Comments in Favor:**

16 **Regulatory:**

- 17 • None

18 **Industry:**

- 19 • None

20 **Advisory:**

- 21 • None

22 **Comments Against:**

23 **Regulatory:**

- 24 • 2023 Interim: Mr. Ed Williams (Ventura County Agricultural Commissioner, CA) commented the
25 language needs clarification on the maximum deliverable amperes and suggested the current language
26 may be restrictive since there is a prescriptive range to test within.

27 **Industry:**

- 28 • 2023 Interim: Mr. Keith Bradley (Electrify America) commented it is difficult to test EVSE devices at
29 low current and has the least impact to the commercial transaction. Mr. Bradley stated it is more
30 appropriate to have a range and recommends striking language in Pub 15, page S&T-287, lines 6-7.
31 Mr. Bradley added this item is needed to address low limit testing.
32 • 2023 Annual: Mr. Keith Bradley, Electrify America (submitter)-working on updates.

33 **Advisory:**

- 34 •

35 **Neutral Comments:**

36 **Regulatory:**

- 37 • 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) agrees
38 with Ms. Butcher's comments and recommends the submitter work with the NIST USNWG EVFE
39 Subgroup for item development.

Industry:

- None

Advisory:

- Ms. Tina Butcher (NIST OWM) referred to the written comments submitted by NIST OWM. Ms. Butcher added there is more work needed to develop this item and referred to WWMA's recommendation to combine with EVF-23.4 and to work with NIST USNWG EVFE Subgroup for item development.

Item Development:

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.

NCWM 2023 Annual Meeting: The Committee heard from Keith Bradley, Electrify America (submitter) that they are working on updates.

Regional Associations' Comments:

WWMA 2022 Annual Meeting: Ms. Scheleese Goudy (Electrify America) – Ms. Goudy commented the item is written to allow testing at any current and the rate to charge is very low compared to the 10% accuracy. Ms. Goudy commented these tests make inspectors wait and are not meaningful for the accuracy of an EV charger. Ms. Goudy commented there was a broad consensus at the USNWG but no official vote was taken by the work group. Ms. Goudy recommended a voting status.

Mr. Chris King (Siemens) – Mr. King commented Siemens targets a 10% accuracy test. Mr. King commented Siemens is in favor of the change.

Ms. Francesca Wahl (TESLA) – Ms. Wahl second the comments by Electrify America and Siemens. Ms. Wahl recommended a voting status.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf commented in full support of recommendations to strike the no load and starting load tests. Mr. Schnepf commented he doesn't think there is consensus from the workgroup. Mr. Schnepf recommend that this item be discussed with the US National working group to make sure that it is highly agreed upon. Mr. Schnepf proposed if two vehicles are charging at once it cuts the 10% in half. Mr. Schnepf commented in favor the range between 10 and 20%. Mr. Schnepf recommended a developing status.

During open hearings, comments were heard that contents in this item were previously discussed in the USNWG, but no official position has been taken by the USNWG. There were also comments during open hearing taking the position the item is not fully developed. The WWMA S&T Committee recommends the submitters work with the USNWG to develop one proposal by combining language from EVF-23.4.

The WWMA S&T Committee recommends that this item be blocked with item EVF-23.4. The WWMA S&T Committee recommends the new blocked items be assigned a developing status.

SWMA 2022 Annual Meeting: Mr. Prince, State of Florida, supports this as a voting item.

Ms. Goudy, Electrify America, recommends this item move forward as a voting item.

The SWMA S&T Committee recommends this item move forward as a Voting Item.

1 CWMA 2022 Interim Meeting: Scheleese Goudy – Electrify America, Low end test was meant to be at 10% but as
2 written would allow anything less than 10 %. Less than 10 % is unnecessarily difficult. Little energy will be delivered
3 at these low rates. Greater inaccuracies below 10 %. Move forward as voting. Note the change on N.5.2.1.(b)(2) to
4 “between 10 % and 20%”.

5 Francesca Wahl – Tesla, Moving forward as voting.

6 Loren Minich – Kansas, P 252 Line 10, remove the “of” before the range.

7 Craig VanBuren – Michigan, Agrees. Ready for voting with recommended changes.

8 The CWMA S&T Committee believes this item is fully developed and recommend voting status with the following
9 changes:

10 **N.1.No Load Test.** – A no load test may be conducted on an EVSE measuring system by applying rated voltage
11 to the system under test and no load applied.

12 **N.2.Starting Load Test.** – A system starting load test may be conducted by applying rated voltage and 0.5-
13 ampere load.

14 **N.5.2.1. Accuracy Testing.** – The testing methodology compares the total energy delivered in a
15 transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement
16 standard.

17 (a) For AC systems:

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

22 (2) Accuracy test of the EVSE system at a load of not greater than between 10 % and 20% of the
23 maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a
24 total energy delivered of at least the minimum measured quantity (MMQ).

25 (b) For DC systems (see note):

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

30 (2) Accuracy test of the EVSE system at a load of not more than between 10 % and 20% and 20 %
31 of the maximum deliverable amperes (expressed as MDA) as determined from the digital
32 communication message from the DCEVSE to the test standard for a total energy delivered of
33 at least the minimum measured quantity (MMQ).

34 Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that
35 circumstance, testing at the load presented by the vehicle shall be sufficient provided that it is greater than 30%
36 of the maximum deliverable amperes of the EVSE system.

1 And
 2 Appendix D:

3 maximum deliverable amperes. - The value in amperes, marked on an EVSE pursuant to paragraph S.5.2. EVSE
 4 Identification and Marking Requirements, of the maximum current that the EVSE can provide.

5 NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) stated that the core problem is testing at low
 6 currents. Mr. Bradley believes that “10%-20%” is better than “up to 10%” as no currently installed charger will be
 7 able to do less than 10%. Currently, the HB doesn’t qualify what the test procedure is for testing device using an EV.
 8 Ms. Juana Williams (NIST-OWM) indicated that the removal of “no load test” and “starting load test” is consistent
 9 with other proposals viewed by the EVSE Subgroup. Ms. William also questioned how an inspector will know they
 10 reached 10% and 85% if there is no pilot signal or information coming from digital communications with the system.
 11 Mr. Williams also noted that a definition being tied to marking requirement is not typically done. Mr. Keith Bradley
 12 (Electrify America) explained that an inspector would know max deliverable amps as it should be marked on the
 13 device, know the current as displayed by the testing apparatus, then compare. Mr. Jason Flint (NJ) recommended that
 14 the item be developing.

15 After hearing comments from the floor, the Committee believes the item has merit. The Committee is recommending
 16 a Developing status

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

EVF-23.7
<p>Regional recommendation to NCWM on item status:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input checked="" type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>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.</p> <p>The committee recommends this item be withdrawn.</p>

19

20 **GMA – GRAIN MOISTURE METERS 5.56 (A)**

21 **GMA-19.1 D Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Method for**
 22 **All Grains and Oil Seeds.**

23 **Source:**

1 NTEP Grain Analyzer Sector

2 **Purpose:**

3 Reduce the tolerances for the air oven reference method.

4 **Item Under Consideration:**

5 Amend Handbook 44, Grain Moisture Meter Code 5.56 (a) as follows:

6 **T.2.1. Air Oven Reference Method.** – Maintenance and acceptance tolerances shall be as shown in
 7 Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as
 8 a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance.
 9 (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	
<u>Tolerance</u>	<u>Minimum Tolerance</u>
<u>0.03 of the percent moisture content</u>	<u>0.5 % in moisture content</u>

(Amended 2001 **and 20XX**)

10 **Background/Discussion:**

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

13 Mr. Karl Cunningham
 14 Illinois Department of Agriculture
 15 217-785-8301, karl.cunningham@illinois.gov

16 Samples and list of grains that AMS, FGIS request from states to include in their ongoing calibration program. States
 17 and other interested parties wanted to verify that corn samples from their state were included in the calibration data
 18 for NTEP meters because of variations states reported between UGMA meter and other meter technologies on corn
 19 samples.

1 During the 2016 Grain Analyzer Sector Meeting, numerous instances of inconsistent moisture meter measurements
2 involving grain shipments from U.S. interior facilities to U.S. export port facilities were reported. The Sector received
3 a suggestion that if the UGMA can make better measurements, then the Sector should consider reducing the applicable
4 tolerances in HB 44. At the 2016 and 2017 Grain Analyzer Sector meetings Mr. Charlie Hurburgh (Iowa State
5 University) agreed to chair a GA Sector Task Group to review the current HB 44 tolerance with both UGMA meters
6 and Non-UGMA meters. During the 2018 meeting Mr. Hurburgh reported that based on data he analyzed from Iowa
7 State Weights and Measures Grain Inspection reports, UGMA meters read closer to the reference air oven moisture
8 results than non-UGMA meters.

9 It was also noted during the 2018 NTEP Grain Analyzer Sector meeting that the current tolerances were developed in
10 1991 and have not been changed to coincide with the change in technology for these devices; and this action is needed
11 for grain industry risk management.

12 Prior to the 2019 NCWM Interim Meeting, all four regional weights and measures associations agreed to forward the
13 proposal as a voting item on the Interim Agenda. However, following the regional meetings, additional data was
14 submitted to the Sector which indicates a need to consider developing different tolerance for some grain types.
15 Through a subsequent ballot, and a majority vote, the Sector agreed to recommend changing the status of the item to
16 developing to provide the Sector time to consider additional data and changes to its original proposal.

17 NCWM 2019 Interim Meeting: The NCWM S&T Committee heard comments to agenda item GMA-3. Mr. Loren
18 Minnich (KS) commented that he spoke with Ms. Diane Lee (NIST OWM) and she reported that one state was
19 concerned with the application of the reduced tolerances to all grain types, specifically grains with hulls or husks. Mr.
20 Minnich suggested that this item be assigned a “Developing” status to allow for more research into this issue. The
21 committee also received written comments from NIST, OWM (see NIST, OWM Analysis posted on the NCWM
22 Website). During the 2019 Interim Meeting, the S&T Committee considered the comments during the opening
23 hearing and comments submitted prior to the meeting and assigned a “Developing” status for this item.

24 NCWM 2019 Annual Meeting: Ms. Diane Lee (NIST OWM) provided an update on the history of the item. Ms. Lee
25 noted that the NTEP Grain Analyzer Sector will review data from Arkansas at its 2019 meeting intended to assure that
26 proposed changes to the tolerances can be applied to all grains. Ms. Lee speaking on behalf of the Sector stated that
27 the Developing status assigned to this item is appropriate.

28 NCWM 2020 Interim Meeting: The Committee heard from Ms. Diane Lee (NIST OWM) who stated that when this
29 item was initially submitted the GMM Sector agreed to reduce tolerance based on data that was limited to corn and
30 soybeans. Following the review of the initial data, additional data from Long Grain Rough Rice was reviewed and
31 the sector agreed that additional data was needed on other grains to include oats, rice, and barley, prior to changing
32 the tolerances. Ms. Lee requested that the item remain developing status as additional data is collected.

33 During the Committee’s work session, the committee agreed to retain this item as Developing to allow the submitter
34 to continue working with members of the grain analyzer sector to collect additional data.

35 NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at
36 which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting
37 Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

38 NCWM 2021 Annual Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that
39 additional data is needed to assess the proposed tolerances. Ms. Lee requested that this item remain Developing.
40 During the Committee’s work session, the Committee agreed to a Developing status for this item.

41 NCWM 2022 Interim Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that
42 additional data is needed to assess the proposed tolerances. Ms. Lee added that states would be submitting more data.
43 Ms. Lee requested that this item remain Developing. During the Committee’s work session, the Committee agreed to
44 a Developing status for this item.

SWMA S&T 2023 Annual Meeting Report

- 1 NCWM 2022 Annual Meeting: The Committee heard updates from Ms. Tina Butcher, NIST OWM. The original
2 intent of this item was to apply the proposed tolerance to corn and soybeans, however, other grains were identified for
3 areas of study. The Grain Sector was working with States to collect additional data; however, the pandemic has slowed
4 the process. The Grain Sector is requesting additional time to collect this data. The Committee has agreed to maintain
5 a Developing status for this item.
- 6 NCWM 2023 Interim Meeting: The S&T Committee heard comments from the floor during open hearings. Mrs. Tina
7 Butcher (OWM/NIST) commented that COVID has put a hamper on the collection of data that is needed for the study.
8 Request that the item remain developing. The committee left the item Developing.
- 9 NCWM 2023 Annual Meeting: The S&T Committee heard comments from NIST that they were still waiting on
10 sample data and that North Carolina had submitted some data for review as stated in the OWM Analysis.
- 11 **Regional Associations' Comments:**
- 12 WWMA 2022 Annual Meeting: No additional data or update was received by the committee. The WWMA S&T
13 Committee recommends withdrawal and encourages the submitter to reintroduce the item when sufficient data is
14 available.
- 15 SWMA 2022 Annual Meeting: No comments were received on this item during the 2022 SWMA Annual Meeting.
16 The SWMA S&T Committee recommends this item remain as a Developing Item.
- 17 CWMA 2022 Interim Meeting: Doug Musick – Kansas, Remain developing, waiting on data.
18 Ivan Hankins – Iowa, 0.5 % tolerance is fair and should move forward to voting.
19 The CWMA S&T Committee recommends this remains a Developing item to allow time to collect additional data
- 20 NEWMA 2022 Interim Meeting: Ms. Diane Lee (NIST-OWM) indicated the need for more data on more grains. This
21 proposal is seeking to lower tolerances due to better technologies of UGMA meters. However, according to data
22 submitted by North Carolina, grains are failing at the proposed tolerances. Ms. Lee requests more time so more states
23 can submit data.
24 The Committee is recommending that this item retain a Developing status.
- 25 Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to
26 www.ncwm.com/publication-15 to review these documents.

GMA-19.1	
Regional recommendation to NCWM on item status:	
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input checked="" type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>	
Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)	
<p>Jason Glass, Kentucky, recommended withdrawing the item due to lack of feedback from the submitter.</p> <p>Aaron Webb, Maryland, stated that the current tolerances were already difficult to achieve, and would not support changing them.</p> <p>The committee recommends Withdrawal of this item, due to no comments in support, feedback, or development of this item over several years.</p>	

1

2 **OTH – OTHER ITEMS**

3 **OTH-16.1 I Electric Watthour Meters Tentative Code**

4 **Source:**

5 NIST, Office of Weights and Measures

6 **Purpose:**

- 7 1) Make the weights and measures community aware of work being done within the NIST U.S. National Work
8 Group (USNWG) on Electric Vehicle Fueling and Submetering to develop proposed requirements for electric
9 watthour meters used in submeter applications in residences and businesses;
10 2) Encourage participation in this work by interested regulatory officials, manufacturers, and users of electric
11 submeters.
12 3) Allow an opportunity for the USNWG to provide regular updates to the S&T Committee and the weights and
13 measures community on the progress of this work;
14 4) Allow the USWNG to vet specific proposals as input is needed.

15 **Item Under Consideration:**

16 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

1 official examination of a Non-Utility Electricity-Measuring System (NUEMS) are advised to see paragraph
 2 G-A.3. Special and Unclassified Equipment.
 3 (Tentative Code Added 20XX)

4 NUEMS Acronym and Definition: As used throughout this code, a Non-Utility Electricity-Measuring System
 5 or “NUEMS” is defined as an electricity measuring system comprised of all the metrologically relevant
 6 components required to measure electrical energy, store the result, and report the result used in non-utility
 7 sales of electricity wherein the sale is based in whole or in part on one or more measured quantities.

8 Safety Note: This code does not specifically discuss Safety. It is essential that all personnel working with the
 9 devices covered by this code and associated electrical equipment be properly trained and adhere to all
 10 applicable safety standards, regulations, and codes. See also General Code Paragraph G-N.1. Conflict of Laws
 11 and Regulations.

12 A. Application

13 A.1. General. – This code applies to measuring systems used in non-utility sales of electric energy wherein the
 14 sale is based in whole or in part on one or more measured quantities.

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

16 (a) The use of any measuring system owned, maintained, and/or used by a utility.

17 (b) Measuring systems used solely for delivering electric energy in connection with operations in which
 18 the amount delivered does not affect customer charges or compensation.

19 (c) Electric vehicle fueling systems. (See 3.40. Electric Vehicle Fueling Systems Code)

20 (d) Transactions not subject to weights and measures authority.

21 A.3. Additional Code Requirements. – In addition to the requirements of this code, Non-Utility Electricity-
 22 Measuring Systems shall meet the requirements of Section 1.10. General Code.

23 A.4. Type Evaluation. – The National Type Evaluation Program (NTEP) will accept for type evaluation only
 24 those measuring systems that have received safety certification by a nationally recognized testing laboratory
 25 (also referred to as “NRTL”) and shall issue an NTEP Certificate of Conformance only to those measuring
 26 systems that comply with all requirements of this code.

27 A.5. NUEMS Type Notation. – Code sections and subsections with an [ES] notation apply to External Sensor
 28 NUEMS only. Code sections and subsections with a [IS] notation apply to Internal Sensor NUEMS only. Code
 29 sections and subsections without [ES] or [IS] notation apply to both NUEMS types.

30 S. Specifications

31 S.1. Indicating and Recording Elements.

32 S.1.1. Units. – Units for any indicated or recorded measurements shall be as follows:

33 Active Energy: kilowatt-hours (kWh)

34 S.1.1.1. Numerical Value of Quantity-Value Divisions. – The value of an increment shall be equal to
 35 a decimal multiple or submultiple of 1.

36 Examples: quantity-value divisions may be 10; or 0.01; or 0.1; etc.

1 S.1.1.2. Digital Indications. – An indication shall include the display of a number for all places that
2 are displayed to the right of the decimal point and at least one place to the left. Otherwise, leading
3 zeros are not required.

4 S.1.2. Nominal Capacity. – A device shall have a minimum capacity indication of five digits of
5 resolution.
6 [Nonretroactive as of January 1, 20XX]

7 S.1.3. NUEMS Indications.

8 S.1.3.1. Primary Indicating Element. – Each NUEMS shall be equipped with a primary indicating
9 element that includes a display visible and accessible after installation which clearly indicates the
10 number of kilowatt-hours measured by the NUEMS.

11 S.1.3.2. Test Output. – A NUEMS shall have either: (1) a rotating disk indicator; (2) a pulse output
12 (visible or infrared), or (3) an electrical pulse (in the form of a closure relay or an electronic means),
13 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
14 the NUEMS's accuracy can be tested in 5 minutes or less for any specific test.

15 S.1.3.3. Segments. – A segmented digital indicating element shall have an easily accessible provision
16 for checking that all segments are operational.

17 S.1.3.4. Real-time Indicating Element. – If the indicating element is not on continuously, it shall be
18 accumulated continuously so that real-time measurement is indicated during activation.

19 S.1.3.5. Multiple NUEMS, Single Indicating Element. – A primary indicating, or combination
20 indicating-recording element coupled to two or more NUEMS shall be provided with a means to easily,
21 clearly, and definitely display information from a selected NUEMS and shall automatically indicate
22 which NUEMS is associated with the currently displayed information.

23 S.1.3.6. NUEMS With External Sensors Located Remotely from the Test Output. – For NUEMS
24 with external sensors located remotely from the test output which can be installed as described in
25 paragraph UR.2.4.8. External Sensors Located Remotely from the Test Output, means shall be
26 provided to allow the test output to be remotely used.

27 S.1.3.7. NUEMS With a Register Ratio. – For NUEMS with a register ratio, the register ratio shall
28 be indicated on the front of the registers that are not an integral part of the NUEMS nameplate. Means
29 shall be provided for the tenant to read the register.

30 S.2. Design of Measuring Elements and Measuring Systems.

31 S.2.1. Metrological Components. – A NUEMS shall be designed and constructed so that metrological
32 components are adequately protected from environmental conditions likely to be detrimental to accuracy
33 based on the specified installation locations for the NUEMS.

34 S.2.2. Provision for Sealing. – Adequate provision shall be made for an approved means of security
35 (e.g., data change audit trail) or physically applying security seals in such a manner that undetected access
36 to metrologically significant mechanisms and parameters is prevented. Specifically, after sealing no
37 adjustment or change may be made to:

38 (a) any measuring element;

39 (b) any metrological parameter that affects the metrological integrity of the device or system; and

1 (c) any wiring connection which affects the measurement.

2 When applicable, any adjusting mechanism shall be readily accessible for purposes of affixing a security
 3 seal. Audit trails shall use the format set forth in Table S.2.3. Categories of Device and Methods of Sealing.

<u>Table S.2.3.</u> <u>Categories of Device and Methods of Sealing</u>	
<u>Categories of Device</u>	<u>Method of Sealing</u>
<u>Category 1: No remote configuration capability.</u>	<u>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</u>
<u>Category 2: Remote configuration capability, but access is controlled by physical hardware.</u> <u>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.</u>	<u>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.</u>
<u>Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</u> <u>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.</u>	<u>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.)</u>

4 S.2.4. NUEMS Watthour Registration Retention. – The NUEMS shall retain the total accumulated
 5 watthour registration and shall not be affected by electrical, mechanical or temperature variations, radio-
 6 frequency interference, power failure, or any other environmental influences to the extent that accuracy is
 7 impaired. This also applies to other billable quantities.

8 S.3. Markings. – The following identification and marking requirements are in addition to the requirements
 9 of Section 1.10 General Code, paragraph G-S.1. Identification.

10 S.3.1. Location of Marking Information. – The marking information may be placed either internally
 11 or externally (as specified in paragraphs S.3.2. Device Identification and Marking Requirements and S.3.3.
 12 External Sensor Identification and in the associated tables) provided:

13 i. the information is permanent and easily read; and accessible for inspection;

1 ii. the information is on a portion of the device that cannot be readily removed or interchanged (e.g.,
2 not on a service access panel). A readily removable cover is an acceptable location for the required
3 information provided: (1) the information is permanently marked elsewhere on the device or is
4 readily accessible through other means such as through an electronic display; or (2) a unique
5 marking on the removable cover can be matched with what is programmed into or permanently
6 marked on the meter, thus linking that marking (and any other markings) included on the cover
7 with that specific device.

8 iii. accessing the information does not require accessing an area with live exposed voltages greater
9 than 40 V.

10 The use of a key or tool to access internal marking information is permitted for retail electricity-measuring
11 devices. Where possible, clear covers should be used to enable viewing of internally marked information.

12 S.3.2. Device Identification and Marking Requirements. – In addition to all the marking
13 requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each device shall have the
14 following information conspicuously, legibly, and indelibly marked on the nameplate or register.

15 S.3.2.1. Device Identification and Marking Requirements of Meter with External Sensors – Sensor
16 input connection with intended polarity shall be physically marked on the meter when direction-
17 sensitive.

18 S.3.2.2. Device Identification and Marking Requirements, Internal Sensor (IS) NUEMS. – The
19 following markings shall be physically marked on an Internal Sensor (IS) NUEMS:

20 (a) AC voltage range or rating in VAC;

21 (b) Watthour constant (K_h) or Watthour test constant (K_t);

22 (c) Register ratio (R_r or K_r) for meters with a rotating disc and multiplier (if greater than one)
23 preceded by “multiply by” or “mult by” or “ K_r ”;

24 (d) Number of wires (W);

25 (e) Form designation (FM) (for A-base and socket NUEMS only); and

26 (f) Current Class (CL).

27 S.3.2.3. Device Identification and Marking Requirements of Meters, External Sensor (ES) NUEMS.
28 – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1.
29 Identification, External Sensor (ES) NUEMS shall have the following legibly, and indelibly marked on
30 the meter as shown in:

31 • Tables S.3.2.3.a. Device Identification and Marking Requirements of Meter – External
32 Sensor (ES) NUEMS; and

33 • Table S.3.2.3.b. Descriptors for Table S.3.2.3.a. Device Identification and Marking
34 Requirements of Meter – External Sensor (ES) NUEMS.

35 (a) service type or service configuration.

Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS		
	<u>Physical Marking</u>	<u>Electronic Display^{*,**}</u>
<u>Manufacturer or Distributor name, initials, or trademark (1)</u>	<u>R</u>	<u>D</u>
<u>Model Prefix (2)</u>	<u>O</u>	<u>D</u>
<u>Model (3)</u>	<u>R</u>	<u>D</u>
<u>Serial Number Prefix (4)</u>	<u>O</u>	<u>D</u>
<u>Serial Number (5)</u>	<u>R</u>	<u>D</u>
<u>NTEP CC Number with Prefix (6)</u>	<u>R</u>	<u>D</u>
<u>NUEMS Voltage Input Rating (7) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Voltage Sensor Rating (8) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Voltage Sensor Ratio (9) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>NUEMS Current Input (10) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Sensor Primary Current Rating (11) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Sensor True Ratio (12) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>K_h or K_t (13)</u>	<u>O</u>	<u>D</u>
<u>Bi-directional (14)</u>	<u>O</u>	<u>D</u>
<u>Temperature Range if narrower than -20 °C to + 50 °C (- 4 °F to + 122 °F) (15)</u>	<u>O</u>	<u>D</u>
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 marking is provided on an electronic display, then all fields must be provided.		

***“Electronic Display” includes, but is not limited to, displays of the required marking information through a NUEMS display, a mobile device, or other electronic means as specified by the manufacturer and retrievable through the NUEMS. This may include providing access directly from the meter to a webpage. If the information is provided via a mechanism other than the NUEMS display, the mechanism must be provided by the device owner/operator as specified in UR.2.4.10. Devices for Viewing Marking Information Provided Via an Electronic Display, External Sensor (ES) NUEMS.**

****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.3.2.3.a. Device Identification and Marking Requirements of External Sensor (ES) NUEMS.**
- **For requirements and details on application, see Table S.3.2.3.b. Descriptors for Device Identification and Marking Requirements of External Sensor (ES) NUEMS.**

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<u>Table S.3.2.3.b.</u> <u>Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS</u>
<u>1. Manufacturer’s Identification. Marked per General Code paragraph G-S.1. Identification.</u>
<u>2. Manufacturer’s Model Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the meter, 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 meet General Code paragraph G-S.1. Identification (b)(1).</u>
<u>3. Manufacturer’s Model Identifier. Marked per General Code paragraph G-S.1. Identification.</u>
<u>4. Serial Number Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the meter, 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 meet General Code paragraph G-S.1. Identification (c)(1).</u>
<u>5. Serial Number. Also see General Code paragraph G-S.1. Identification.</u>
<u>6. NTEP Certificate of Conformance Number and Prefix. NUEMS electronics that has been evaluated by NTEP and has its own NTEP CC shall be marked per General Code paragraph G-S.1. Identification.</u>
<u>7. NUEMS Voltage Input Rating (V_{nom}). The nominal voltage input(s) for the voltage channel of the NUEMS electronics (e.g., 120VAC, 600VAC, 120-480VAC, etc.). Multiple forms of the term such as “Rated Voltage,” “Max Voltage,” and “Reference Voltage” are permitted.</u> <u>[Nonretroactive as of January 1, 2024]</u>
<u>8. Voltage Sensor (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.</u> <u>[Nonretroactive as of January 1, 2024]</u>
<u>9. Voltage Sensor Ratio. 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.</u> <u>[Nonretroactive as of January 1, 2024]</u>

<p>10. NUEMS Current Input (Input I_{nom} or I_{max}). <i>The nominal current or voltage input for the current channel of the NUEMS electronics. The output of the current sensor must match the input configuration of the meter.</i> <i>[Nonretroactive as of January 1, 2024]</i></p>
<p>11. Sensor Primary Current Rating (Sensor I_{nom}). <i>The nominal current input through the sensor.</i> <i>[Nonretroactive as of January 1, 2024]</i></p>
<p>12. True Ratio – True Ratio. <i>The True Ratio, in primary amperes or volts to secondary amperes or volts shall be physically marked on a meter unless it is contained in either electronic or printed documentation. 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.</i> <i>[Nonretroactive as of January 1, 2024]</i></p> <p style="padding-left: 40px;"><u>Examples of sensor ratio markings include:</u></p> <p style="padding-left: 80px;"><u>200A:5A</u> <u>400A:0.3V</u> <u>480V:120V</u></p>
<p>13. Kh or Kt. Watthour test constant.</p>
<p>14. Bi-Directional. <i>Marking via a “Separate Document” is permissible only if instructions for accessing that information is described in an accompanying NTEP Certificate of Conformance.</i></p>
<p>15. Temperature Range if Narrower Than – 20 °C to + 50 °C (– 4 °F to + 122 °F): <i>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.</i></p>

1 **S.3.3. Device Identification and Marking Requirements – External Sensors.** – In addition to all the
 2 marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each external
 3 sensor that is non-integral with the meter shall have the following conspicuously, legibly, and indelibly
 4 marked as shown in Table S.3.3.a. Device Identification and Marking Requirements – External Sensors
 5 and in Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements –
 6 External Sensors.

Table S.3.3a. Device Identification and Marking Requirements - External Sensors			
	<u>Physical Marking on Sensor</u>	<u>Electronic Display</u>	<u>Separate Document (Hard Copy or Electronic)</u>
<u>Manufacturer name, initials, trademark (1)</u>	<u>R</u>	<u>D</u>	<u>D</u>
<u>Model Prefix (2)</u>	<u>O</u>	<u>D</u>	<u>D</u>
<u>Model (3)</u>	<u>R</u>	<u>D</u>	<u>D</u>
<u>Serial Number Prefix “S/N” (4)</u>	<u>O †</u>	<u>D †</u>	<u>D †</u>
<u>Serial Number (5)</u>	<u>O †</u>	<u>D †</u>	<u>D †</u>
<u>NTEP CC Prefix and Number (6)</u>	<u>O †</u>	<u>D †</u>	<u>D †</u>
<u>True Ratio (7) [Nonretroactive as of January 1, 2024]</u>	<u>O</u>	<u>D</u>	<u>D</u>

<u>Maximum Primary Current (8)</u>	<u>Q</u>	<u>D</u>	<u>D</u>
<u>Rated Frequency (Hz) (9)</u>	<u>Q</u>	<u>D</u>	<u>D</u>
<u>Maximum Safety Voltage Rating (10)</u>	<u>Q</u>	<u>D</u>	<u>D</u>
<u>Polarity (11)</u>	<u>Q</u>	<u>D</u>	<u>D</u>
<u>R</u> Required to be marked on the device <u>O</u> Required to be marked on the device if information is not available on a display or in printed form <u>D</u> Required when data is displayed on an electronic display or printed document <u>‡</u> Required only when a specific sensor must be matched to a specific meter input to meet accuracy specifications <u>†</u> Required only when a sensor has separate approval from the metering system as a whole.			
<u>Notes:</u> <ul style="list-style-type: none"> • <u>Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.3.b. Descriptors for External Sensor Marking Requirements.</u> • <u>For requirements and details on application, see Table S.3.3.b. Descriptors for External Sensor Marking Requirements.</u> • <u>“Electronic” includes, but is not limited to, displays of the required marking information through a NUEMS display, a mobile device, or other electronic means as specified by the manufacturer.</u> 			
<u>Summary:</u> <u>When a NUEMS system is approved as a system, then the only hard marking required on sensors is the Manufacturer’s name and the Model Number, unless pairing a specific sensor to a specific NUEMS input is required, then the serial number is required.</u>			

1

<u>Table S.3.3.b.</u> <u>Descriptors for Device Identification and Marking Requirements - External Sensors</u>	
1.	<u>Manufacturer’s Identification. Marked per General Code paragraph G-S.1. Identification.</u>
2.	<u>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 or in a separate document accompanying the NUEMS provided that the NUEMS has its NTEP number clearly identified, conspicuously and indelibly marked on the meter, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings).</u>
3.	<u>Manufacturer’s Model. Marked per General Code paragraph G-S.1. Identification.</u>
4.	<u>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).</u>
5.	<u>Serial Number. Also see General Code paragraph G-S.1. Identification.</u>

<p>6. <u>NTEP Certificate of Conformance Prefix and Number.</u> A current sensor that has been evaluated separately by NTEP and has its own NTEP CC shall be marked per General Code paragraph G-S.1. <u>Identification.</u></p>
<p>7. <u>True Ratio.</u> <i>The True Ratio, in primary amperes or volts to secondary amperes or volts shall be physically marked on a sensor unless it is contained in either electronic or printed documentation. 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.</i> <u>[Nonretroactive as of January 1, 2024]</u></p> <p><u>Examples of sensor ratio markings include:</u> <u>200A:5A</u> <u>400A:0.3V</u> <u>480V:120V</u></p>
<p>8. <u>Maximum Primary Current.</u> The maximum primary current at which the sensor can be safely and accurately operated.</p>
<p>9. <u>Rated Frequency.</u> A sensor shall be marked with its rated frequency if other than 40Hz to 400Hz.</p>
<p>10. <u>Maximum Safe Operating Voltage.</u> A sensor shall be marked with a Maximum Safe Operating Voltage if it is less than 600VAC.</p> <p><u>Examples of sensor maximum safe operating voltage ratings:</u></p> <ul style="list-style-type: none"> • <u>250 Vac</u> • <u>250 VAC</u> • <u>50 V</u> <p><u>Note:</u> The maximum safe operating voltage rating marking may not be higher than the voltage to which the device was verified during type evaluation.</p>
<p>11. <u>Polarity Marking.</u> The sensor shall be marked to indicate proper orientation when the accuracy of the NUEMS is affected by orientation.</p>

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S.3.4. Abbreviations and Symbols. – When using abbreviations or symbols on a meter , sensor, or indicator, the following shall be used.

- (a) **FM = Form**
- (b) **CL = Class**
- (c) **V = Volts**
- (d) **Hz = Hertz, Frequency or Cycles Per Second**
- (e) **TA = Test Amperes**
- (f) **Kh = Watthour Constant; Revolution or Pulse**
- (g) **Rr = Register Ratio**
- (h) **CSR = Current Sensor Ratio (may also be referred to as “current transformer ratio” or “CTR”)**
- (i) **VTR or PTR = Voltage or Potential Transformer Ratio**
- (j) **MULT BY = Multiply By**
- (k) **W = wire (example: 240V 3W)**

(d) 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.

(e) 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.

(f) All tests shall be made at the rated voltage \pm 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 emit more than one test pulse output.

T.3. NUEMS Starting Load Test. – The watt-hour test constant (Kt or Kh) output indications or register indication 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.

<u>Table T.4.</u>		
<u>Tolerances for NUEMS</u>		
	<u>Tests Conducted at Unity Power Factor</u>	<u>Tests Conducted at 0.5 Lagging Power Factor</u>
<u>Acceptance Tolerances</u>	<u>1.0 %</u>	<u>2.0 %</u>
<u>Maintenance Tolerance</u>	<u>2.0 %</u>	<u>3.0 %</u>

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.

1 **UR. User Requirements**

2 **UR.1. Selection Requirements.**

3 **UR.1.1. Customer Indicating Element, Accessibility. – For systems in which the primary indicating**
4 **element is not reasonably accessible to the customer, such as one of the following shall be provided.**

5 (a) **Console display which is accessible to the customer on which the customer can unambiguously**
6 **select the NUEMS output associated with this load.**

7 (b) **Remote display which is provided to customer as a part of the system.**

8 (c) **At the option of the customer, through an application that provides readings in real time.**

9 **UR.1.2. Submeter Required. – When a tenant is not directly served by the serving utility, and charges**
10 **for electric energy are not included in the fixed periodic rent charges, a dedicated NUEMS that measures**
11 **only the energy used at the discretion of the tenant shall be used.**

12 **UR.1.3. Suitability of Equipment. – A NUEMS shall be suitable for use on its electrical system.**

13 **UR.1.3.1. Service Applications. – A NUEMS shall accurately measure all loads 5 percent or greater of**
14 **the electric service capacity of the tenant. Service capacity shall be determined by the master thermal**
15 **overload protectors to the tenants' service or by the rated capacity of the wiring and its circuits used**
16 **to provide power from the service panel to the tenant.**

$$\text{Annual Max} = \sum_{\text{phases}} [(\text{Phase Voltage} * \text{Current Class})/1000] * \text{HoursPerYear}$$

17 **UR.1.3.2. Maximum Quantity-Value Division. – The maximum quantity-value division shall not**
18 **exceed the minimum increment to be used in billing.**

19 **UR.1.4. Current Sensor. – The current sensor output shall be correctly matched to the meter current**
20 **input.**

21 **UR.2. Installation Requirements.**

22 **UR.2.1. Manufacturer's Instructions. – A device shall be installed in accordance with the manufacturer's**
23 **instructions, and the installation shall be sufficiently secure and rigid to maintain this condition.**

24 **UR.2.2. Load Range. – A device shall be installed so that the current and voltage will not exceed the**
25 **maximum continuous ratings of the NUEMS. Means to limit current and/or voltage shall be incorporated**
26 **in the installation if necessary.**

27 **UR.2.3. Regulation Conflicts and Permit Compliance. – If any provision of this section**
28 **(UR.2. Installation Requirements) is less stringent than that required of a similar installation by the**
29 **National Electrical Code®, as amended and adopted by the Local Authority having Jurisdiction, the**
30 **installation shall be in accordance with the National Electric Code.**

31 **The installer of any new NUEMS service shall obtain all necessary permits and shall conform to all**
32 **applicable regulations.**

33 **UR.2.4. NUEMS Installation Requirements.**

1 UR.2.4.1. Certification. – It is the responsibility of the owner of a NUEMS to obtain written
2 certification for each device from the appropriate regulatory agency.

3 The required certification shall meet the requirements of that agency and should identify the address,
4 space, or number, of the premise served by the NUEMS connection; be signed by an agency
5 representative; and shall clearly state the:

- 6 • installation is on a tariff schedule that qualifies for NUEMS use,
- 7 • billing format, rates, and charges conform to all applicable tariff rules,
- 8 • date of such determination, and
- 9 • designee’s name and title if performed by a designee, and

10 The certification shall be provided prior to a NUEMS being used for commercial purposes.

11 UR.2.4.2. NUEMS Test Features. – All NUEMS shall be provided with test features to facilitate
12 common tests methods used in the electrical submetering industry.

13 UR.2.4.3. Safety Mechanism. – NUEMS installations that are equipped with current transformers
14 with a current output that is not self-limiting shall have a mechanism installed to allow the meter to be
15 connected to or removed for safe testing without the risk of dangerous voltages that can result from
16 secondary open circuit CTs.

17 UR.2.4.4. Metered Circuits (Submeter Load Service). – For NUEMS with separate line and load
18 service connections, all electricity used by a tenant shall be taken exclusively from the load service of
19 the tenant's NUEMS. This service and its associated NUEMS shall accurately measure the tenant's
20 load and be capable of being used only at the discretion of the tenant.

21 UR.2.4.5. Dedicated Tenant NUEMS Service. – A NUEMS shall serve only the space, lot, building,
22 room, suite, stall, slip, or premise occupied by the tenant.

23 UR.2.4.6. NUEMS Tenant Premise Identification. – Tenant premise identification shall be clearly
24 and permanently shown on or at the NUEMS, and on all separate components of a NUEMS, including,
25 but not limited to, current sensor(s), modem(s), and transmitter(s) if equipped. Remote indications
26 and all printed indications shall be readily identifiable and readily associated with the tenant’s
27 premise. Printed indications shall also include time and date information. For field configured systems
28 the information shall be after actual configuration is established.

29 UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Display, External
30 Sensor (ES) NUEMS. – When required markings are provided via an electronic display the
31 owner/operator of the NUEMS is responsible for providing means for viewing this information on the
32 site at the time of inspection or on request. See also Table S.3.2.3.a. Device Identification and Marking
33 Requirements for External Sensor (ES) NUEMS.

34 UR.2.4.8. External Sensors Located Remotely From the Pulse Output or Display. – If the NUEMS
35 is installed in such a way that testing cannot be conducted by a single inspector from a reasonable
36 testing position, then means shall be provided to allow the pulse output or display to be remotely used
37 at the sensor location. For example, a portable device that receives the pulse by radio/WiFi and
38 provides the pulse as a dry contact closure to the test equipment.

39 UR.3. Use of Device.

1 UR.3.1. Recorded Representations. – A record, either printed or electronic, providing the following
2 information on electrical energy usage shall be available at the end of the billable interval:

3 (a) the total quantity of the energy delivered with unit of measure;

4 (b) the total computed price of the energy sale;

5 (c) the unit price of the energy.

6 For systems capable of applying multiple unit prices for energy during the billable interval, the following
7 additional information is required:

8 (1) A schedule of the rate time periods and the unit price applied for each

9 (2) the total quantity of energy delivered during each;

10 (3) the total purchase price for the quantity of energy delivered during each rate time period.

11 Appendix D. Definitions

12 The following definitions are proposed for addition to NIST Handbook 44 Appendix D, Definitions at the time
13 when the status of this Tentative Code is changed from “tentative” to “permanent.” Until such time that the
14 status of the code is designated as “permanent,” these proposed definitions will remain in this section of the
15 Tentative Code.

16 The specific code to which the definition applies is shown in [brackets] at the end of the definition. Definitions
17 for the General Code [1.10] apply to all codes in Handbook 44.

18 A

19 active energy. – The integral of active power with respect to time. Typically measured in units of kilowatt-
20 hours (kWh), or watt-hours.

$$E(T) = \int_0^T v(t) \cdot i(t) \cdot dt \quad \text{Eq. 1}$$

21 Where T is much greater than the period of the AC line frequency.

22 alternating current (AC). – An electric current that reverses direction in a circuit at regular intervals. [3.XX]

23 ampere. – The practical unit of electric current. It is the quantity of current caused to flow by a potential
24 difference of one volt through a resistance of one ohm. One ampere is equal to the flow of one coulomb of charge
25 per second. One coulomb is the unit of electric charge equal in magnitude to the charge of 6.24×10^{18} electrons.
26 [3.XX]

27 audit trail. – An electronic count and/or information record of the changes to the values of the calibration or
28 configuration parameters of a device. [1.10, 2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]

29 (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 self-contained meters, 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

element. – **A combination of a voltage-sensing unit and a current-sensing unit, which provides an output proportional to the quantities measured. Meters can include multiple elements based on service type. For mechanical meters, 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]**

1 energy flow. – The flow of energy between line and load terminals (conductors) of a NUEMS. Flow from the
2 line to the load terminals is considered energy delivered. Energy flowing in the opposite direction (i.e., from
3 the load to line terminals) is considered as energy received. [3.XX]

4 equipment, commercial. – Weights, measures, and weighing and measuring devices, instruments, elements, and
5 systems or portion thereof, used or employed in establishing the measurement or in computing any basic charge
6 or payment for services rendered on the basis of weight or measure. As used in this definition, measurement
7 includes the determination of size, quantity, value, extent, area, composition (limited to meat and poultry),
8 constituent value (for grain), or measurement of quantities, things, produce, or articles for distribution or
9 consumption, purchased, offered, or submitted for sale, hire, or award. [1.10, 2.20, 2.21, 2.22, 2.24, 3.30, 3.31,
10 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]

11 (Added 2008)

12 external sensor. – Any voltage sensor or current sensor not located inside of the meter body NUEMS itself
13 and not inside the sealed enclosure containing the NUEMS. [3.XX]

14 event counter. – A nonresettable counter that increments once each time the mode that permits changes to
15 sealable parameters is entered and one or more changes are made to sealable calibration or configuration
16 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]

17 (Added 1993)

18 event logger. – A form of audit trail containing a series of records where each record contains the number from the
19 event counter corresponding to the change to a sealable parameter, the identification of the parameter that was
20 changed, the time and date when the parameter was changed, and the new value of the parameter. [2.20, 2.21, 3.30,
21 3.37, 3.39, 3.XX, 5.54, 5.56(a), 5.56(b), 5.57]

22 (Added 1993)

23 **F**

24 form designation (FM). – An alphanumeric designation denoting the circuit arrangement for which the NUEMS
25 is applicable and its specific terminal arrangement. The same designation is applicable to equivalent NUEMS
26 for all manufacturers. (Example: FM 2S) [3.XX]

27 **H**

28 hertz (Hz). – Frequency or cycles per second. One cycle of an alternating current or voltage is one complete set
29 of positive and negative values of the current or voltage. [3.XX]

30 **I**

31 internal sensor. – Any voltage sensor or current sensor located inside of the meter body NUEMS itself or
32 inside the sealed enclosure containing the NUEMS. [3.XX]

33 **K**

34 kilowatt (kW). – A unit of power equal to 1,000 watts. [3.XX]

35 kilowatt-hour (kWh). – A unit of energy equal to 1,000 watthours. [3.XX]

36 **L**

1 line service. – The service terminals or conductors connecting the (NUEMS) to the power source. [3.XX]

2 load service. – The service terminals or conductors connecting the (NUEMS) to the electrical load (e.g., vehicle,
3 tenant, etc.). [3.XX]

4 load, full. – A test condition with rated voltage, current at 100% of test amps level, and power factor of 1.0.
5 [3.XX]

6 load, light. – A test condition with rated voltage, current at 10% of test amps level, and power factor of 1.0.
7 [3.XX].

8 M

9 master meter, electric. – A (NUEMS) owned, maintained, and used for commercial billing purposes by the
10 servicing utility. All the electric energy served to a submetered service system is recorded by the master meter.
11 [3.XX]

12 metrological components. – Elements or features of a measurement device or system that perform the
13 measurement process or that may affect the final quantity determination or resulting price determinations.
14 This includes accessories that can affect the validity of transactions based upon the measurement process. The
15 measurement process includes determination of quantities; the transmission, processing, storage, or other
16 corrections or adjustments of measurement data or values; and the indication or recording of measurement
17 values or other derived values such as price or worth or charges. [3.XX]

18 N

19 non-integral. – Used to describe external sensors that can be disconnected from the meter body. [3.XX]

20 non-utility electricity measuring system (NUEMS). – An electricity measuring system comprised of all the
21 metrologically relevant components required to measure electrical energy, store the result, and report the
22 result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more
23 measured.

24 O

25 ohm. – The practical unit of electric resistance that allows one ampere of current to flow when the impressed
26 potential is one volt. [3.XX]

27 P

28 percent error. – Percent error is calculated as follows:

29 percent error = (NUEMS reading – standard reading)/standard reading x 100
30 [3.XX]

31 power factor (PF). – The ratio of “active power” to “apparent power” in an AC circuit. It describes the efficient
32 use of available power. [3.XX]

33 primary indicating or recording elements. – The term “primary” is applied to those principal indicating
34 (visual) elements and recording elements that are designed to, or may, be used by the operator in the normal
35 commercial use of a device. The term “primary” is applied to any element or elements that may be the
36 determining factor in arriving at the sale representation when the device is used commercially. (Examples

1 of primary elements are the visual indicators for meters or scales not equipped with ticket printers or other
2 recording elements and both the visual indicators and the ticket printers or other recording elements for
3 meters or scales so equipped.) The term “primary” is not applied to such auxiliary elements as, for example,
4 the totalizing register or predetermined-stop mechanism on a meter or the means for producing a running
5 record of successive weighing operations, these elements being supplementary to those that are the
6 determining factors in sales representations of individual deliveries or weights. (See “indicating element”
7 and “recording element.”) [1.10, 3.XX]

8 R

9 reactive power. – For sinusoidal quantities in a two-wire circuit, reactive power is the product of the voltage,
10 the current, and the sine of the phase angle between them, using the current as the reference. [3.XX]

11 register ratio (R_r). – The number of revolutions of the gear meshing with the worm or pinion on the rotor
12 shaft per complete rotation of the fastest (most sensitive) wheel or dial pointer. [3.XX]

13 remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable
14 parameters from or through some other device that is not itself necessary to the operation of the weighing or
15 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)]
16 (Added 1993)

17 retail device. – A measuring device primarily used to measure product for the purpose of sale to the end user.
18 [3.30, 3.32, 3.37, 3.39, 3.XX]

19 (Amended 1987 and 2004)

20 S

21 sensor ratio. – The stated ratio of the primary circuit current or voltage compared to the secondary circuit
22 current or voltage. (example: CSR = 200 : 0.1) [3.XX]

23 serving utility. – The utility distribution company that owns the master meter and sells electric energy to the
24 owner of a submeter system. [3.XX]

25 starting load. – The minimum load above which the device will indicate energy flow continuously. [3.XX]

26 submeter. – A meter or meter system downstream of the electric master meter. [3.XX]

27 T

28 tenant. – The person or persons served electric energy from a non-utility electricity-measuring system
29 (NUEMS). [3.XX]

30 test amperes (TA). – The full load current (amperage) specified by the device manufacturer for testing and
31 calibration adjustment. (Example: TA 30). [3.XX]

32 thermal overload protector. – A circuit breaker or fuse that automatically limits the maximum current in a
33 circuit. [3.XX]

34 U

35 unit price. – The price at which the product is being sold and expressed in whole units of measurement. [1.10,
36 3.30, 3.XX]

37 (Added 1992)

1 **utility. – A corporation, person, agency, authority, or other legal entity or instrumentality aligned with**
 2 **distribution facilities for delivery of electric energy for use primarily by the public. Included are investor-owned**
 3 **electric utilities, municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few**
 4 **entities that are tariff based and corporately aligned with companies that own distribution facilities are also**
 5 **included.**

6 **A list of recognized utilities in the U.S. can be found at the U.S. Energy Information Administration (EIA) at:**
 7 **<https://www.eia.gov/electricity/data/eia861> [3.XX]**

8 **V**

9 **volt. – The practical unit of electromotive force. One volt will cause one ampere to flow when impressed across**
 10 **a resistance of one ohm. [3.XX]**

11 **W**

12 **watt. – The practical unit of electric power. In an alternating-current circuit (AC), the power in watts is volts**
 13 **times amperes multiplied by the circuit power factor. [3.XX]**

14 **wattour (Wh). – The practical unit of electric energy, which is expended in one hour when the average power**
 15 **consumed during the hour is one watt. [3.XX]**

16 **meter – self-contained. – A meter in which the terminals are arranged for connection to the circuit being**
 17 **measured without using external instrument transformers. [3.XX]**

18 **wattour constant (K_h). – The expression of the relationship between the energy applied to the meter and the**
 19 **output indication, expressed as “watthours per revolution” or “watthours per output indication.” [3.XX]**

20 **wattour test constant (K_t). – The expression of the relationship between the energy applied to the meter and**
 21 **the output indication, expressed as “watthours per output indication,” when the meter is in test mode [3.XX]**

22 **Background/Discussion:**

23 This item has been assigned to the submitter for further development. For more information or to provide comment,
 24 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 Wattour Meters Subgroup:
 Ms. Lisa Warfield, Chair
 NIST Office of Weights and Measures
 301-975-3308, lisa.warfield@nist.gov

25 This item was submitted as a Developing item to provide a venue to allow the USN WG to update the weights and
 26 measures community on continued work to develop test procedures and test equipment standards within its Electric
 27 Vehicle Refueling Subgroup. This item will also serve as a forum in which to report work on the development of a
 28 proposed tentative code for electric wattour meters in residential and business locations by the USN WG’s Electric
 29 Wattour Meters Subgroup and a placeholder for its eventual submission for consideration by NCWM.

30 Ms. Tina Butcher (NIST OWM), Chairman of the USN WG on Electric Refueling & Submetering has continued to
 31 provide regular updates to the Committee on this work. See the Committee’s 2016 through 2018 Final Reports for
 32 details.

33 **NCWM 2018 Interim Meeting:** No comments were heard on this item and the Committee agreed to maintain its
 34 “Developing” status. The Committee did not take comments during open hearings on Developing items at the 2018

1 NCWM Annual Meeting and agreed to allow only the submitter of a Developing item (or block of Developing items)
2 to provide an update on the progress made to further develop the item(s) since the 2018 NCWM Interim Meeting. The
3 Committee received an update on this item from Ms. Tina Butcher (NIST OWM), Chair of the USN WG on Electric
4 Refueling & Submetering. See the Committee's 2018 Final Report for Details.

5 OWM personnel were unable to attend the 2019 NCWM Interim Meeting due to the Federal Government shutdown
6 in early 2019 due to a lack of appropriations; however, OWM provided written comments to the Committee on this
7 item in the advance of the meeting, including the following update on this item:

- 8 • The Electric Watthour Meter Subgroup (EWH SG) of the USN WG on Electric Vehicle Fueling &
9 Submetering has held multiple in-person and web meetings since the 2017 NCWM Annual Meeting.
- 10 • The SG met in September 2017, November 2017, May 2018, and August 2018. All meetings included web-
11 conferencing to allow those not able to attend in person to participate.
- 12 • The SG developed a proposed addition to NIST Handbook 130's Uniform Regulation for the Method of Sale
13 (MOS) of Commodities (see Item MOS-8 on the L&R Committee's Agenda) to specify a method of sale for
14 electrical energy sold through these systems and submitted the proposal to the four regional weights and
15 measures association meetings in Fall 2018.
 - 16 ○ Three of the four regions recommend the MOS proposal on the L&R Agenda as a voting item, with
17 the fourth abstaining due to lack of experience with these systems within the region.
- 18 • The SG continues work on a proposed code for EWH-type meters for NIST Handbook 44 and expects to have
19 a draft ready for the 2020 NCWM cycle.
- 20 • OWM requests this item be maintained on the S&T Committee's agenda as a Developing Item while the SG
21 finalizes its proposed HB 44 draft. OWM will continue to apprise the Committee of progress.
- 22 • At their Fall 2018 meetings, all four regional associations indicated support for maintaining this as a
23 Developing item on the Committee's agenda.
- 24 • The SG will hold its next in-person meeting in February 2019 in Sacramento, CA. (*Technical Advisor's Note:*
25 *This meeting was rescheduled to April 2019.*)
- 26 • Those interested in participating in this work are asked to contact SG Chair, Ms. Lisa Warfield, or Technical
27 Advisor, Ms. Tina Butcher.

28 NCWM 2019 Interim Meeting: The Committee heard no comments on this item. At its work session, Committee
29 members agreed with the submitter and the Regional Associations that this item should be assigned a Developing
30 status.

31 NCWM 2019 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided the Committee with an update on the further
32 development of this item. Ms. Butcher reported that the EWH SG will meet next in August 2019 to continue its work
33 and requested this item remain on the S&T Committee agenda as a Developing item. During the committee's work
34 session, the Committee agreed with the submitter to retain this item in a Developing status.

35 NCWM 2020 Interim Meeting: The Committee heard from Ms. Butcher who provided an update on developments in
36 the Electric Watthour Meters Code which is also included in the NIST OWM analysis. Ms. Butcher requested that
37 this item be given a developing status.

38 During the Committee work session, the committee agreed that this item should be given a Developing status.

- 1 NCWM 2020 Annual Meeting: Due to the 2020 Covid-19 pandemic, this meeting was adjourned to January 2021, at
2 which time it was held as a virtual meeting. Due to constraint of time, only those items designated as 2020 Voting
3 Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.
- 4 NCWM 2021 Interim Meeting: The Committee heard from Ms. Tina Butcher who provided an update on the
5 developments in the Electric Watthour Code which is include in the NIST OWM analysis and Ms. Butcher requested
6 that this item be given a developing status. The Committee agreed that the item be given a Developing status.
- 7 NCWM 2021 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided an update on the developments in the
8 Electric Watthour Code which is included in the NIST OWM analysis. Ms. Butcher noted that the Electric Watthour
9 Code is in Development and anticipates a Code by Fall 2021. There was discussion on definitions for electric master
10 meters and possibly separating the definitions for gas and water master meters and Ms. Butcher requested that this
11 item be given a developing status. The Committee agreed that the item be given a Developing status.
- 12 NCWM 2022 Interim Meeting: Matt Douglas (California – DMS) stated that California supports the development of
13 this item but has concerns about identity marking requirements being on a separate document. Also that the devices
14 should be easy to test before and after installation. This device should allow for electronic data logger. Juana Williams
15 (NIST) commented that the subgroup had provided a draft code that is on the website. Ms. Williams requested
16 comments be submitted to Tina Butcher (NIST) or Lisa Warfield (NIST) by March 22, 2022. Ms. Williams stated
17 these comments will be used to provide and updated draft for the 2022-2023 submission cycle and the item remain in
18 developing status. The Committee agreed that the item be given a Developing status.
- 19 As discussed at the weighing sector meeting, multiple vehicle types are tested during the NTEP publication 14 test. If
20 a specific vehicle type is failed or not tested, there needs to be a restriction on the vehicle types passed on the certificate.
21 This restriction must also be marked on the device.
- 22 NCWM 2023 Interim Meeting: Ms. Tina Butcher (NIST) commented that the USNWG on Electric Watthour Meters
23 Subgroup believes that the draft code is ready for consideration as a voting item. Ms. Butcher asked for continued
24 feedback from the weights and measures community. During the committee work session, the committee agreed that
25 the item is fully developed and has merit, and assigned the item a voting status.
- 26 NCWM 2023 Annual Meeting:
27 Henry Alton (METERGY) spoke as a member of industry and a member of the workgroup. He stated the item is ready
28 for a vote and it has been worked on by the members of the workgroup, including regulators. The commentator referred
29 to a letter of support submitted to the committee which was posted on NCWM website.
- 30 Andrew Kimura (Santa Cruz County, CA) requested the de-escalation of the item from voting to developing. The
31 commentator noted the regulators on the work group were not in agreeance with the final draft of the agenda item. He
32 provided feedback on specific areas and presented a PowerPoint during open hearing. Mr. Kimura stated the final
33 draft of the agenda item does not address concerns by regulators. The commentator requested the work group consult
34 with regulators to address specific concerns as presented during open hearings and in a letter submitted by the
35 California Agricultural Commissioner and Sealers Association (CACASA). He commented there is no intent to delay
36 the item any further, but expressed the need to develop the item further to address regulators concerns.
- 37 Mattew Douglas (Division of Measurement Standards, CA) referenced the letter submitted by California Agricultural
38 Commissioner and Sealers Association (CACASA) and requested de-escalation of the item from voting to developing.
39 He requested the work group work with regulators for further development.
- 40 Jose Arriaga (Orange County, CA) requested the de-escalation of the item from voting to developing. He requested
41 the work group work closely with regulators for further development.
- 42 Austin Shepard (San Diego County, CA) requested de-escalation of the item from voting to developing. He requested
43 the work group work with regulators for further development.

1 The committee agreed with many of the comments heard during open hearings and decided to downgrade the item to
2 Informational prior to the voting session. The committee was notified the task group was no longer working on this
3 specific item as it has considered it fully developed. The committee believes the Informational status will allow for
4 further development of the item through the S&T Committee.

5 The committee received written comments from Mr. Kimura, the regulator representing the County of Santa Cruz,
6 CA who presented during open hearings. Written comments included specific, proposed changes to the item which
7 were referred to in open hearings and that were represented in the letter submitted by CACASA. The committee heard
8 from a member of industry in support of the item and considered the National Electrical Manufactures Association
9 (NEMA) presentation posted on NCWM’s website.

10 The committee considered the edits submitted by Mr. Kimura and cross-referenced those changes to the NIST OWM
11 Electric Watthour Subgroup – Recommended Crosswalk. The committee has decided to incorporate the recommended
12 edits from NIST OWM’s crosswalk into the item under consideration to be forwarded to the regions. Additional
13 changes recommended by Mr. Kimura are available for review on the NCWM website.

14 **Regional Associations’ Comments:**

15 WWMA 2022 Annual Meeting: No comments were heard on this item. The WWMA S&T Committee recommends
16 that this item should remain developing to allow the USNWG to continue development of the model code.

17 SWMA 2022 Annual Meeting: The following comments were received during the 2022 SWMA Annual Meeting:

18 Ms. Lisa Warfield, NIST, stated the workgroup planned to have an item in Pub 15 before the 2023 NCWM Interim
19 Meeting.

20 The SWMA S&T Committee recommends this item remain as a Developing Item.

21 CWMA 2022 Interim Meeting: No comments from the floor.

22 The CWMA S&T Committee recommends this as a Developing item.

23 NEWMA 2022 Interim Meeting: Ms. Lisa Warfield (NIST-OWM) commented that NIST is still working on this item.
24 An update will be available for the NCWM Interim meeting.

25 The Committee is recommending that this item retain a Developing status.

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

OTH-16.1

Regional recommendation to NCWM on item status:

- Recommend as a Voting Item on the NCWM agenda
- Recommend as an Information Item on the NCWM agenda
- Recommend as an Assigned Item on the NCWM agenda
(To be developed by an NCWM Task Group or Subcommittee)
- Recommend as a Developing Item on the NCWM agenda
(To be developed by source of the proposal)
- Recommend Withdrawal of the Item from the NCWM agenda
(In the case of new proposals, do not forward this item to NCWM)
- No recommendation from the region to NCWM
(If this is a new proposal, it will not be forwarded to the national committee by this region)

Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)

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.

1

2 **OTH-24.1 Appendix D, Definitions: liquefied petroleum gas retail motor-fuel device.**

3

4 **Source:**

5 National Propane Gas Association

6 **Purpose:**

7 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
8 will substitute the term “liquefied petroleum gas retail motor-fuel device” for the terms “retail motor-fuel dispenser”
9 and “retail motor-fuel device” throughout 3.32.

10 **Item under Consideration:**

11 Amend Handbook 44 Appendix D, Definitions as follows:

12 liquefied petroleum gas retail motor-fuel device. – A device designed for the measurement and delivery of liquefied
13 petroleum gas used as a fuel for internal combustion engines in vehicles bearing a state or federal license plate for
14 use on public roads. **The device can be operated either by trained personnel or the customer.** ~~The term means~~
15 ~~the same as “retail motor-fuel dispenser” and “retail motor-fuel device” as it appears in section 3.32 LPG and~~
16 ~~Anhydrous Ammonia Liquid Measuring Devices. [3.32]~~

17
18 **Note: These devices are required to be listed to UL 495 Power-Operated Dispensing Devices for LP-Gas**
19 **and equipped with a Type K15 nozzle in accordance with ISO/DIS 19825, Road vehicles- Liquefied petroleum**
20 **gas refueling connector.**

21 **Previous Status:**

22 2024: New Proposal

23 **Original Justification:**

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

27 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
28 more precisely define what a liquefied petroleum gas retail motor-fuel device is. This is a UL-listed device that is
29 electricity-powered and that has all of the features required by Handbook 44. It includes a safety nozzle that connects
30 to the fill valve on the vehicle which will not flow gas unless a positive connection is made. These devices are required
31 by NFPA 58 for all LP-gas dispensers installed at refueling facilities open to the public.

1 Opposition would most likely come from those opposed to the primary changes in S.2.5.1 and S.2.5.2. Opposition
2 may also come from those concerned about vehicles that do not have the K15 mating connection on the fill valve of
3 the vehicle. Rebuttal to that would be that propane industry sources indicate that older vehicles that do not have the
4 K15 connection are being retrofit at a high rate to incorporate the safety features of the K15 connection.
5 The submitter requested Voting status in 2024.

6 **Comments in Favor:**

7 **Regulatory:**

- 8 •

9 **Industry:**

- 10 •

11 **Advisory:**

- 12 •

13 **Comments Against:**

14 **Regulatory:**

- 15 •

16 **Industry:**

- 17 •

18 **Advisory:**

- 19 •

20 **Neutral Comments:**

21 **Regulatory:**

- 22 •

23 **Industry:**

- 24 •

25 **Advisory:**

- 26 •

27 **Item Development:**

28 New Proposal

29 **Regional Associations' Comments:**

30 New Proposal

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

OTH-24.1	
Regional recommendation to NCWM on item status:	
<input type="checkbox"/> Recommend as a Voting Item on the NCWM agenda <input type="checkbox"/> Recommend as an Information Item on the NCWM agenda <input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i> <input checked="" type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i> <input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i> <input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i>	
Comments and justification for the regional recommendation to NCWM: (This will appear in NCWM reports)	
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.	

1

2 **OTH-24.2 Appendix D, Definitions: National Type Evaluation Program (NTEP) and**
 3 **Certificate of Conformance (CC)**

4

5 **Source:**
 6 Jerry Buendel

7 **Purpose:**
 8 Add a definition of Certificate of Conformance (CC) and a definition of National Type Evaluation Program (NTEP)
 9 to Handbook 44, Appendix D.

10 **Item under Consideration:**
 11 Amend Handbook 44 Appendix D, Definitions as follows:

12 Certificate of Conformance (CC) - A document issued based on testing by a Participating Laboratory, which the
 13 certificate holder maintains in active status under the National Type Evaluation Program (NTEP). The document
 14 constitutes evidence of conformance of a model or models of a particular device, measurement system,
 15 instrument, or element that positively identifies the design with the requirements of this document, NIST
 16 Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring
 17 Devices," and the test procedures contained in NCWM Publication 14. By maintaining the Certificate in active
 18 status, the Certificate holder declares the intent to continue to manufacture or remanufacture the device consistent
 19 with the type and in conformance with the applicable requirements. A device is traceable to an active CC if: (a)
 20 it is of the same type identified on the Certificate, and (b) it was manufactured during the period that the Certificate
 21 was maintained in active status. For manufacturers of grain moisture meters, maintenance of active status also
 22 involves annual participation in the NTEP Laboratory On-going Calibration Program, OCP (Phase II). Some
 23 certificates may be designated as inactive. An inactive Certificate of Conformance is a Certificate which was
 24 previously active, but the devices are no longer being manufactured for commercial applications subject to local

1 regulations or laws. However, devices already manufactured, installed or in inventory, but not yet sold, may be
2 used, sold, repaired and resold under inactive Certificates of Conformance.

3 National Type Evaluation Program (NTEP) – A program operated by NCWM. NTEP is a program of cooperation
4 between the NCWM, NIST, other federal agencies, the states, and the private sector for determining, on a uniform
5 basis, conformance of a model or models of a particular device, measurement system, instrument, or element that
6 positively identifies the design with the relevant provisions of NIST Handbook 44, “Specifications, Tolerances,
7 and Other Technical Requirements for Weighing and Measuring Devices,” and NCWM, Publication 14,
8 “National Type Evaluation Program, Technical Policy, Checklists, and Test Procedures.”

9 **Previous Status:**

10 2024: New Proposal

11 **Original Justification:**

- 12 • The term National Type Evaluation Program (NTEP) is used in the General, Scales, Automatic Weighing System,
- 13 Hydrogen Gas-Measuring, Electric Vehicle Fueling Systems, Grain Moisture Meter, Near-Infrared Grain
- 14 Analyzers, and Multiple Dimension Measuring Devices codes, and in Appendix A. Fundamental Considerations.
- 15 • Some users of the Handbook, including regulatory officials, have little or no knowledge of NTEP and the
- 16 significance of Certificates of Conformance.
- 17 • The terms NTEP and Certificate of Conformance appear in NCWM’s Basic Competency, Professional
- 18 Certification, and Service Agent examinations. Examinees are expected to be able to understand NTEP CCs and
- 19 apply information found on the CCs.
- 20 • The definition for NTEP and CC are taken from NIST Handbook 130, Uniform Regulation for National Type
- 21 Evaluation. The statements on inactive CCs are taken from the NCWM website, NTEP Frequently Asked
- 22 Questions page.
- 23 • The absence of definitions could cause enforcement or other legal issues.

24 The submitter requested Voting status for 2024.

25 **Comments in Favor:**

26 **Regulatory:**

- 27 •

28 **Industry:**

- 29 •

30 **Advisory:**

- 31 •

32 **Comments Against:**

33 **Regulatory:**

- 34 •

35 **Industry:**

- 36 •

37 **Advisory:**

- 38 •

39 **Neutral Comments:**

1 **Regulatory:**

- 2 •

3 **Industry:**

- 4 •

5 **Advisory:**

- 6 •

7 **Item Development:**

8 New Proposal

9 **Regional Associations' Comments:**

10 New Proposal

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

OTH-24.2
<p>Regional recommendation to NCWM on item status:</p> <p><input checked="" type="checkbox"/> Recommend as a Voting Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Information Item on the NCWM agenda</p> <p><input type="checkbox"/> Recommend as an Assigned Item on the NCWM agenda <i>(To be developed by an NCWM Task Group or Subcommittee)</i></p> <p><input type="checkbox"/> Recommend as a Developing Item on the NCWM agenda <i>(To be developed by source of the proposal)</i></p> <p><input type="checkbox"/> Recommend Withdrawal of the Item from the NCWM agenda <i>(In the case of new proposals, do not forward this item to NCWM)</i></p> <p><input type="checkbox"/> No recommendation from the region to NCWM <i>(If this is a new proposal, it will not be forwarded to the national committee by this region)</i></p>
<p>Comments and justification for the regional recommendation to NCWM: <i>(This will appear in NCWM reports)</i></p> <p>The committee heard no comments on this item during Open Hearings.</p> <p>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.)</p> <p>The committee recommends this item move forward as a Voting item.</p>

13

14 **ITEM BLOCK 1 (B1) TRANSFER STANDARD**

15 **Source:**

16 California Department of Food and Agriculture, Division of Measurement Standards

17 **B1-LMD-24.1 ~~N.3.5.X. Field Standard Meter Test~~ N.3.5.X. Transfer Standard Test.**

18 **Purpose:**

1 Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard”, harmonize the
2 language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove
3 the non-retroactive status from the section.

4 **Item under Consideration:**

5 Amend Handbook 44 Liquid Measuring Devices Code as follows:

6 *N.3.5.X. Field Standard Meter Test. — The minimum quantity for any test draft shall be equal to or greater than*
7 *the amount delivered in one minute at the flow rate being tested.*

8 *(Added 2023)*

9 *[Nonretroactive as of January 1, 2023]*

10

11 **N.3.5.X. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the**
12 **minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute**
13 **at the flow rate being tested.**

14 **(Added 2023) (Amended 20XX)**

15 **Previous Status:**

16 2024: New Proposal

17 **B1-VTM-24.1** ~~*N.3.5.X. Field Standard Meter Test*~~ **N.3.5.X. Transfer Standard Test.**

18 **Purpose:**

19 Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard”, harmonize the
20 language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove
21 the non-retroactive status from the section.

22 **Item under Consideration:**

23 Amend Handbook 44 Vehicle Tank Meters Code as follows:

24 *N.3.X. Field Standard Meter Test. — The minimum quantity for any test draft shall be equal to or greater than*
25 *the amount delivered in one minute at the flow rate being tested.*

26 *(Added 2023)*

27 *[Nonretroactive as of January 1, 2023]*

28

29 **N.3.X. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the**
30 **minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute**
31 **at the flow rate being tested.**

32 **(Added 2023) (Amended 20XX)**

33 **Previous Status:**

34 2024: New Proposal

35 **Original Justification:**

36 If the term “Field Standard Meter”, which is undefined, remains in NIST HB 44 this will lead to confusion regarding
37 what a “Field Standard Meter” is. This proposal is intended to remove this confusion by replacing this term with one
38 that is defined in NIST HB 44. The item is a test note which would only apply to tests of devices moving forward, the
39 item also identifies when it was added to NIST HB 44, therefore a non-retroactive status is not necessary.

40 The section to be amended was recently added to NIST HB 44. There may be an additional purpose regarding the non-
41 retroactive status of the section.

1 The submitter requested Voting status for this item in 2024 as a retroactive provision.

2 **B1-LPG-24.3** **N.3.2. Field Standard Meter Transfer Standard Test.**

3 **Purpose:**

4 Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard” and harmonize the
5 language in the paragraph with existing language in other sections regarding tests using transfer standards.

6 **Item under Consideration:**

7 Amend Handbook 44 Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

8 ~~N.3.2. Field Standard Meter~~ **Transfer Standard Test. – When comparing a meter with a calibrated transfer**
9 **standard,** ~~the~~ minimum quantity for any test draft shall be equal to or greater than the amount delivered in one
10 minute at the flow rate being tested.
11 (Added 2023) (Amended 20XX)

12 **Previous Status:**

13 2024: New Proposal

14 **Original Justification:**

15 If the term “Field Standard Meter”, which is undefined, remains in NIST HB 44 this will lead to confusion regarding
16 what a “Field Standard Meter” is. This proposal is intended to remove this confusion by replacing this term with one
17 that is defined in NIST HB 44.

18 The section to be amended was recently added to NIST HB 44.

19 The submitter requested Voting status for this item in 2024 as a retroactive provision.

20 **B1-MLK-24.1** ~~**N.3.2. Field Standard Meter Test.**~~ **N.3.2. Transfer Standard Test.**

21 **Purpose:**

22 Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard”, harmonize the
23 language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove
24 the non-retroactive status from the section.

25 **Item under Consideration:**

26 Amend Handbook 44 Milk Meters Code as follows:

27 ~~*N.3.2. Field Standard Meter Test. —The minimum quantity for any test draft shall be equal to or greater than the*~~
28 ~~*amount delivered in one minute at the flow rate being tested.*~~
29 ~~*(Added 2023)*~~
30 ~~*[Nonretroactive as of January 1, 2023]*~~

31
32 **N.3.2. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the**
33 **minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute**
34 **at the flow rate being tested.**
35 **(Added 2023) (Amended 20XX)**

1 **Previous Status:**

2 2024: New Proposal

3 **Original Justification:**

4 If the term “Field Standard Meter”, which is undefined, remains in NIST HB 44 this will lead to confusion regarding
5 what a “Field Standard Meter” is. This proposal is intended to remove this confusion by replacing this term with one
6 that is defined in NIST HB 44. The item is a test note which would only apply to tests of devices moving forward, the
7 item also identifies when it was added to NIST HB 44, therefore a non-retroactive status is not necessary.

8 The section to be amended was recently added to NIST HB 44. There may be an additional purpose regarding the non-
9 retroactive status of the section.

10 The submitter requested Voting status for this item in 2024 as a retroactive provision.

11 **B1-MFM-24.1** ~~N.3.2. Field Standard Meter~~ Transfer Standard Test.

12 **Purpose:**

13 Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard”, harmonize the
14 language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove
15 the non-retroactive status from the section.

16 **Item under Consideration:**

17 Amend Handbook 44 Milk Meters Code as follows:

18 N.3.2. ~~Field Standard Meter~~ Transfer Standard Test. – **When comparing a meter with a calibrated transfer**
19 **standard,** the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one
20 minute at the flow rate being tested except for tests of the minimum measured quantity specified for the meter.
21 (Added 2023) **(Amended 20XX)**

22 **Previous Status:**

23 2024: New Proposal

24 **Original Justification:**

25 If the term “Field Standard Meter”, which is undefined, remains in NIST HB 44 this will lead to confusion regarding
26 what a “Field Standard Meter” is. This proposal is intended to remove this confusion by replacing this term with one
27 that is defined in NIST HB 44.

28 The section to be amended was recently added to NIST HB 44.

29 The submitter requested Voting status for this item in 2024 as a retroactive provision.

30 **Comments in Favor:**

31 **Regulatory:**

- 32 •

33 **Industry:**

- 34 •

35 **Advisory:**

- 36 •

1 **Comments Against:**

2 **Regulatory:**

- 3 •

4 **Industry:**

- 5 •

6 **Advisory:**

- 7 •

8 **Neutral Comments:**

9 **Regulatory:**

- 10 •

11 **Industry:**

- 12 •

13 **Advisory:**

- 14 •

15 **Item Development:**

16 New Proposal

17 **Regional Associations' Comments:**

18 New Proposal

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

ITEM BLOCK 1

Regional recommendation to NCWM on item status:

- Recommend as a Voting Item on the NCWM agenda
- Recommend as an Information Item on the NCWM agenda
- Recommend as an Assigned Item on the NCWM agenda
(To be developed by an NCWM Task Group or Subcommittee)
- Recommend as a Developing Item on the NCWM agenda
(To be developed by source of the proposal)
- Recommend Withdrawal of the Item from the NCWM agenda
(In the case of new proposals, do not forward this item to NCWM)
- No recommendation from the region to NCWM
(If this is a new proposal, it will not be forwarded to the national committee by this region)

Comments and justification for the regional recommendation to NCWM: *(This will appear in NCWM reports)*

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.

Mr. Mark Lovisa, Louisiana | Committee Chair
Mr. Timothy Morales, Texas | Member
Mr. Heath Higdon, Kentucky | Member
Mr. Greg Gholston, Mississippi | Member
Mr. Alan Walker, Florida | Member

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 and 1)
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]

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

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.

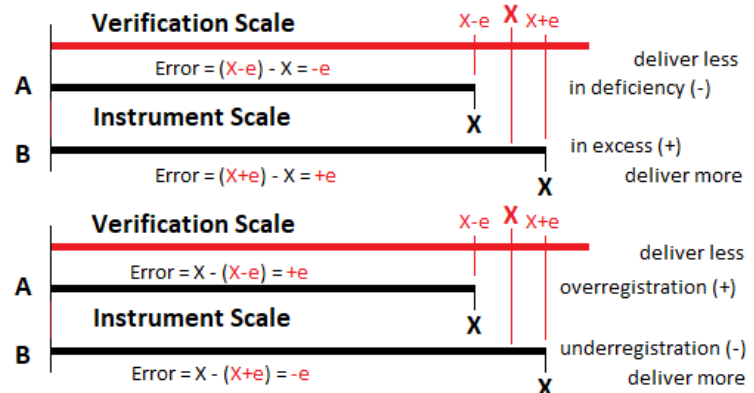
Instrument Scale	Scale div d	Verification “True Value” Scale	Scale div e	Relation e to d
Rule	1/16 in	Standard Rule or Tape	1/16 in	e = d
Taximeter	1/10 mi	Road Course	2 ft	e << d
LMD’s	0.1 gal	Prover indication	5 cu in	e > d
Mass Flow Meter	1 lb	Reference Scale	0.01 lb	e < d
Weighing Devices	0.01 lb	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.

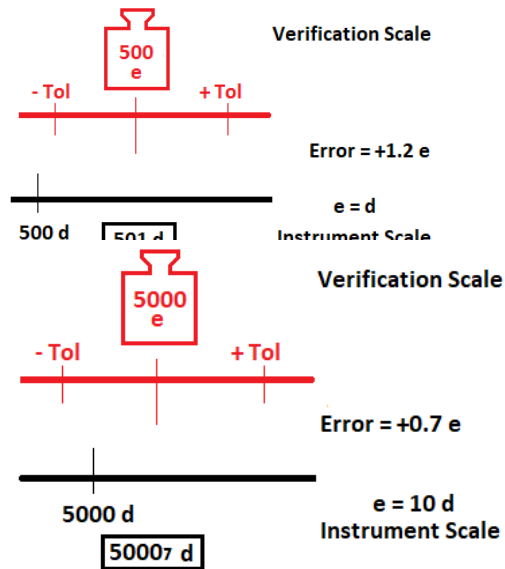
Error of delivery =
verification scale – instrument scale
+ in excess
– in deficiency

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 $+0.7 e$. $\text{Error} = \text{instrument scale} - \text{verification scale}$. 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).

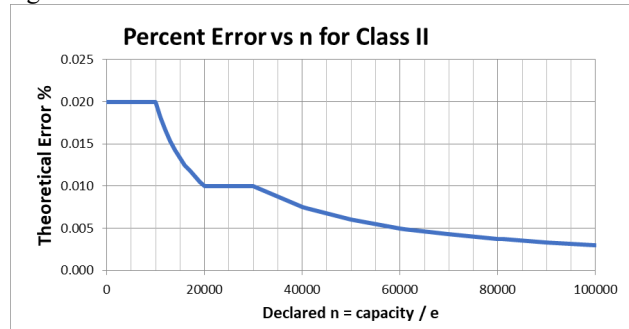
T.N.1.3. Scale Division. – The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.

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]

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

(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 (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			
<i>Class</i>	<i>Value of the Verification Scale Division (d or e¹)</i>	<i>Number of <u>Verification Scale</u>⁴ Divisions (n)</i>	
		<i>Minimum</i>	<i>Maximum</i>
<i>SI Units</i>			
<i>I</i>	<i>equal to or greater than 1 mg</i>	<i>50 000</i>	<i>--</i>
<i>II</i>	<i>1 to 50 mg, inclusive</i>	<i>100</i>	<i>100 000</i>
	<i>equal to or greater than 100 mg</i>	<i>5 000</i>	<i>100 000</i>
<i>III^{2,5}</i>	<i>0.1 to 2 g, inclusive</i>	<i>100</i>	<i>10 000</i>
	<i>equal to or greater than 5 g</i>	<i>500</i>	<i>10 000</i>
<i>III L³</i>	<i>equal to or greater than 2 kg</i>	<i>2 000</i>	<i>10 000</i>
<i>III</i>	<i>equal to or greater than 5 g</i>	<i>100</i>	<i>1 200</i>

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 $n = \text{capacity} / e$.

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 CC¹	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 <u>Verification Scale Division</u> , “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 $e \neq d$ 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	
<u>Type of device (see Note)</u>	<u>Relative magnitude of e to d</u>
<u>Graduated, without an auxiliary indicating device</u>	<u>e = d</u>
<u>Graduated, with an auxiliary indicating device</u>	<u>e > d and e is chosen by the manufacturer according to Table 3. and S.1.2.2.1.</u>
<u>Graduated, and marked for use in special applications (weight classifier)</u>	<u>e ≤ d and e is chosen by the manufacturer according to Table 3. and S.1.2.2.4.</u>

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 $e \neq d$, 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 $e \neq d$, the value of “d” shall be a decimal submultiple of “e,” and the ratio shall not be more than 10:1. If $e \neq d$, 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 III 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 IIII Scales. On Class IIII 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 IIII where e should always equal d. Now all classes (I, II, III, IIII, 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 independent¹ weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):

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

(d) $v_{min} \leq \frac{d^* e}{\sqrt{N} x \text{ (scale multiple)}}$ 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 $e \neq d$ 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 <u>verification</u> 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 III L 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 III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 ~~e~~ 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 <u>Verification Scale Division “e”</u> (d or e*)	Recommended Minimum Load <u>in</u> 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 equal to or greater than 0.1 g	20 50
III	All**	20
III L	All	50
IIIH	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 IIIH 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 ~~40 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 $\frac{1}{2}$ 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 weight of 0.05 g. That's 4.8% relative error in the weight ($0.05 \text{ g} / 1.05 \text{ g}$) 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 weight ($0.005 / 1.005$). 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 |

Group 6. Changes to correctly reference to e or d as appropriate.

S.1.1.1. Digital Indicating Elements.

(a) A digital zero indication shall represent a balance condition that is within $\pm \frac{1}{2}$ the value of the verification scale division.

*(b) A digital indicating device shall either automatically maintain a "center-of-zero" condition to $\pm \frac{1}{4}$ verification scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to $\pm \frac{1}{4}$ of a verification 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, and 20XX)

The changes correctly reference e in this section as this is an issue of ensuring the zero indication is accurate to $\frac{1}{4} e$. 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 verification scale division (~~(d)~~ (e); 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 $e \neq d$ 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 1/4 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 $\text{gross} - \text{tare} = \text{net}$ 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 $1.02 \text{ lb} - 0.03 \text{ lb} = 0.99 \text{ lb}$.

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 IIIIL instruments are already high resolution somewhat similar to Class I and II instrument with $e > d$. Class IIIIL 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 explore 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.

