

## Specifications and Tolerances (S&T) Committee 2023 Interim Meeting Report

Mr. Jason Glass, Committee Chair  
Kentucky

### 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](http://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..

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**Subject Series List**


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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
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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
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**Glossary of Acronyms and Terms**

<b>Acronym</b>	<b>Term</b>	<b>Acronym</b>	<b>Term</b>
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

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**Details of All Items**  
(In order by Reference Key)

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**GEN – GENERAL CODE**

**GEN-23.1            V    G-N.3. Test Methods**

**Source:**

Seraphin Test Measure Company

**Purpose:**

There are several proposals on the S&T agenda with the objective to recognize meters for use as field standards or as transfer standards. This proposal offers an option to add a paragraph to the General Code to state that other field standards and transfer standards may be approved by the State weights and measures Director for use to test commercial devices, rather than adding paragraphs to each specific code for this purpose.

**Item Under Consideration:**

Amend Handbook 44, General Code, as follows:

**G-N.3. Test Methods. – Permissible test methods for verifying compliance of commercial weighing and measuring systems with the provisions of the General Code and Specific Codes include, but are not limited to, test methods and apparatus that have been approved by the Director as outlined in Appendix A - Fundamental Considerations, Section 3. Testing Apparatus.**

**Previous Action:**

2023: New Item

**Original Justification:**

Several device codes already contain references regarding transfer standards used to test commercial measurement devices (e.g., Cryogenic Liquid-Measuring Devices Code, Carbon Dioxide Liquid-Measuring Devices Code and Hydrogen Gas-Measuring Devices Code). Rather than revising a specific code in Handbook 44 every time a new field or transfer standard is proposed or developed, it is better to have an overall statement in the General Code that recognizes the use of other field and transfer standards that meet the requirements for use as field or transfer standards. The joint OWM/Seraphin proposal (GEN-19.1 and OTH-22.1) provides definitions and criteria to be included in Handbook 44 and in the Fundamental Considerations in Appendix A. It also prescribes the tolerances to be applied when using Type 2 transfer standards. For those who believe a specific statement in Handbook 44 is needed to recognize additional field and transfer standards, the proposed addition of G-N.3. will provide the reference they want without the need to change individual codes on a regular basis to recognize each particular field or transfer standard.

Some regulators may argue that if Handbook 44 does not specifically recognize a specific type of field or transfer standard, then the use of the field or transfer standard is not allowed. However, this approach would mean that every type of field or transfer standard must be specifically recognized in an H44 code and then the Handbook must be changed every time a new standard is proposed to be recognized. The Fundamental Considerations already recognize the authority of the Director to recognize new standards and transfer standards for use to test commercial devices. Footnote 2 to Section 3.1. includes the statement, “This section shall not preclude the use of additional field standards and/or equipment, as approved by the Director, for uniform evaluation of device performance.”

Others may argue that this paragraph in the General Code is not needed, since (1) the definitions of field standard and transfer standard and (2) the Fundamental Considerations already provide for the recognition and use of other field standards and transfer standards.

1 The submitter requests that this be a retroactive section.

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

3 **Comments in Favor:**

4 **Regulatory:**

- 5 • 2023 Interim: Tim Chesser from the State of Arkansas supports the item moving forward with voting  
6 status.

7 **Industry:**

- 8 • 2023 Interim: Bob Murnane (Submitter) from Seraphin feels it is fully developed and ready for voting  
9 status.  
10 • 2023 Interim: Michael Keilty from Endress + Hauser commented that the item is redundant but points  
11 to block 8 items and supports GEN 23.1 moving forward as a voting item.  
12 • 2023 Interim: Brent Price (Gilbarco) commented that this highlights the state's ability to determine  
13 suitable standards and supports this item as a voting item.

14 **Advisory:**

- 15 • 2023 Interim: Tina Butcher (NIST OWM) commented that this item is fully developed and provides  
16 clarity in regard to Director's ability to approve standards used in a particular jurisdiction.

17 **Comments Against:**

18 **Regulatory:**

- 19 • 2023 Interim: Hal Prince from the State of Florida comments that this may be problematic in the General  
20 Code for some states dependent on specific circumstances. This is redundant as state law gives the  
21 director the discretion to determine standards used.

22 **Industry:**

- 23 •

24 **Advisory:**

- 25 •

26 **Neutral Comments:**

27 **Regulatory:**

- 28 •

29 **Industry:**

- 30 •

31 **Advisory:**

- 32 •



**Item Development:**

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. Based on open hearing and written comments, the committee removed the words “State” and “of weights and measures” from the proposal. The committee also added the word “commercial” between “of” and “weighing”. With the modifications, the committee believes this item is fully developed and has assigned it a voting status.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Mr. Robert Murnane (Seraphin Test Measure Company) – Provided the reason for this addition. Mr. Murnane commented rather than adding paragraphs to each code regarding use of testing equipment, and published in Appendix A, putting it in the general code would it applicable to all, having to avoid referencing Appendix A. Mr. Murnane recommends this as a voting item.

Mr. Michael Keilty (Endress+Hauser) - Expressed opposition to this item. Mr. Keilty commented that Mr. Murnane also submitted the item under block 8. Mr. Keilty commented that everything in this proposal is repeated in Block 8 and is in the fundamentals of consideration, it is redundant. Recommends withdrawal of this item.

During open hearings there was testimony heard about redundancy between this item and Block 8. The WWMA S&T Committee recommends that this item be assigned a developing status with the recommendation that the submitters of GEN-23.1 and Block 8 make one cohesive item or develop them in tandem to reduce redundancies.

SWMA 2022 Annual Meeting: Dr. Matt Curran, State of Florida, commented that he wasn’t clear on who the submitter of this item is. He cautioned that this item would allow the use of a device not in the handbook and would lay the burden of responsibility for the use of that device solely on the Director. He also stated concern that this would move us away from uniformity.

Mr. Robert Murnane of Seraphin Test Measures, the submitter of this item, stated that the Handbook already gives the Director the authority to use any device, and that this would make it easier to adopt new technologies as they are developed. He recommended moving this forward as a Voting item.

Mr. Tim Chesser, State of Arkansas, echoed Mr. Curran’s concerns. He also stated that he liked the item, and that it would give us some teeth when making accommodations for alternate test methods.

Mr. Keilty, Endress + Hauser, stated that we discuss new technology and how to deal with it in every meeting. He added that lines 12-15 were redundant to S&T Block 8 page 310, lines 33-46. He also stated that this issue is ultimately addressed by the Fundamental Considerations and recommended that the item be withdrawn.

Mr. Hal Prince, State of Florida, stated that he didn’t see a need for this proposal.

Mr. Ken Ramsburg, State of Maryland echoed Mr. Prince.

The SWMA S&T Committee believes that the need for this item is ambiguous, and that it would be redundant to Block 8 if those items are added to the handbook as well.

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

CWMA 2022 Interim Meeting: Bob Murnane - Seraphin – Add “commercial” to line 12 between the words “of” and “weighing”.

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

**G-N.3. Test Methods. – Permissible test methods for verifying compliance of commercial weighing and measuring systems with the provisions of the General Code and Specific Codes include, but are not limited to, test methods and apparatus that have been approved by the State Director of weights and measures as outlined in Appendix A - Fundamental Considerations, Section 3. Testing Apparatus.**

NEWMA 2022 Interim Meeting: Mr. Bob Murnane (Seraphin Test Measure) commented that the reason for this proposal is to put a reference in the General Code to Section 3 of the Fundamental Considerations. This would make it clear that directors have authority to use master meters and would eliminate the need to change all codes. Mr. Michael Keilty (Endress Hauser) commented that he believes this item is redundant in conjunction with the other blocked items authored by the submitter and recommends the item be withdrawn. Ms. Diane Lee (NIST-OWM) commented that this item clarifies in General Code that the choice of master meter rests on individual states. NIST believes the item has merit. A full analysis has not been developed but will provide for Interim. Mr. Bob Murnane (Seraphin Test Measure) responded to Mr. Keilty comments regarding redundancy and reiterated that this item would make it clear that directors have authority to use master meters and would eliminate the need to change all codes. Mr. Lou Sakin (Holliston, MA) recommended this item have a voting status. Mr. Jim Willis (NY) indicated that this item will have a voting status.

After hearing comments from the floor, the Committee agrees that the item has merit. The Committee agrees with the commenters that this item will give clarity as to the use of master meters and recommends a Voting status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **SCL – SCALES**

### **SCL-22.1 V Recorded Representation of Axle or Axle Group Weights**

*NOTE: At the 2023 Interim Meeting, the Committee agreed to remove this item from Block 6.*

#### **Source:**

NIST, Office of Weights and Measures

#### **Purpose:**

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

#### **Item Under Consideration:**

Amend NIST Handbook 44, Scales Code as follows:

#### **S.1.15. Recorded Representations, Multi-Independent Platform<sup>1</sup> Vehicle Scale Systems**

**S.1.15.1. Axle and Axle Group Loads. – All recorded representations of the different axle and axle group loads of a vehicle when weighed in a single draft on a multi-independent platform vehicle scale system shall be identified by providing indication of either:**

**(a) the portion of the vehicle to which they represent (e.g., “axle-group 1, axle group 2, axle group 3,” or if using axle and axle group descriptions, “steering axle, drive axles, trailer axles”), or**

**(b) the particular independent scale platform from which they were obtained (e.g., “Platform 1, Platform 2, Platform 3”).**

**S.1.15.2. Total Vehicle Weight. – If a summed total of all axle and axle group loads of a vehicle weighed on a multi-independent platform vehicle scale system is recorded, the recorded value shall be clearly identified as:**

**(a) “Total Vehicle Weight,” “Vehicle Weight,” (or other similar terms that clearly identify the value as the vehicle’s total weight) providing all axle(s) and axle groups of the vehicle weighed were positioned on a live portion of the weighing/load-receiving elements and weighed simultaneously when the summed total was determined<sup>2</sup>, or**

**(b) “Not-Legal-For-Trade” unless all axle and axle groups of the vehicle weighed were simultaneously positioned on a live portion of the weighing/load-receiving elements when the summed total was determined, or the vehicle was weighed using the alternative method described in footnote 2 of this paragraph.**

**<sup>1</sup>Multi-independent platform means each platform of the scale is a single independent weighing/load-receiving element unattached to adjacent elements and with its own A/D conversion circuitry and displayed weight.**

**<sup>2</sup>Alternatively, the individual components of the vehicle being weighed may be uncoupled, positioned completely on the live elements of the scale, weighed separately, and then totaled.**

*[subsequent requirements to be renumbered as appropriate]*

**Previous Action:**

2022: Developing

**Original Justification:**

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

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

The submitter requested voting status for these items in 2022.

**Comments in Favor:**

**Regulatory:**

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

**Industry:**

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

**Advisory:**

- 2022 Interim: NIST (submitter) recommended that GEN 22.1 be separated and given voting status. Asked that remainder of block remain developing.

- 2023 Interim: NIST (the submitter) agrees with the SMA changes and recommends voting. They also agree that SCL-22.3 should remain developing.

**Comments Against:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

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

**Industry:**

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

**Advisory:**

- 

**Item Development:**

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

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

Mr. Richard Harshman  
NIST Office of Weights and Measures  
301-975-8107, [richard.harshman@nist.gov](mailto:richard.harshman@nist.gov)

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

NCWM 2023 Interim Meeting: The committee agreed to remove SCL-22.1 from Block 6. The committee renumbered paragraphs S.1.14.x to S.1.15.x. The committee also changed S.1.15.1. by adding the words “when” and “in a single draft” as recommended by the SMA updated proposal that was received on October 16, 2022.

**Regional Associations’ Comments:**

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

During open hearings the Committee received an update from NIST OWM indicating that new language for this proposal was submitted to NCWM. This language was not available for review at the time of open hearings by the

committee or membership. The WWMA S&T Committee recommends that this item should remain developing to allow membership to review the updated proposal.

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

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

### **SCL-22.3                      D      UR.3.3. Single-Draft Vehicle Weighing., and UR.3.4. Axle and Axle Group Weight Values.**

*NOTE: At the 2023 Interim Meeting, the Committee agreed to remove this item from Block 6.*

#### **Source:**

NIST, Office of Weights and Measures

#### **Purpose:**

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

#### **Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

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

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

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

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

(Added 1992)

And

**UR.3.4. Weighing of Axle- and Axle-Group Loads – Establishing weight values for the different individual axle- and axle-group loads of a vehicle or coupled-vehicle combination is oftentimes necessary to verify compliance with state and federal highway load limits. When a fee is charged for the use of an axle-load scale or vehicle scale to determine such values, the transaction is considered “commercial” under the provisions of the General Code paragraph G-A.1. Commercial and Law Enforcement Equipment and the scale shall comply with all applicable NIST Handbook 44 requirements for commercial weighing systems.**

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

**In no case, however, shall a summed result of the different axle- and axle-group loads of a vehicle or coupled vehicle combination weighed in multiple drafts be used for commercial purposes except as provided in subparts (a) and (b) of paragraph UR.3.3. Single-Draft Vehicle Weighing.**

Renumber existing paragraphs UR.3.4 through UR.3.12.

**Previous Action:**

2022: Developing

**Original Justification:**

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

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

The submitter requested voting status for these items in 2022.

**Comments in Favor:**

**Regulatory:**

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

**Industry:**

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

**Advisory:**

- 2022 Interim: NIST (submitter) recommended that GEN 22.1 be separated and given voting status. Asked that remainder of block remain developing.
- 2023 Interim: NIST (the submitter) agrees with the SMA changes and recommends voting. They also agree that SCL-22.3 should remain developing.

**Comments Against:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

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

**Industry:**

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

**Advisory:**

- 

**Item Development:**

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

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

Mr. Richard Harshman  
NIST Office of Weights and Measures  
301-975-8107, [richard.harshman@nist.gov](mailto:richard.harshman@nist.gov)

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

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

**Regional Associations' Comments:**

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

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

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

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **SCL-23.1            W    S.1.12. Manual Weight Entries**

**Source:**  
NTEP Weighing Sector

**Purpose:**  
Provide Specifications corresponding with User Requirements that limit how manual weight entries are allowed.

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

***S.1.12. Manual Weight Entries. – ~~A device~~ ~~When~~ being used ~~in a~~ ~~for~~ direct sale application and when in a zero-balance condition, a device or a Point-of-Sale System\*\* shall accept an entry of a manual gross or net weight value only when: ~~the scale gross or net\* weight indication is at zero.~~***

***(a) a point-of-sale system interfaced with a scale is giving credit for a weighed item;***

***(b) an item is pre-weighed on a legal for trade scale and marked with the correct net weight;***

***(c) a device or system is generating labels for standard weight packages;***

***(d) postal scales or weight classifiers are generating manifests for packages to be picked up at a later time; or***

***(e) livestock and vehicle scale systems generate weight tickets to correct erroneous tickets.***



Recorded **representations for** manual weight entries, except those on labels generated for packages of standard weights, shall identify the weight value as a manual weight entry by one of the following terms: “Manual Weight,” “Manual Wt,” or “MAN WT.” The use of a symbol to identify multiple manual weight entries on a single document is permitted, provided that the symbol is defined on the same page on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.

[Nonretroactive as of January 1, 1993] [\*Nonretroactive as of January 1, 2005] [**\*Nonretroactive as of January 1, 20XX**]

(Added 1992) (Amended 2004 **and 20XX**).

**Previous Action:**

2023: New Item

**Original Justification:**

The instances in which manual weight entries are allowed are limited by UR.3.9. but there are no corresponding limitations in S.1.12. This addition will allow the evaluation of devices, software, or systems for compliance with these limitations and provide manufacturers specific requirements to comply with when designing a commercial device.

The submitter acknowledges that this is a complicated requirement to incorporate into the design of a device or system and some may argue that it should remain a user requirement.

**Requested Status by Submitter:** Voting Item

**Comments in Favor:**

**Regulatory:**

- 2023 Interim: Kevin Schnepf (State of California) supports the further development of this item.

**Industry:**

- 2023 Interim: Russ Vires (Scale Manufacturers Association) supports the item.

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- 2023 Interim: Loren Minnich (State of Kansas-Submitter) commented that NIST’s evaluation was appreciated, and he asked the committee for Withdrawal or Developing status.

**Industry:**

- 

**Advisory:**

- 2023 Interim: Jan Konijnenburg (NIST OWM) commented that the item was not ready for a vote.

**Neutral Comments:**

**Regulatory:**

-

**Industry:**

- 

**Advisory:**

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**Item Development:**

NCWM 2023 Interim Meeting: Based upon comments received on the floor the committee has decided to withdraw this item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Kurt Floren (County of Los Angeles, CA) – Commented the item needs further development and explanation of the application. It was mentioned the item is going in the scales code and will impact specific performance requirements. Mr. Floren commented on the direct sale application and reference the sub sections when making further comments. He noted the direct sale application would not be known until after the device is installed. Questions arose on subsection “A”, which speaks to the interface, the purpose remains unclear. Subsection “C” references the pre-packing and labeling of standard packages which does not meet a direct sale application. Subsections “B” and “D” are not direct sale applications and require further clarification. Mr. Floren believes the item is not ready for voting and supports a developing status.

Mr. Raymond Johnson (Fairbanks Scales, representing the Scale Manufacturers Association) – Commented the SMA has not met and has not formulated a position on this item. The SMA is scheduled to meet in November 2022.

Mr. Matt Douglas (State of California, Division of Measurement Standards) – Mr. Douglas agreed with Mr. Floren and his previous comments. He further commented the language needs a lot of wordsmithing to address concerns, including addressing the retroactive status which would require an introduction of a third retroactive date with double asterisk. Section S.12 is for direct sales, and it is not clear how the language applies to this method of sale. Mr. Douglas also noted the content should be broken into two sections.

During open hearings the committee heard testimony that the SMA has not evaluated this proposal and has not taken a position or developed comments on the item. The committee heard several questions and concerns regarding the direct sale application which conflicts with the subsections, along with the non-retroactive date formatting. The committee believes these concerns should be addressed for the item to move forward. The WWMA S&T Committee recommends that this item be assigned a developing status.

SWMA 2022 Annual Meeting: The SWMA S&T Committee recommends this item move forward as a Developing Item.

CWMA 2022 Interim Meeting: Loren Minich – Kansas: Shouldn't change the application, just makes it easier to understand how it's applied. A,B,C,D are now user requirements. This communicates with manufacturers so they understand how they should be designed. Changing to S specification so that it applies to manufacturing. Only allowed in direct sale manual weight entries.

Greg VanderPlaats – Minnesota Suggested change. Move “when in zero balance condition” to the list so it's more understood that manual entry is only allowed when at zero balance condition.

The CWMA S&T Committee believes this item is fully developed and recommends voting status.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**SCL-23.2 V Table S.6.3.a. Marking Requirements, and Table S.6.3.b. Notes for Table S.6.3.a. Marking Requirements**

**Source:**

NTEP Weighing Sector

**Purpose:**

Add an additional marking requirement for single draft weigh-in-motion vehicle scale to include a vehicle type restriction.

**Item under Consideration:**

Table S.6.3.a. Marking Requirements					
To Be Marked With ↓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC <sup>1</sup>	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)
Minimum and Maximum Speed (25)		<u>X</u>	<del>X</del>		
Maximum Speed Change (26)		<u>X</u>	<del>X</del>		
Vehicle Direction Restriction (27)		<u>X</u>	<del>X</del>		
<b><u>Vehicle Restriction (28)</u></b>		<u>X</u>			

And

**Table S.6.3.b.**

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

**28. Weigh-in-Motion vehicle scales must be marked with any vehicle restrictions, if applicable, which shall be readily apparent when viewing the reading face of the scale indicator.**

**(Added 20XX)**

**Previous Action:**

2023: New Item

**Original Justification:**

As discussed at the NTEP Weighing Sector Meeting, multiple vehicle types are tested during the NTEP publication 14 test. If a specific vehicle type is failed or not tested, there needs to be a restriction on the vehicle types passed on the certificate. This restriction must also be marked on the device.

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

**Comments in Favor:**

**Regulatory:**

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**Industry:**

- 2023 Interim: Jessica Ferree (Mettler-Toledo) commented that the item adds clarity and recommends voting status.
- 2023 Interim: Russ Vires (SMA) supports the item.

**Advisory:**

- 2023 Interim: Jan Konijnenburg (NIST OWM) supports with revisions from OWM.

**Comments Against:**

**Regulatory:**

- 2023 Interim: Kurt Floren (County of Los Angeles) expressed concerns about the vehicle type and exactly what that means.
- 2023 Interim: Tim Chesser (State of Arkansas) relayed concerns about reference vehicles that aren't specified on the NTEP CC could be an issue.
- 2023 Interim: Kevin Schnepp (State of California) expressed concerns over the language being ambiguous which could lead to confusion.

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

- Russ Vires (Mettler Toledo) commented that tankers are dealt with in other spots.

**Advisory:**

- Daryl Flocken (NTEP) made comments explaining class of vehicles and a possible clarification to certifications to restrict tanker trucks due to the accuracy challenges dealing with liquid loads that will slosh inside a vessel.

**Item Development:**

NCWM 2023 Interim Meeting: The committee updated the item per recommendations from the submitter and comments received. With the modifications, the committee believes this item is fully developed and has assigned it a voting status.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Kurt Floren (County of Los Angeles, CA) – Mr. Floren commented that he does not know the definition of vehicle type, it is not defined in any way and seems short of complete and not ready for a vote.

Mr. Raymond Johnson (Fairbanks Scales, representing the Scale Manufacturers Association) – Mr. Johnson stated that the SMA has not met and has not formulated a position on this item. The SMA is scheduled to meet in November.

Mr. Matt Douglas (State of California, Division of Measurement Standards) - Mr. Douglas concurred with Mr. Floren and had the same question about vehicle types. The “X” is under the weighing element column but applies to the indicator. If it applies to both, the “X” should be in both.

Mr. Aaron Yanker (Colorado Dept of Agriculture) – Mr. Yanker agreed with Mr. Floren’s comments.

During open hearings, testimony was received that the SMA had not evaluated this proposal with a position. Questions were raised by members in open hearings regarding “vehicle types”, and the proposed change to the markings table in 2.20. Scales Code. The WWMA S&T Committee recommends that this item be assigned a developing status.

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

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

CWMA 2022 Interim Meeting: Loren Minich – Kansas, If the installation isn’t tested with all vehicle configurations, then the use would be restricted to only the vehicles that were evaluated during type evaluation. This new marking requirement would be visible to the operator. Possibly also apply to field testing and not just type evaluation?

Lenny Goebel – Illinois, Questions if the limitation / marking would apply to different axle configurations for different vehicles.

Doug Musick – Kansas, Doesn’t like the word “type”. Does it differentiate between liquids and solids in a tanker? Recommends item be developing.

The CWMA S&T Committee recommends this as a Developing item. The submitter should consider clarifications related to the comments provided.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

**Source:**  
NCWM Verification Scale Division e Task Group

**Purpose:**  
To update Handbook 44, Section 2.20 Scales and relevant portions of OIML R76, using items from the S&T Block 2 items as a reference point to:  
1. Clarify how error is determined in relation to the verification scale division (e) and the scale division (d)

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

**Item under Consideration:**

Amend Handbook 44 Scales Code as follows:

**Part 1. Amendment of T.N.1.3. and related sections**

**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 verification scale division (~~d~~e).

**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~~ based on the verification scale division (e) ~~and is generally expressed in terms of d or e.~~

**(Amended 20XX)**

**Appendix D. Definitions**

**scale division, number of (n).** – See “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)**

**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)**

<b>Table 6.</b> <b>Maintenance Tolerances</b> <b>(All values in this table are in <u>verification</u> scale divisions <u>(e)</u>)</b>				
<b>Tolerance-in-Scale Divisions</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>5</b>
<b>Class</b>	<b>Test Load <u>Applied (e)</u></b>			
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 <del>e</del> for each additional 500 <del>e</del> 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.**

**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) (~~e~~) and be within tolerance limits.

(Amended 1986 **and 20XX**)

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

#### **T.N.6.1. Test Load.**

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

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

**(Amended 20XX)**

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

- (a) types of devices approved prior to January 1, 1986, and manufactured prior to January 1, 1988, need not meet the requirements of this section;
- (b) new types of devices submitted for approval after January 1, 1986, shall comply with the requirements of this section; and
- (c) all devices manufactured after January 1, 1988, shall comply with the requirements of this section.

(Amended 1985)

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

- (a) three ~~divisions~~ e per 5 °C (9 °F) change in temperature for Class III L devices; or
- (b) one ~~division~~ e per 5 °C (9 °F) change in temperature for all other devices.

(Amended 1990 **and 20XX**)

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

- (a) blank the indication; or
- (b) provide an error message; or
- (c) the indication shall be so completely unstable that it cannot be interpreted, or transmitted into memory or to a recording element, as a correct measurement value.

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

(Amended 1997 **and 20XX**)

**T.1. Tolerance Values.**

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

~~(Amended 1990)~~

**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 1990 **and 20XX**)

**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 d.

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

[Nonretroactive as of January 1, 20XX]

~~(b)(c) A digital indicating device shall either automatically maintain a “center of zero” condition to  $\pm \frac{1}{4}$  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 a zero balance condition when the deviation from zero is not more than  $\pm 0.25 e$ . A “center-of-zero” indicator may operate when zero is indicated for gross and/or net mode(s). The “center-of-zero” indicator is not mandatory on a device equipped with an auxiliary 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)~~

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

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

**(Amended 20XX)**

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 CC <sup>1</sup>	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)

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

<p align="center"><b>Table S.6.3.b.</b> <b>Notes for Table S.6.3.a. Marking Requirements</b></p>	
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 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., <math>15 \times 0.005</math> kg, <del><math>30 \times 0.01</math> lb,</del> or capacity = 15 kg; <math>d = 0.005</math> kg, <u>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” <del>or weight unit</del> <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>[Nonretroactive as of January 1, 1983] (Amended 2005 <u>and 20XX</u>)</p>
4.	<p><i>Required only if different from “d.” Exceptions to Note 3 regarding marking of “e” and “d.”</i></p> <p>(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></p> <p>(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></p> <p>[Nonretroactive as of January 1, 1986] (Amended 20XX)</p>

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

#### Appendix D. Definitions

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)

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

(Added 20XX)

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

(Added 1987) (Amended 20XX)

#### S.1.2.2. Verification Scale ~~Interval~~ Division “e”.

(Added 20XX)

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

$$d < e \leq 10 d$$

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

The value of e must satisfy the relationship,  $e = 10^k$  of the unit of measure, where k is a positive or negative whole number or zero. This requirement does not apply to a Class I device with  $d < 1$  mg where  $e = 1$  mg. If  $e \neq d$ , 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)

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

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

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

**(a) The value of “e” shall be greater than “d” and less than or equal to 10 “d” ( $d < e \leq 10 d$ ), and**

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

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

**Examples: If  $e = 1$  g for Class I or II, then “d” may only be 0.5 g, 0.2 g, or 0.1 g**

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

(Added 1999) (Amended 20XX)

**S.1.2.2.3. Deactivation of a “d” Resolution. – It shall not be possible to deactivate the “d” resolution on a Class I or II scale equipped with an auxiliary indicating device 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 20XX)

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

(Added 20XX)

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

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

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

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

(Added 20XX)

Table 3. Parameters for Accuracy Classes			
Class	Value of the Verification Scale Division ( <del>d or</del> $e^1$ )	Number of <u>Verification</u> Scale <sup>4</sup> Divisions (n)	
		Minimum	Maximum
SI Units			
I	equal to or greater than 1 mg	50 000	--
II	1 to 50 mg, inclusive	100	100 000
	equal to or greater than 100 mg	5 000	100 000
III <sup>2,5</sup>	0.1 to 2 g, inclusive	100	10 000
	equal to or greater than 5 g	500	10 000
III L <sup>3</sup>	equal to or greater than 2 kg	2 000	10 000
IIII	equal to or greater than 5 g	100	1 200

The middle section of the table is omitted for brevity.

[Nonretroactive as of January 1, 1986]

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

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

<sup>1</sup> 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.).

<sup>2</sup> 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)

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

**S.5.4. 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, e, for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent<sup>1</sup> weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):

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

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

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

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

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

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

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

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

*[Nonretroactive as of January 1, 1994]*

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

1

<b>Table 8. Recommended Minimum Load</b>		
<b>Class</b>	<b>Value of <u>Verification Scale Division e</u> (<del>d</del> or <del>e</del>*)</b>	<b>Recommended Minimum Load <u>in</u> scale divisions <u>d</u> (See notes) (<del>d</del> or <del>e</del>*)</b>
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
III	All	10
<p><del>*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 III devices the value of “e” is specified by the manufacturer as marked on the device; “e” must be less than or equal to “d.”</del></p> <p><u><i>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.).</i></u></p> <p><u><i>For an ungraduated device, the scale division d shall be replaced with the verification scale division e in the last column.</i></u></p> <p><del>**A minimum load of 40 <u>d</u> 5 <u>e</u></del> is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.</p>		

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.

16 The flaws arise from the use of the scale division d in these paragraphs. The first paragraph deals with accuracy class  
 17 (classification) and the second with tolerances (accuracy measurement). The correct principle is to only use e in both

paragraphs since accuracy is correctly expressed in e. Notice also that in T.N.1.3. the Code specifies both e and d 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. However, the confusion that arises in enforcement should indicate that maybe it is not as clear as we think. Using e, which follows correct measurement principles, should eliminate the confusion.

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

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

## Other Issues Discussed by the Task Group:

- 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.



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

Code Section	Applies to	Justification
S.1.2.3.	e	This is a classification issue. It ensures accuracy of the piece counts.
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)

3. The Task Group also observed that method of referencing the scale division and verification scale division is inconsistent throughout the Code. In some cases the paragraph only uses the abbreviation d or e, in other cases the name is stated without the abbreviation and in other cases the name is included with the abbreviation d or e in quotes or parentheses. Because the proposal only considers sections that needed change this issue is not addressed formally in the proposal. The Task Group believes the change to a consistent method could be made editorially by OWM.
4. The Task Group believes additional work is required to fully understand the application of e and d to dynamic monorail scales. The recommendations presented do not include dynamic monorail systems in the discussion of the auxiliary indicating device.

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

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

#### Comments in Favor:

##### Regulatory:

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

##### Industry:

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

##### Advisory:

- 

#### Comments Against:

##### Regulatory:

- 

##### Industry:

- 

##### Advisory:

-

**Neutral Comments:**

**Regulatory:**

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

**Industry:**

- 

**Advisory:**

- 

**Item Development:**

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

**Regional Associations' Comments:**

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

**Source:**

NCWM Cannabis Task Group

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

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

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

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

**Purpose:**

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

**Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

**UR.1.1. General.**

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

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

Table 7a. Typical Class or Type of Device for Weighing Applications	
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
<b>Notes:</b> 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>	

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

**UR.3.1.2. Required Minimum Loads for Cannabis products. - The recommended minimum loads specified in Table 8 shall be considered required minimum loads for scales used to weigh Cannabis and Cannabis-containing products.**

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

**(Added 20XX)**

**Previous Action:**

2022: Assigned to the Cannabis Task Group.

**Original Justification:**

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

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

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

The submitter requested that this item be a Developing Item.

#### **Comments in Favor:**

##### **Regulatory:**

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

##### **Industry:**

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

##### **Advisory:**

- 

#### **Comments Against:**

##### **Regulatory:**

- 

##### **Industry:**

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

##### **Advisory:**

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

#### **Neutral Comments:**

##### **Regulatory:**

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

##### **Industry:**

- 

##### **Advisory:**

1 •

## 2 **Item Development:**

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

7 Vince Wolpert  
8 NCWM Cannabis Task Group  
9 [vwolpert@azda.gov](mailto:vwolpert@azda.gov)

Charles Rutherford  
NCWM Cannabis Task Group  
[charlie@cprsquaredinc.com](mailto:charlie@cprsquaredinc.com)

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

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

## 16 **Regional Associations' Comments:**

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

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

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

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

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

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

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

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

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

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

**The recommended minimum loads specified in Table 8 shall be considered required minimum loads for scales used to weigh Cannabis and Cannabis-containing products.**

**[Non Retroactive as of January 1, 20XX]**

And

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

Table 7a. Typical Class or Type of Device for Weighing Applications	
Class	Weighing Application or Scale Type

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## WIM – WEIGH-IN-MOTION SYSTEMS – TENTATIVE CODE

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

#### Source:

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

#### Purpose:

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

#### Item under Consideration:

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

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

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

#### A. Application

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

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

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

#### S. Specifications

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

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

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

3           (a) 1, 2, or 5; or

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

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

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

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

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

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

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

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

14           (b) feet and inches; or

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

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

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

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

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

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

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

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

26           (d) The vehicle changes lanes within the sensor locations.

27    **S.1.7. Recorded Representations.**

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

33           (a) transaction identification number;

34           (b) station ID;



- ~~(b)~~(c) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in motion);
- ~~(e)~~(d) vehicle speed;
- ~~(d)~~(e) number of axles;
- ~~(e)~~(f) weight of each axle;
- (g) **weight of each axle group;**
- ~~(f)~~(h) identification and weight of axle groups;
- ~~(g)~~(i) axle spacing;
- ~~(h)~~(j) total vehicle weight;
- (k) **weight limits as specified in paragraph S.2.1;**
- ~~(l)~~ **total vehicle length;**
- ~~(i)~~(m) all fault conditions that occurred during the weighing of the vehicle;
- ~~(j)~~(n) violations, as identified in paragraph S.2.1. Violation Parameters, which occurred during the weighing of the vehicle; and
- ~~(k)~~(o) time and date.

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

## **S.2. System Design Requirements.**

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

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

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

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

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

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

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

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

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

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

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

## **N. Notes**

### **N.1. Test Procedures.**

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

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

- (a) The first test vehicle may be a two-axle, six-tire, single-unit truck; that is, a vehicle with two axles with the rear axle having dual wheels. The vehicle shall have a maximum gross vehicle weight of 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. Violation thresholds may be dependent on additional items, not specified in this code.

**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) an empty load condition for a minimum of 15 runs per test vehicle type, and**

**(b) a fully load condition (> 90% of the legal load limit for the roadway) for a minimum of 30 runs per test vehicle type**

**N.1.3. Reference Scale.** – Each reference vehicle shall be weighed statically on 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;

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

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

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

The scale shall be tested immediately prior to using it to establish reference test loads and in no case more than **2 weeks/24 hours** prior. To qualify for use as a suitable reference scale, it must meet NIST Handbook 44, Class III L maintenance tolerances.

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

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

**N.1.4.1. Test Speeds for Class A – Speed shall be at the posted speed limit.**

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

**(a) high speed – maximum posted speed limit.**

**(b) low speed – 10 mph.**

**(c) operation speed – average between N.1.4.2.(a) high speed and N.1.4.2.(b) low speed.**

**N.1.5. Test Procedures.**

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

At the conclusion of the dynamic test, there will be a minimum of 20 weight readings for each single axle, axle group, and gross vehicle weight of ~~the each~~ test vehicle. The tolerance for each weight reading shall be based on the percentage values specified in Table T.2.2-1 Tolerances for Accuracy Class A.

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

**N.1.5.3. Dynamic Load Test for Class E.** – **The dynamic test for Class E shall be conducted using the test vehicles defined in N.1.1.2, Selection of Test Vehicles for Class E. The test shall consist of a minimum of 45 runs for each test vehicle. A minimum of 15 runs at empty load condition and a minimum of 30 runs at fully load condition.**

**At the conclusion of the dynamic test, there will be a minimum of 45 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.2.2-2 Tolerances for Accuracy Class E.**

**N.1.5.4. Vehicle Position Test for Class E.** – **During the conduct of the dynamic testing for Class E, ensure the vehicle stays within the defined roadway along the width of the sensor. Only gross vehicle weight is used for this test and the tolerance for each weighment shall be based on the tolerance value specified in T.2.3. Tolerance Value for Vehicle Position Test.**

**(a) Empty load condition.** – **The test shall be conducted with 15 runs in total or 5 runs at each speed as stated in N.1.4.2, Test Speeds for Class E. The test shall be conducted with 9 runs with the vehicle centered along the width of the sensor (3 runs per speed); 3 runs with the vehicle on the right side along the width of the sensor (1 run per speed); and 1 run with the vehicle on the left side along the width of the sensor (1 run per speed).**

**(b) Fully load condition.** – **The test shall be conducted with 30 runs in total or 10 runs at each speed as stated in N.1.4.2, Test Speeds for Class E. The test shall be conducted with 18 runs with the vehicle centered along the width of the sensor (6 runs per speed); 6 runs with the**

vehicle on the right side along the width of the sensor (2 run per speed); and 6 runs with the vehicle on the left side along the width of the sensor (2 run per speed).

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

<b><u>Table N.1.5.</u></b> <b><u>Number of Test per Each Test Vehicle for Class E</u></b>		
<b><u>Load Condition</u></b>	<b><u>Speed</u></b>	<b><u>Vehicle Position</u></b>
<b><u>Fully Load</u></b> <b><u>(30 runs)</u></b>	<b><u>High Speed (10 runs)</u></b>	<b><u>Left (2 runs), Center (6 runs), Right (2 runs)</u></b>
	<b><u>Low Speed (10 runs)</u></b>	<b><u>Left (2 runs), Center (6 runs), Right (2 runs)</u></b>
	<b><u>Operation Speed (10 runs)</u></b>	<b><u>Left (2 runs), Center (6 runs), Right (2 runs)</u></b>
<b><u>Empty Load</u></b> <b><u>(15 runs)</u></b>	<b><u>High Speed (5 runs)</u></b>	<b><u>Left (1 run), Center (3 runs), Right (1 run)</u></b>
	<b><u>Low Speed (5 runs)</u></b>	<b><u>Left (1 run), Center (3 runs), Right (1 run)</u></b>
	<b><u>Operation Speed (5 runs)</u></b>	<b><u>Left (1 run), Center (3 runs), Right (1 run)</u></b>
<b><u>45 runs</u></b>	<b><u>15 runs x 3 speeds</u></b>	<b><u>9 runs (left) + 27 runs (center) + 9 runs (right)</u></b>

**N.1.5.3.5.** **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 and Class E.**

**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.2.2-1 **for screening as well as enforcement purposes.**

**T.2.2.1. Tolerance Value for Class A for Screening Purpose and Class E for Enforcement Purposes**

<b>Table T.2.2-1. Tolerances for Accuracy</b>	
<b>Load Description*, ^</b>	<b>Tolerance as a Percentage of Applied Test Load</b>
Axle Load	± 20 %
Axle Group Load <b>(including bridge formula)</b>	± 15 %
Gross Vehicle Weight	± 10 %
* <b>Class A for Screening Purposes:</b> No more than 5 % of the weighments in each of the load description subgroups shown in this table shall exceed the applicable tolerance.	
^ <b>Class E for Enforcement Purposes: All weighments shall be 100% compliance.</b>	

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

**T.2.4. Tolerance Value for Axle Spacing.** – The tolerance value applied to each axle spacing measurement shall be ± 0.15 m (0.5 ft).

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

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

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

**UR. User Requirements**

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

**UR.1.1. General.** – The typical class or type of device for particular weighing applications is shown in 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>
<b>Note:</b> A WIM system with a higher accuracy class than that specified as “typical” may be used.	

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

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

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

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

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

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

## Appendix D. Definitions

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

### A

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

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

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

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

S

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

T

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

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

W

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

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

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

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

**Previous Action:**

2023: New Item

**Original Justification:**

**1. INTRODUCTION**

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

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



infrastructure is an issue of national concern.

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

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

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

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

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

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

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

The New York City Mayoral Executive Order 51, executed in January 2020, mandated the formation of the New York City Police Department (NYPD) BQE Truck Enforcement Task Force, whose purpose is to ensure that all existing weight restrictions on the BQE are strictly enforced. However, the lack of roadway shoulders on this stretch of the BQE means that there is insufficient space for the New York City Department of

Transportation (NYCDOT) to introduce stationary weighing stations, or for NYPD enforcement officers to pull over overweight vehicles and use portable scales to screen and enforce legal weight limits.

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

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

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

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

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

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

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

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<sup>1</sup> 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

<sup>2</sup> 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

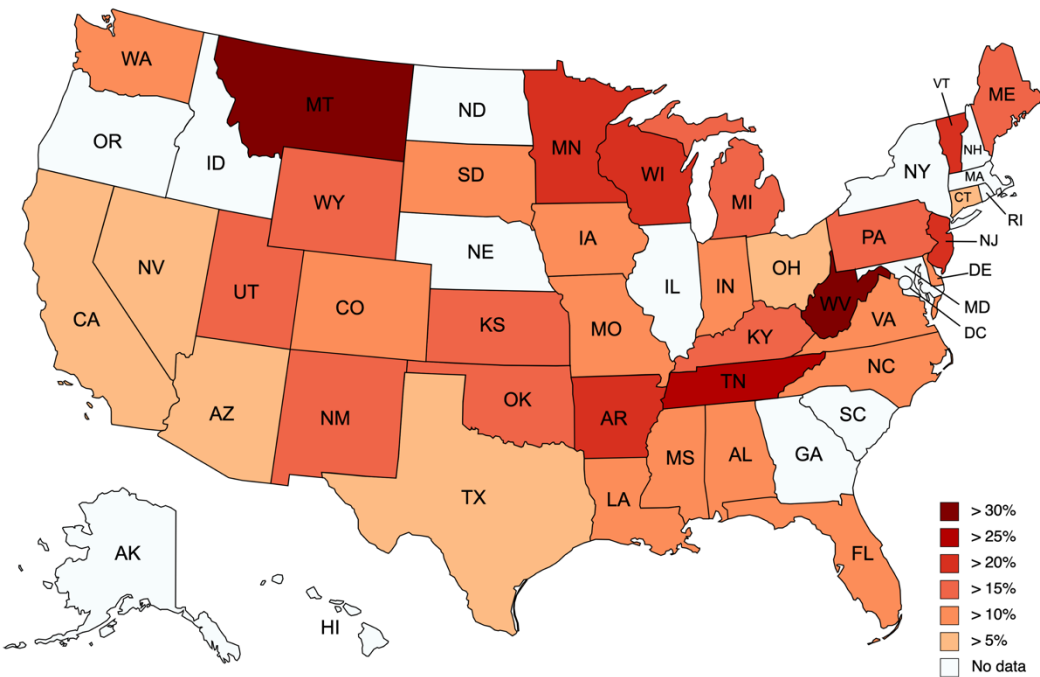


Figure 1. Overweight percentage per State

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.

## 5. CONCLUSIONS

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

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

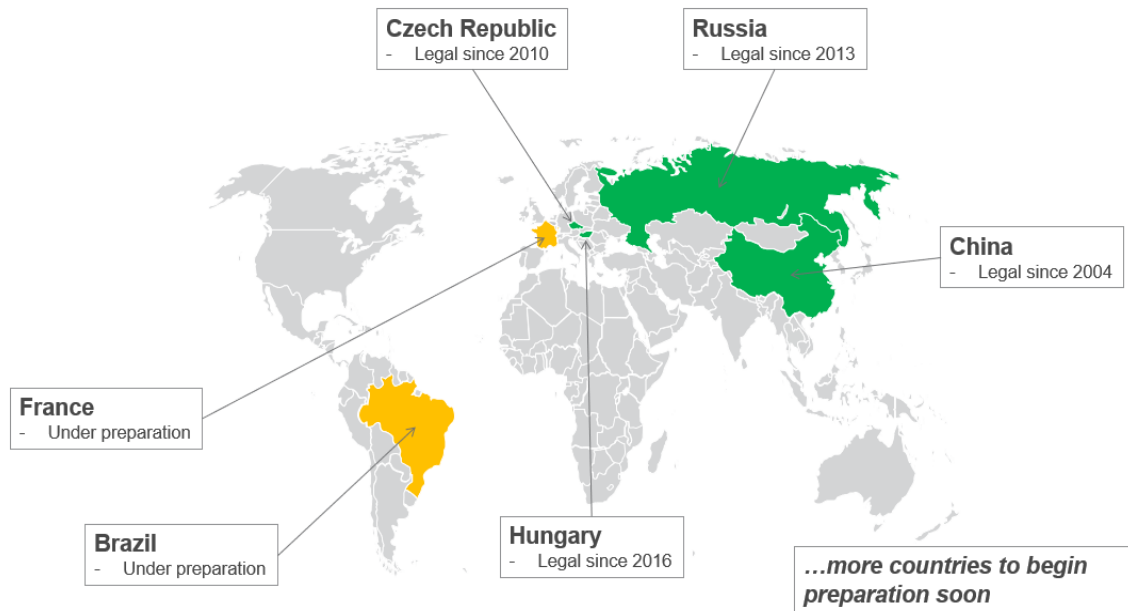


Figure 2. Automated enforcement around the world

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

### Comments in Favor:

#### Regulatory:

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

- Interim 2023: Tim Chesser (State of Arkansas) commented that he supports removing the tentative status for screening and that a set procedure for testing is missing from the proposal. This cannot be guesswork. Recommended Developmental status.

**Industry:**

- Interim 2023: Tanvi Pandya (NYC DOT- Submitter) gave a brief overview of the deteriorating infrastructure issue on the Bronx Queens Expressway in NYC and this proposal seeks to remove the tentative status of the WIM proposal and establish testing standards for the automated enforcement of weight infractions.
- Interim 2023: Jess Helmlinger from Kistler gave a brief presentation. Commented also that this application is to increase efficiency vs accuracy and the tolerances proposed allow for the tolerance to be taken into account.
- Interim 2023: Russ Vires (SMA) recommended to remove the tentative status and use this code as originally intended for screening.

**Advisory:**

- Interim 2023: Jan Konijnenburg (NIST OWM) supports this item, but item is not ready for a vote yet. This application is for situations that do not allow for static scales.

**Comments Against:**

**Regulatory:**

- Interim 2023: Vince (State of Arizona) commented that the notes are confusing and needs work.

**Industry:**

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**Advisory:**

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**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

-

**Item Development:**

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

**Regional Associations' Comments:**

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

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

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

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

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

Mr. Jan Konijnenburg (NIST Associate) – Mr. Konijnenburg confirmed NIST has been involved with this item but has not reviewed the proposal in detail to come to a conclusion. Mr. Konijnenburg made reference the WIM code that currently exists is idle and obsolete. Mr. Konijnenburg acknowledged this is a method of a WIM system enforcement. Mr. Konijnenburg stated he is looking forward to how this will develop. Mr. Konijnenburg made no recommendation at this time for the status of this item.

Mr. Raymond Johnson (Fairbanks Scales, Inc., representing the Scale Manufacturers Association) – Mr. Johnson commented the SMA has not met and has not formulated a position on this item. Mr. Johnson commented the SMA is scheduled to meet in November 2022.

Mr. Matt Douglas (State of California, Division of Measurement Standards) – Mr. Douglas commented he believes that there is some merit to some of the item. Mr. Douglas recommended keeping the accuracy class "A" and add accuracy class "E".

Mr. Kenn Burt (San Luis Obispo County, California on behalf of S&T Committee) – Mr. Burt sought clarification if industry has seen this proposal and understand what they might be dealing with regard to how the WIM system will be used and applied for enforcement?

Ms. Tanvi Pandya (New York City DOT) – Ms. Pandya addressed Mr. Burt’s question regarding industry reviewing this item. Ms. Pandya commented the submitters have met regularly and developed a task force. Ms. Pandya commented the task force has discussed this for the past several months. Ms. Pandya commented they have not directly engaged with the trucking industry but have spoken with some freight industry in general.

Mr. Jess Helmlinger (Kistler Group) – Mr. Helmlinger commented the Commercial Vehicle Safety Alliance (CVSA) has been made aware of this item.

During open hearings there was testimony that neither the SMA nor NIST has evaluated this proposal. The committee looks forward to the analysis of this item by NIST and SMA. The committee asked the submitters questions about the tolerance table “T.2.2. Tolerances for Accuracy Class E”, specifically the last line in the table. The submitter clarified their statement made during open hearings in the committee work session. The committee recommended that the submitter consult the Scales Code for similar applications to expressing tolerances.

The WWMA S&T Committee recommends that this item be assigned a developing status.

SWMA 2022 Annual Meeting: Dr. Hanni Nasif of Rutgers University, the submitter of this item, presented. During the presentation he stated that the device currently operates within 6% of the Type III ASTM Standard. The submitter stated that their intentions is for direct enforcement fines to not apply within 10 % of weight limit based on local enforcement procedures.

Mr. Peter Fedechko, International Road Dynamics, stated that he supports this item.

Mr. Chesser, State of Arkansas, stated that he liked the language on page 167 lines 25-28. He asked why strike paragraph B. He also cited some errors on page 170.

Mr. Paul Floyd, State of Louisiana, stated that he has concerns about the accuracy of this system. He stated that he would support this item for screening purposes and recommends it moving forward as developing.

The SWMA S&T Committee asked about the speed and weight requirements used for testing in the proposal not matching with what the devices will be used to regulate. The committee also questioned whether these devices would receive a type evaluation from NTEP if specifications were added to the handbook. Additionally, the committee questioned whether a direct enforcement procedure should be separated from the tentative screening code.

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

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

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

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

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

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

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

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

24 After hearing comments from the floor, the Committee agrees that the item has merit. Considering the underlying  
25 questions about tolerances and test procedures, the Committee is recommending 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](http://www.ncwm.com/publication-15) to review these documents.

## 28 **LMD – LIQUID MEASURING DEVICES**

### 29 **LMD-23.4 V N.3.5. Wholesale Devices.**

#### 30 **Source:**

31 American Petroleum Institute

#### 32 **Purpose:**

33 Clarification that Small Volume Provers are included in N.3.5. Wholesale devices.



**Item under Consideration:**

Amend Handbook 44 Liquid Measuring Devices Code as follows:

**N.3.5 Wholesale Devices**

**N.3.5.1. Test Drafts** – The delivered quantity ~~should~~ **shall** be equal to at least the amount delivered by the device in one minute at its maximum discharge rate ~~and shall in no case be less than 200 L (50 gal).~~

(Amended 1987, ~~and~~ 1996, **and 20XX**)

**N.3.5.X. Small Volume Prover Test.** – **The total delivered quantity for any required accuracy test shall be representative of at least the amount delivered by the device in one minute of continuous flow at its maximum discharge rate.**

**(Added 20XX)**

**Previous Action:**

2023: New Item

**Original Justification:**

The 1996 NCWM agreed that small volume provers (SVP) are suitable as a test standard. The 1996 changes included modifications to paragraph N.3.5. to remove barriers for technology that could achieve the maximum flow rate of the product flowing through the meter.

That said, portions of the text in paragraph N.3.5. have been interpreted to prohibit the use of an SVP because the paragraph states, that the delivered quantity for the meter test (1) “should be equal to at least the amount delivered by the device in one minute at its maximum discharge rate” and (2) “shall in no case be less than 200 L (50 gal).” Given these criteria, an SVP could meet the first requirement, and may not meet the second requirement unless the base prover volume was at least 200 L (50 gal). Research indicates that a reference to a 50-gallon minimum draft has been in the Handbook since 1937. The size of wholesale meter deliveries when the 50 gal minimum was established in paragraph N.3.5. is not reflective of the discharge rates of meters used today in commerce.

Therefore, modifications are warranted to paragraph N.3.5. to clarify that SVP’s that are properly sized for the test, which can include having a base prover volume of less than 50 gallons, achieve the accuracy required to meet the original design of N.3.5. The proposed additions clarify that the test device – whether SVP, neck-type prover, or another type of test standard – must be capable of testing the maximum flowrate through the meter being tested. The phrase “and shall in no case be less than 50 gal,” is deleted as SVPs with smaller volumes (e.g., 20-gallon base prover volume) are capable of testing wholesale devices at flowrates exceeding 600 gallons per minute.

In 1996, the weights and measures community gathered data and published a report that recognized the suitability of the SVP as a test standard for liquid measuring devices. Additionally, a 105 series (*Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures*) standard exists for Dynamic SVPs.

Over the last 25 years, SVP technology has improved significantly and API Manual of Petroleum Measurement Standards (MPMS) Chapter 4.6, *Pulse Interpolation*, provides the appropriate standards that ensure the SVP achieves the necessary measurement tolerances. API standards MPMS has 23 chapters with Chapter 4.2, Displacement Provers covering SVPs. The 3<sup>rd</sup> Edition of the standard was published in 2003, and an Addendum was issued in 2015. The committee responsible for Chapter 4.2 includes over subject matter experts that assess the data and consider updates and revisions to the standard. The accepted technology of the SVP’s achieves an accuracy, at a 95 percent confidence level, that the calculated based prover volume is within plus or minus 0.029% when three consecutive runs agree within 0.02% of one another. In other words, there is only a 5% probability that the true prover base volume lies outside the range of plus or minus 0.029% of the calculated base volume.

The goals for the proposed modification to paragraph N.3.5 are to:

- Reinforce the 1996 goal to remove any test conditions that would prohibit or restrict the use of an SVP or other methodologies
- Establish fair test conditions within the OEM's intended range of the meter's operating conditions
- Specify the minimum test conditions based on the meter's ratings and the key characteristics for the proving device to conduct a test that demonstrates the meter's performance in a commercial application
- Encompass the concept of both the volumetric neck-type prover and small-volume prover (SVP) test or any other methodologies that may be developed in the future
- Eliminate any language that would circumvent or alter the proper use of testing devices or their results
- Provide guidance on test parameters which meet the Fundamental Considerations without the need for a laundry list of possible test methodologies and equipment. The decision of whether or not to accept a given type of test standard still rests with the Director as outlined in the Fundamental Considerations.

In addition to the action taken on the proposed revision to N.3.5., NIST has suggested it may be helpful to review and provide updates or supplements to the NIST Examination Procedure Outline 25 for Loading Rack Meters and possibly suggest modifications to NIST 105-7, "*Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures: Specifications and Tolerances for Dynamic Small Volume Provers*," 1997, to provide additional guidance on properly sizing and selecting a suitable size small volume prover for a given metering system. Such guidance would require input from SVP manufacturers as well as regulators.

Some may oppose the removal of the 50-gallon test draft. However, research indicates that a reference to a 50 gallon minimum draft has been in the Handbook since 1937. The size of wholesale meter deliveries when the 50 gal minimum was established in paragraph N.3.5. is not reflective of the discharge rates of meters used today in commerce.

**Links to NIST OWM** newsletter articles written by Diane Lee on SVPs used in testing commercial measuring systems: [Weights and Measures Newsletter Archives - Field Standards | NIST](#)

- H-003 Part 1 (2005)
- H-004 Part 2
- H-007 Part 3
- H-010 Part 4
- H-012 Part 5

Background Q&A:

1. Can you explain how uncertainty calculations differ between SVP vs can provers?
  - Tank provers provide a cubic inch uncertainty per 1,000 gallon prover by comparing the volume in the tank vs the volume of the computer.
  - SVPs provide a meter factor that is a ratio of the prover vs the meter for a period between detector switches. In addition, calibrations are performed multiple times and a statistical uncertainty of ~0.027% between calibrations is required.
2. What are the pros of SVPs vs cans?

<b>Small Volume Prover</b>	<b>Volumetric (Can) Prover</b>
Prove in actual operating load conditions (flow, pressure, and temperature) by proving into customer loads	Lower cost to operate
Prove at multiple flow rates	Can visually see the quantity by viewing the neck
Establish multiple factors that can be applied	No moving part
Faster proving runs	
No need to pump back	
Gravimetric water draw more repeatable	
Lower prove uncertainty	
Higher turn down ratio	
Health Safety Security and Environment (HSSE) - reduced risk / impact to environment	
Digital history of meter performance at all flow rates with Meter Factor Control Chart (MFCC) to evaluate the health of each meter	
Help identify rack issues such as control valve issues as well as identify hydraulic issues that have a direct effect on measurements.	
Repeatability issues are easier to identify	
Repeatability is verified by making the comparison over 5 runs	Tank Provers repeatability is verified by one run after the initial meter factor change

3. How are SVPs certified?

- NIST Traceable cans in a water draw lab, or NIST Traceable weights in a gravimetric lab.

4. How do the computers calculate the final calibration result?

- Comparing gross standard volume (GSV) of the meter vs the GSV of the prover

5. How are peripheral equipment used in meter proving calibrated /verified (portable electronic thermometer (PET), Pressure Gauge, Transmitters)

- PET calibrated via NIST certified
- Pressure gauges NIST certified
- PET and gauges used to determine if transmitters are in tolerance

The submitter requested that this amendment be retroactive and that the item be a Voting item in 2023.

**Comments in Favor:**

**Regulatory:**

- 2023 Interim: Doug Musick (State of Kansas) commented that the language in the proposal is not an issue however he questioned the suitability.
- 2023 Interim: Craig VanBuren (State of Michigan) commented that testing performed in Michigan was done at different rates and results were favorable. He supports this change.
- 2023 Interim: Mahesh Albuquerque (State of Colorado) commented that these have been in use and the 50-gallon reference may need to be deleted from N.3.5.1.

**Industry:**

- 2023 Interim: Prentiss Searles (API - Submitter) gave a presentation about small volume provers and the proposal to remove the 50-gallon minimum volume in LMD code.
- 2023 Interim: John Hathaway (Murry Systems) commented that he supports this proposal and recommends voting status.

- 2023 Interim: Letitia Arriaga (Marathon Petroleum) – Both low and high flow rates are entered into the computer and calibrated. Labs use NIST SOP 26 for calibration of the provers. Likes the updated language and supports as Voting.
- 2023 Interim: Michael Keilty (Endress + Hauser) Recommends voting status.
- 2023 Interim: Dimitri Karimov (Liquid Controls) supports the use of small volume provers.
- 2023 Interim: Jim Pettinato (TechnipFMC) supported the grammar changes to eliminate “equal to”.

**Advisory:**

- 2023 Interim: Tina Butcher (NIST OWM) commented to clarify HB44 deals with commercial meters and 105 series is for test standards. She spoke of support for the clarity offered with this proposal and also pointed out that the jurisdiction determines the suitability of the device. Supports voting status.

**Comments Against:**

**Regulatory:**

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**Industry:**

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**Advisory:**

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**Neutral Comments:**

**Regulatory:**

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**Industry:**

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**Advisory:**

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**Item Development:**

NCWM 2023 Interim Meeting: The submitter agreed to change paragraph N.3.5.1. and add N.3.5.X. per discussions with submitters of related items. With the modifications, the committee believes this item is fully developed and has assigned it a voting status.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Prentiss Searles (API) - Wanted to re-enforce the 1996 goal to remove test conditions that restrict the use of small volume provers. He stated that the director has the authority to use or not use the device. He spoke about what a captive displacer is. Claimed to have worked with NIST on this. There was a concern at the Annual conference that someone could take a 100-gallon prover and use multiple drafts to test a meter with a 500 gallon per minute flow rate, so they added language to address that. They are ANSI accredited. 95% confidence level that you will be within .029%.

Ms. Letitia Arriaga (Marathon Petroleum Company) – Supported the item which acknowledges the change from 1996 and removes the restriction that prohibits it.

- 1 Mr. Brent Price (Gilbarco, Inc.) - Supported the item. Expressed concerns that 50 gallons is a lot for a proving size.  
2 Liked the wording as is with 1-minute maximum flow rate. Agreed with the Central Region's edits.
- 3 Mr. Prentiss Searles (API) – He believed the proposed language from the presentation was ready for a vote.
- 4 Mr. Michael Keilty (Endress + Hauser Flow USA, Inc.) - Would not disagree with the use of small volume provers.  
5 Works on these standards all of the time. As it pertains here in changes to HB 44, he couldn't support this revision or  
6 support this moving forward as a voting item. Claimed that it doesn't address the issue at hand, which is the small  
7 sample size, and that this item only massages the language. He recommended that this item should be a sub-paragraph,  
8 as in Block 1. Also recommended that this item remain developing.
- 9 Mr. Prentiss Searles (API) - Explained that it is not capturing the entire amount that is being delivered, it's 20 gallons,  
10 a representative sample. The captive displacer can test holding 20 gallons with a resolution of 4 digits from the  
11 decimal. It is capable of hitting the accuracy that is required. Believed that it was ready for a vote.
- 12 Mr. Michael Keilty (Endress + Hauser Flow USA, Inc.) - Because of the math that Prentiss described, if it is a 20-  
13 gallon captive displacement prover the flow computer math says that it's 40 gallons. It's double and that's what the  
14 volume is.
- 15 During open hearings, the submitter provided a presentation (to be submitted to the NCWM) which contained updated  
16 language to the proposal. The WWMA S&T Committee recommends that this item be assigned a developing status  
17 with the further recommendation that the submitter of this item and Block 5 item LMD-23.2 work  
18 together to develop language that will support both of their purposes; including taking into consideration the testimony  
19 heard during open hearings.
- 20 SWMA 2022 Annual Meeting: Mr. Prentiss Searles, American Petroleum Institute, gave a presentation on this item.  
21 He stated that the 50 gallon minimum draft size is not relevant to adequate testing and should be removed.
- 22 Mr. Chesser, State of Arkansas, stated that SVP tolerances are much tighter than traditional methods.
- 23 Mr. Keilty, Endress+Hauser, stated that he agrees with Mr. Searles and supports this item. He also stated that he  
24 believed this item could describe SVPs separately from fixed neck Provers. He recommends this move forward as a  
25 developing item.
- 26 Mr. Nicholas Suemnick, Marathon Petroleum, supports this item.
- 27 Mr. Brent Price, Gilbarco, stated that he supports this item with Mr. Searles changes.
- 28 The SWMA S&T Committee recommends this item move forward as a Voting Item.
- 29 CWMA 2022 Interim Meeting: Prentiss Searles – API, Goal is to reinforce that SVPs are allowed, approved, and are  
30 recognized. Wants fair test conditions. This change is only an additional allowance, not a requirement. Feels this is  
31 developed and ready for voting. The approach when using a SVP is to start with a primed line, no air is present. After  
32 that, it is accurate at both the ramp up and ramp down portion of the meter operation.
- 33 Doug Musick – Kansas, Interpretation of maximum discharge rate can change from state to state. Is it the marked rate  
34 or the rate of the installation? It needs to be clarified.
- 35 Dmitri Karimov – Liquid Controls, Support. “the meter’s” is confusing. Should stay at “its”. Also, add the word  
36 “continuous” may help. As written, it could imply that tests can be performed by starting and stopping.

Henry Oppermann - WM Consulting (in absentia), Mr. Oppermann submitted comments in writing regarding concerns and opposition.

Matthew Jambor – Marathon, SVPs are being used in their terminals. They directly communicate with internal software and limits data entry errors associated with using open neck provers. Bias can be present in any system, not specific to SVPs (response to HO letter). Side by side testing has been performed in AL and MN with traditional provers and SVPs and they netted the same results.

Michael Keilty – Endress+Hauser, These are used extensively and are of very high precision. Standards and requirements from API are stricter than Handbook 44. Nomenclature LMD-23.2 is also assigned to a separate item in Block 5.

Doug Musick – Kansas, Lots of types and names for this kind of equipment. In a lab setting they could be very accurate and repeatable. In the field, there is a difference. Some do not meet the 1/3 requirement from HB44 Fundamental Considerations. These provers don't capture the error from meter ramp up and ramp down. Ramp up and ramp down are where the errors are, not in the middle of a full flow, which is what the SVPs are testing.

Craig VanBuren – Michigan, Their office compared a SVP to a 1000 gal prover in 2005. No longer has the data.

The Committee requests that these items be renumbered. The CWMA S&T Committee believes this item is fully developed and recommend voting status with the following changes:

**N.3.5. Wholesale Devices.** – The **total** delivered quantity **for any required accuracy test** should be equal to, **or is recognized as being representative of, a volume equivalent to** at least the amount delivered by the device in one minute **of continuous flow** at **its the meter's** maximum discharge rate **and shall in no case be less than 200 L (50 gal).**

(Amended 1987, ~~and~~ 1996, **and 2023**)

NEWMA 2022 Interim Meeting: Mr. Prentiss Searles (API) gave a presentation on this item. Mr. Searles indicated that there has been a language change to the proposed item after hearing comments from CWMA. Mr. John Hathaway (Total Control Systems/Murray Equip) inquired about the use of “should” in the language instead of “shall” or “must”. Mr. Michael Keilty (Endress Hauser) commented that he does not challenge the validity of SVPs, but suggested to the submitter that the language is confusing and brought up volume equivalence. Mr. Keilty suggested that this item should be a line item, separate from wholesale, and should be explained explicitly. Mr. Keilty pointed out that there are three different proposals on this subject and recommends developing status. Ms. Tisha Arriaga (Marathon Petroleum) commented that she supports the item as voting. Ms. Arriaga feels that the change that occurred in the handbook in 1996 has accepted this test measure. Ms. Diane Lee (NIST-OWM) appreciated the presentation and stated that NIST has been working with API. Ms. Lee noted that the requirements for provers in the handbook were created in 1937 and this technology did not exist. Mr. Walt Remert (PA) commended the outstanding work done by the group and supports the item as developing. Mr. Jim Willis (NY) indicated that this item is going the right direction with addressing to advances in technology and recommended a developing status.

After hearing comments from the floor, the Committee agrees that this item has merit. The Committee agrees with the commenters and believes that this item should have a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## VTM – VEHICLE TANK METERS

### VTM-18.1 V S.3.1 Diversion of Measured Liquid and S.3.1.1. Means for Clearing the Discharge Hose and UR.2.6. Clearing the Discharge on a multiple-product, single discharge hose.

*NOTE: At the 2020 Interim Meeting the Committee agreed to combine both VTM-18.1 and VTM-20.1. Both items are now one item under VTM-18.1*

#### Source:

New York and NIST OWM (Carryover from 2018, VTM 1-B) and Murray Equipment, Inc., Total Control Systems

#### Purpose:

Provide specifications and user requirements for manifold flush systems on a multiple-product, single-discharge hose. Recognize that there is a balance between a mechanism that provides an important safety benefit but also, if used incorrectly, facilitates fraud. Ensure that VTM owners understand their responsibilities when installing such a system and ensure uniformity in enforcement throughout the country and clarify the paragraph to protect vehicle motor fuel quality, retain safe operating procedures when handling vehicle motor fuels, and to prevent fraud during delivery of vehicle motor fuels from vehicle tank meters.

#### Item Under Consideration:

Amend Handbook 44, Vehicle-Tank Meters Code as follows:

**S.3.1. Diversion of Measured Liquid.** – No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or the discharge line thereof. However, two or more delivery outlets may be installed if means are provided to ensure that:

- (a) liquid can flow from only one such outlet at one time; and
- (b) the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated.

This paragraph does not apply to the following:

- (1) Equipment used exclusively for fueling aircraft.
- (2) Multiple-product, single-discharge hose metering systems that are equipped with systems designed to flush the discharge hose, provided the flushing system complies with the provisions of paragraph S.3.1.1. Means for Clearing the Discharge Hose, **Multiple-Product, Single-Discharge Hose Metering Systems.**

(Amended 2018 **and 20XX**)

**S.3.1.1. Means for Clearing the Discharge Hose, Multiple-Product, Single-Discharge Hose Metering Systems.** - **Multiple-product, single-discharge hose** Metering systems may be equipped with systems specifically designed to facilitate clearing of the discharge hose prior to delivery to avoid product contamination. In such systems, a valve to temporarily divert product from the measuring chamber of the meter to a storage tank, shall be installed only if all the following are met:

- (a) the discharge hose remains of the wet-hose type;
- (b) the valve and associated piping are approved by the weights and measures authority having jurisdiction over the device prior to commercial use;

- (c) the valve is permanently marked with its purpose (e.g. flush valve);
- (d) the valve is installed in a conspicuous manner and as far from the hose reel as practical;
- (e) the system clearly and automatically indicates the direction of product flow during operation of the flush system; and
- (f) clear means, such as an indicator light or audible alarm, is used to identify when the valve is in use on both quantity indications and any associated recorded representations (e.g., using such terms as “flushing mode” or “not for commercial use”);  
[nonretroactive as of January 1, 2024.]
- (g) effective, automatic means shall be provided to prevent passage of liquid through any such flush system during normal operation of the measuring system; and  
[nonretroactive as of January 1, 2024.]
- (h) no hoses or piping are connected to the inlet when it is not in use.

(Added 2018) (Amended 20XX)

#### UR.2.6. Clearing the Discharge Hose.

**UR.2.6.1. Clearing the Discharge Hose, General.** – A manifold flush or similar system designed to accommodate the flushing of product on single-hose, multiple-product systems is not to be used during a commercial transaction. The following restrictions apply:

- a) The inlet valves for the system are not to be connected to any hose or piping (dust covers are permitted) when not in use.
- b) When the flushing system is in operation, the discharge hose is only to be connected to the port for the product type being flushed from the discharge line.
- c) Following the flushing process, indications and recording elements must be reset to zero prior to beginning a commercial delivery.

(Added 20XX)

**UR.2.6.2. Minimizing Cross Contamination.** – When dissimilar products are dispensed through a single meter, the user shall take steps to ensure the system is properly flushed to minimize the potential for cross contamination of product in receiving tanks on subsequent deliveries. Dispensing products having radically different characteristics (e.g., gasoline and diesel fuel) through a single meter delivery system is not recommended.

(Added 20XX)

**UR.2.6.3. Records.** Whenever, prior to delivery, a different product is pumped through the discharge hose to avoid contamination, a record including the date, time, original product, new product, and gallons pumped shall be maintained. These records shall be kept for a period of 12 months and available for inspection by the weights and measures authority.

(Added 2018)

#### Background/Discussion:

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



1 Mr. Jim Willis  
 2 New York Department of Agriculture and Markets  
 3 518-485-8377, [james.willis@agriculture.ny.gov](mailto:james.willis@agriculture.ny.gov)

4 This item was one of two separate parts of VTM-1 (previously VTM-1A and VTM-1B) considered by the Committee  
 5 at the 2018 NCWM Annual Meeting. The item voted on at the 2018 Annual Meeting, VTM-1A was adopted and  
 6 VTM-1B was assigned an Informational status and carried-over to the next cycle.

7 Manifold flush systems are typically used on VTM's with multiple compartments, delivering multiple products  
 8 through a single hose. The purpose of the system is to allow the driver a means of clearing the hose of product prior  
 9 to delivery (e.g., clearing the hose of diesel fuel before delivering clear kerosene). These types of systems are often  
 10 marketed as a safety feature in that it eliminates the need for the driver to climb on top of the truck to clear the hose.  
 11 Such systems are also useful in helping avoid cross-contamination. Typically, the driver attaches the nozzle to the  
 12 manifold and pumps product back into the supply tank via the manifold until the previous product is flushed from the  
 13 hose. There is often a sight gauge which allows the driver to tell when the product is flushed.

14 The obvious concern is that this makes it very easy for the driver to circulate product through the meter prior to  
 15 delivery, which goes against S.3.1. It should be noted that it also goes against S.3.1. when the driver climbs on top of  
 16 the tanker and clears the hose. The submitter has voiced concerns involving the safety of this practice noting that the  
 17 operator could be subject to falls from the tanker. The distance between the flush system and the hose reel is also a  
 18 factor in how easy it is for the driver to facilitate fraud.

19 Manifold flush systems are available from OEMs and can be found in various catalogs. Looking on multiple websites,  
 20 these systems are being installed across the country and for some manufacturers seem to be standard equipment for  
 21 new trucks. The submitter of VTM-1 has also seen these systems installed on trucks that are for sale where the seller  
 22 notes the system as a selling point. He can foresee these systems being mandated in the future as a safety requirement  
 23 and would like W&Ms to have a clear policy before that happens.

24 Another concern is with systems fabricated onsite. These systems are often difficult to distinguish and installed in an  
 25 inconspicuous manner. While the submitter of VTM-1 has ordered many of these systems out-of-service until  
 26 repaired, it can be frustrating for the owner because the truck was used in another state for years and approved by  
 27 weights and measures jurisdiction in the other state. This lack of uniformity is problematic for both officials and  
 28 private industry.

29 NCWM 2018 Annual Meeting: The Committee heard comments from OWM that this item needed additional work  
 30 to address concerns that had been identified in OWM's 2018 Interim Meeting (and earlier) analyses. While there are  
 31 clear benefits to improving safety when flushing hoses, OWM and others have noted these systems can facilitate fraud  
 32 without appropriate safeguards in place. OWM noted the language in the Item Under Consideration in the  
 33 Committee's 2018 Interim Report would:

- 34 1. provide an (unintentional) exemption to the provisions for "diversion of product" for *all* single meter,  
 35 multiple product, multiple compartment systems;
- 36 2. would (unintentionally) require all such systems to be equipped with a manifold flush system;
- 37 3. fail to include requirements for the system to clearly indicate (on both display and recorded representations)  
 38 when the flush system is in operation; and
- 39 4. fail to include limitations on how the user is permitted to appropriately use these systems.

40 In discussing the changes OWM felt were needed prior to the Annual Meeting, the submitter and OWM agreed that  
 41 some of OWM's proposed changes would be considered editorial and others technical in nature. Since other than  
 42 editorial changes could affect the Voting status of the item, OWM offered the following two courses of action for the  
 43 Committee to consider:

1. Downgrade the item to Informational to allow time to address all the changes that are needed; or
2. Split the item into two parts to allow the portion of the item needing only editorial changes to move forward for vote; and carryover the remaining portion to allow time for it to be further developed and considered during the next NCWM cycle.

Rather than hold up the entire item to be considered in the next Conference cycle, the submitter requested the item be split into two parts to allow the completed portion, including the editorial changes, to move forward for vote.

NCWM 2019 Interim Meeting: The Committee heard comments to Agenda Item VTM-1 as well as position statements from MMA that they objected to manifold flush systems. NIST OWM provided an analysis to the Committee prior to the Interim Meeting. The comments heard during the open hearing and/or received prior to the Interim meeting are summarized below:

Mr. Hal Prince (FL) stated that it was missing any inclusion for limitation of use, such as when delivering multiple products. Mr. Prince suggested that the Committee consider language forwarded by the SWMA in its 2018 Annual Report. Mr. Prince also suggested that the item be kept developmental. Mr. Dan Murray (Murray Equipment, Total Controls System) stated that Manifold Flush Systems were a big problem in Europe where they are permitted. Mr. Murray suggested these systems could facilitate fraud and NTEP should carefully consider this before granting approval. These systems should also be sealed. Mr. Murray's opinion was that the item should be withdrawn. Mr. Dmitri Karimov speaking on behalf of Meter Manufacturers Association, stated that MMA objected to manifold flush systems.

NIST OWM agreed with the WWMA and the CWMA that this item is fully developed and agreed with assigning it a voting status. OWM provided the following review of the operation of the equipment, proposed changes, and additional points to consider:

- At the 2018 NCWM Annual Meeting the Conference voted to allow an exemption to S.3.1. for Manifold Flush Systems, which is currently in the 2019 HB 44 VTM code.
- S.3.1. states "no means" shall be provided to divert liquid from the measuring chamber of the meter or the discharge line.
- A manifold flush system allows liquid to be diverted from the discharge line on single hose multi-compartment VTMs so that liquid of one product is not mixed with liquid of another in the discharge line.
- Without a manifold flush system, the operator must manually return the product to the correct compartment to clear the discharge line before using another product.
- There are safety hazards with manually returning the product to storage (operator climbing on top of tank and lifting hose to return the product. There are also safety concerns when not properly clearing the discharge lines prior to delivering a different product and because of these safety concerns it was reported that more of these systems will likely be installed on single hose multicompartment trucks.
- Although safety is a high priority, the "means" used to return product back to storage is not as visible and makes facilitation of fraud a high possibility.
- The additional changes proposed are intended to ensure such systems are designed such that they do not facilitate fraud; help ensure owners understand their responsibilities when installing such a system; and ensure uniformity in enforcement though out the country.
- The changes reflect the suggested language from OWM's previous analysis and incorporate comments received from the MMA and others during the 2018 Annual meeting.

Non-retroactive dates may need to be added to allow time for manufacturers of flush systems to incorporate the safeguards into their systems. During the committee's work session, the Committee considered the comments received during the Interim Meeting open hearings and recommended a voting status for this item.

NCWM 2019 Annual Meeting: The Committee supported amendments proposed to subparts (f) and (g) based upon statements from the submitter (NY) indicating that manufacturers of manifold flush systems will need additional time to incorporate the safeguards into their systems. The Committee also agreed to place the item on the voting consent calendar as amended, and as shown in the Item Under Consideration.

During the open hearing sessions, the Committee heard comments from NIST OWM's Mrs. Tina Butcher offering a revision of S.3.1.1.(f). suggesting this portion be split into separate bullet points. Also heard were comments from Mr. Jim Willis (NY) in support of NIST OWM's suggestion and his recommendation for making this a nonretroactive requirement to allow manufacturers time to accommodate the necessary changes.

During the voting session, it was requested this item be removed from the voting consent calendar and voted on separately. The item failed to receive enough votes for adoption and was therefore returned to the Committee.

NCWM 2020 Interim Meeting: The Committee heard from Ms. Butcher (NIST OWM) who recommended that VTM-18.1 and VTM-20.1 be combined because both items address manifold flush systems, but VTM 18-1 does not restrict the use of the system to certain products and VTM 20-1 restricts the use of the system to home heating fuel. Mrs. Butcher recommended that the combined item be given a developing status to address the design and use of these systems adequately. Mrs. Butcher also recommended improvements to VTM 18-1 and VTM 20-1.

Mr. Dmitri Karimov (MMA) agreed with the language proposed in VTM 18-1 and acknowledged that there is value in the alternative proposal VTM-20.1 and supports combining both proposals into one. Mr. Hal Prince (FL) also agreed that Item VTM-18.1 and VTM-20.1 be combined and given a developing status. Mr. Prince expressed a willingness to work with submitters to further develop the items and noted that he has concerns with cross-contamination caused by these systems. Mr. Jim Willis agreed with Mrs. Butcher's statements. Mr. Karimov recommended including more categories for types of fuels in the proposal is important such as flammable, explosive, etc. Mr. John Hathaway (Murray Equipment) submitter of VTM-20.1 expressed interest in working together with the submitters of VTM-18.1.

During the Committee's work session, the committee agreed that this item, VTM-18.1 should be combined with VTM-20.1 and be given a developing status to allow the submitters of both items to work together towards resolving the conflicts in these two items.

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

NCWM 2021 Interim Meeting: The Committee heard from Mr. Mike Smith (NY) who supports VTM 18.1 as a Developing item and he agreed to work with the other submitters of this item on paragraphs S.3.1.1. (f) and (g) and to address contamination. Mr. Hal Prince (FL) supports a Developing status for VTM-18.1 and noted that with VTM-18.1 there will be issues with fuel contamination. The concern raised in previous discussions was that if these manifold systems are used with multi-product, single discharge hose dispensers for the delivery of both motor fuels and home heating fuels, a small amount of home heating fuel mixed with a motor fuel could be problematic. It was also noted that these fuels could get contaminated repeatedly whenever there is a change from one fuel to another and that there is also the safety issue of flashing when mixing a gasoline with diesel or kerosene. Ms. Diane Lee report that VTM-18.1 and VTM-20.1 conflict. VTM-20.1 restricts the use of these systems to be used with only home heating fuels. Dmitri Karimov (MMA) noted if VTM-18.1 is adopted then VTM-20.1 would not be required. Mr. Charles Stutesman, (KS) was not sure if VTM-18-1 and VTM-20-1 were being discussed together and it was pointed out that it was agreed that they be combined at the 2020 interim meeting. Mr. John Hathaway (Total Control Systems) agreed with a Developing status for this item and noted that the changes to Paragraphs (f) and (g) would help to address some of the issues that were raised. The committee agreed to a Developing status for VTM-18.1 and to Withdraw VTM-20.1. The committee also stated that any concerns with contamination and safety should also be addressed.

NCWM 2021 Annual Meeting: Mr. Jim Willis (NY, submitter) reported that there are no updates due to the pandemic and requested that it remain under Developing status. NIST OWM included written comments in its analysis.

NCWM 2022 Interim Meeting: Item under consideration presented to 2022 NCWM Interim meeting as:

**S.3.1. Diversion of Measured Liquid.** – No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or the discharge line thereof. However, two or more delivery outlets may be installed if means are provided to ensure that:

- (b) liquid can flow from only one such outlet at one time; and
- (b) the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated.

This paragraph does not apply to the following:

- (2) Equipment used exclusively for fueling aircraft.

- (2) Multiple-product, single-discharge hose metering systems that are equipped with systems designed to flush the discharge hose, provided the flushing system complies with the provisions of paragraph S.3.1.1. Means for Clearing the Discharge Hose, **Multiple-Product, Single-Discharge Hose Metering Systems.**

(Amended 2018 **and 20XX**)

**S.3.1.1. Means for Clearing the Discharge Hose, Multiple-Product, Single-Discharge Hose Metering Systems.** - **Multiple-product, single-discharge hose** ~~M~~metering systems may be equipped with systems specifically designed to facilitate clearing of the discharge hose prior to delivery to avoid product contamination. In such systems, a valve to temporarily divert product from the measuring chamber of the meter to a storage tank, shall be installed only if all the following are met:

- (i) the discharge hose remains of the wet-hose type;
- (j) the valve and associated piping are approved by the weights and measures authority having jurisdiction over the device prior to commercial use;
- (k) the valve is permanently marked with its purpose (e.g. flush valve);
- (l) the valve is installed in a conspicuous manner and as far from the hose reel as practical;
- (m) the system clearly and automatically indicates the direction of product flow during operation of the flush system; and
- (n) clear means, such as an indicator light or audible alarm, is used to identify when the valve is in *use on both quantity indications and any associated recorded representations (e.g., using such terms as “flushing mode” or “not for commercial use”);*  
**[nonretroactive as of January 1, 2024.]**
- (o) **effective, automatic means shall be provided to prevent passage of liquid through any such flush system during normal operation of the measuring system; and**  
**[nonretroactive as of January 1, 2024.]**

- (p) no hoses or piping are connected to the inlet when it is not in use.

(Added 2018)(**Amended 20XX**)

**UR.2.6. Clearing the Discharge Hose.**

**UR.2.6.1. Clearing the Discharge Hose, General. – A manifold flush or similar system designed to accommodate the flushing of product on single-hose, multiple-product systems is not to be used during a commercial transaction. The following restrictions apply:**

- d) The inlet valves for the system are not to be connected to any hose or piping (dust covers are permitted) when not in use.**
- e) When the flushing system is in operation, the discharge hose is only to be connected to the port for the product type being flushed from the discharge line.**
- f) Following the flushing process, indications and recording elements must be reset to zero prior to beginning a commercial delivery.**

**(Added 20XX)**

**UR.2.6.2. Records.** Whenever, prior to delivery, a different product is pumped through the discharge hose to avoid contamination, a record including the date, time, original product, new product, and gallons pumped shall be maintained. These records shall be kept for a period of 12 months and available for inspection by the weights and measures authority.

(Added 2018)

The Committee heard from Mr. Jim Willis (NY, submitter) and provided an update that contained amended language with modifications to UR.2.6.2 and creating UR.2.6.3. The amendments were agreed upon by the other joint submitters, NIST OWM and Murray Equipment. He stated that the new proposed language would hold device owners responsible for ensuring there is no cross-contamination of fuels and also allows jurisdictions to prohibit using manifold flush systems or dispensing dissimilar products through a single meter. The Meter Manufacturers Association, Mr. John Hathaway (Murray Equipment), Ms. Cheryl Ayer (NH), and Mr. John McGuire (NJ) also voiced support for the amended language and urged the item be given a voting status. Mr. Hal Prince (FL) opposes the entire item, indicating the use of a single meter to dispense different products is not legal in his state and has concerns of cross-contamination of fuel. During the Committee work session, the committee assigned this item a voting status with the amended language seen above as the item under consideration. The item as presented to the 2022 NCWM interim meeting can be seen below the item under consideration.

NCWM 2022 Annual Meeting: The Committee heard comments on the item as printed in Publication 16 and introduces during the NCWM 2022 Interim meeting.

Mr. Dmitri Karimov spoke on behalf of the MMA in support of the item, as its helps minimize fraudulent activities and increase safety for operators.

Mrs. Tina Butcher of NIST OWM, as one of the submitters of the item expressed support as a voting item. She commented the item has undergone a significant amount of work in the past two cycles, collaboration with NIST OWM, Murray Equipment, and the state of New York to address previous concerns. Mrs. Butcher added the item addresses safeguards to prevent product contamination, limit fraud, and adds distinct safety advantages. Mrs. Butcher referred to the written NIST OWM analysis for details. She added this may be a widespread practice in many jurisdictions and this proposal provides requirements to limit fraud during such deliveries. Mrs. Butcher added a reminder that the implementation and enforcement of these requirements can be administered and controlled through jurisdictional legislative means.

Mr. Hal Prince (FL) commented in opposition of the item, noting it is not appropriate for a delivery through a single meter, single hose system where contamination can occur. Mr. Prince was concerned with UR.2.6.2., adding the language is misleading when referring to avoiding contamination, where the act of flushing a meter and hose is introducing contamination. Mr. Prince commented if the item were to pass, he would like to see added language to make clear users of such devices should confirm with the jurisdiction before use.

1 Mr. Jim Willis (NY) provided comments in support of the item. He referred to these device types currently used by  
2 small businesses throughout New York State, noting this would provide a safer method to clear discharge hoses and  
3 not require operators to climb on top of the truck to clear discharge hoses. Mr. Willis is in support of the item.

4 Mr. Charlie Stutesman (KS) commented the item provides a way to address safety concerns by not requiring operators  
5 to climb on top of the delivery truck to clear discharge hoses. He also noted the increased number of single meters,  
6 single hoses with multi-calibrated capabilities seen in the field and would like to see a way to address these meter  
7 types. Mr. Stutesman questioned if existing meter manifolds can be retrofitted to meet these requirements, requesting  
8 clarification to address the retroactive versus nonretroactive dates.

9 Mr. Jon Hathaway (Murray Equipment) commented in support of the item, adding that product contamination is not  
10 eliminated, but minimized with these requirements, adding UR.2.6.2. addresses concerns. Mr. Hathaway stated vehicle  
11 tank meter manufacturers support and are in agreeance to not have dissimilar fuels metered through a single system.  
12 Metering of dissimilar fuels (gasoline v. diesel) is completed through a separate metering system.

13 Mr. Kevin Schnepf (CA) expressed concern with the terms, “radically different” and “not recommended”, as these  
14 terms are not well defined and provide no authority for enforcement. Mr. Schnepf also stated his concerns with the  
15 potential for contamination.

16 Ms. Angela Godwin (San Bernadino County, CA) was concerned with the nonretroactive versus the retroactive status  
17 and encourages the consideration of any impact this may have.

18 Ms. Cheryl Ayer (NH) expressed her support of the item with a retroactive date.

19 Mr. Jim Willis (NY) offered suggestive language to address concerns about jurisdictional discretion.

20 The Committee did not recommend any changes to the item as written in Publication 16. The item was assigned a  
21 voting status during the NCWM 2022 annual meeting where the item was voted upon and failed to meet the required  
22 number of votes by membership. The item was returned to committee.

23 NCWM 2023 Interim Meeting: John Hathaway (Murray Equipment) – supports change that had to do with UR.2.6.2.  
24 that was offered by the SWMA. Mentioned that this proposal is not about allowing use in commerce; it is about being  
25 able to use existing code. Supports as voting item.

26 Hal Prince (Florida Dept of Agriculture and Consumer Services) – opposes item in its current form. There is some  
27 good language that does embody the intent. He would support it with the amendment proposed by the SWMA.

28 Dmitri Karimov (Meter Manufacturers Association) – Commented that there are meters that use 2 discharge hoses.

29 Jim Willis (New York Dept of Agriculture and Markets) – disagrees with proposed new language. The whole issue is  
30 that in NY state they deliver multiple products on the same truck with the same hose. Not allowing this is an imposition  
31 on the delivery companies. Stands behind the original proposal. Does not support changes that restrict diesel and gas  
32 on the same truck.

33 Tina Butcher (NIST) – NIST open to modifying item to address concerns. There are already requirements in handbook;  
34 the purpose was to reduce the potential for fraud. Respects that some jurisdictions allow, and some don't. Asked if it  
35 would be it possible to split this and move forward with part of the proposal.

36 Dmitri Karimov (Advanced Flow Solutions dba Liquid Controls) – Pointed out that it is not possible for gasoline and  
37 diesel to be delivered from the same mechanical meter due to meter calibrations.

38 Steve Timar (New York) – Stated that they see this issue on trucks with multiple meters.

Kevin Schnepf (California Division of Measurement Standards) – Pointed out that item f should not be italicized on page 208 of Publication 15.

Based upon concerns from the submitter, the committee believes the recommendations from the SWMA would change the intent of the item, therefore the committee has decided to not include them and assigned this item voting status.

#### **Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Scott Simmons (Colorado Division of Oil and Public Safety) – Mr. Simmons stated that he supports this item, and that flushing is already happening. It is dangerous to flush into the tank. Due to multipoint calibration, you can run different products through the electronic meters very easily. They need to be able to flush products through and do so safely. He stated that he thinks this is fully developed, and it's time for it to pass and be part of the code.

Mr. Michael Keilty (Endress+Hauser) – Mr. Keilty is the Chairman of the NTEP Measuring Sector. He stated that they have talked about test drafts and this item. The Measuring Sector has no recommendations. The absence of the word electronic; how would you do this with an analog system? It has been described that you could not do this with an analog system.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf stated that while he is not opposed to this item, he has concerns that have not been addressed, “radically different characteristics,” and “not recommended” is not an avenue for enforcement. Mr. Schnepf commented that this needs further development.

Mr. Scott Simmons (Colorado Division of Oil and Public Safety) – Mr. Simmons stated that, it may not be appropriate for older analog devices; however, they have been doing it and will continue to do it on the newer technology. This does not need to be retroactive. Mr. Simmons agreed with Mr. Schnepf but does not want to prevent this from going forward.

During open hearings, the Committee heard testimony supporting the item, but there are concerns about the language contained in UR.2.6.2. including “radically different” and “not recommended” concerning enforceability. There were also comments heard regarding the applicability to analog devices. The WWMA S&T Committee recommends that this item be assigned a developing status.

SWMA 2022 Annual Meeting: Jason Glass, State of Kentucky, a member of the NCWM S&T Committee, proposed the following amendment to this proposal:

#### **VTM 18.1**

#### **UR 2.6.2.**

**This system shall not be used for products, that when exposed to one another, will cause either of those products to not meet their respective quality specifications.**

Mr. Prince, State of Florida, stated that he has been concerned with weak language on cross contamination in the past.

Mr. Keilty, Endress+Hauser, stated that “electronic” should be added between hose and metering on page 187 line 10.

The SWMA S&T Committee recommends moving this item forward as a Voting Item with the proposed language from Mr. Glass replacing the current UR 2.6.2. language.

CWMA 2022 Interim Meeting: Dmitri Karimov – Liquid Controls, Some of these systems contain one meter and two hoses. This would not apply to those. Believe the intent was to refer to a single meter instead of a single hose.

The CWMA S&T Committee believes this item is fully developed and recommends voting status.

NEWMA 2022 Interim Meeting: Mr. Jim Willis (NY) recalled a recent incident in NY where a tank-truck that was next to inspectors testing a vehicle tank meter experienced an issue after possible switch loading in which static discharge caused an explosion. An employee of company received burns and a broken leg while the inspectors were knocked to the ground. Mr. Willis urged a voting status on this item due to safety considerations. Mr. Michael Keilty (Measuring Sector Chairman) commented that this system should be identified as “electronic” as it will not work with an analog system. Mr Keilty also noted that in UR-2.6.2 “dispensing products with radically different characteristics...not recommended” is vague. Mr. John Hathaway (Total Control Systems/Murray Equip) commented that he was surprised it was not accepted at NCWM Annual in 2022 and would like to understand what could be changed so that it passed. Mr. Hathaway noted that flush systems are being used, there is code in HB44 that describes them and the language in this item is making it a more controlled system to prevent contamination and fraud. Mr. John McGuire (NJ), Mr. Jim Willis (NY), Mr. James Cassidy (MA), Ms. Cheryl Ayer (NH), and Mr. Marc Paquette (VT) all voiced support for a voting status.

After hearing comments from the floor, the Committee believes this item has merit and is fully developed. The Committee recommends this item for a Voting status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

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

**Source:**  
POUL TARP A/S

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

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

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

(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%

(Amended 20XX)

**Background/Discussion:**

A Milk Meter Tolerance Task Group was formed and assigned to this item. Please contact the task group chair for more information:

To Be Determined  
Milk Meter Tolerance Task Group  
Phone, Email

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

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

The submitter provided the following:

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

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

The consequence of introducing pump systems on milk tankers is that it causes air to be mixed with the milk which again will influence the accuracy of the magnetic flow-meter mounted in the system. Milk entrains air unlike

1 petroleum liquids which do not. As you know, the flow meter will count anything that passes through the meter –  
2 liquid as well as air – and it is therefore essential that as much air as possible is removed from the milk before it  
3 reaches the flow-meter. However, it is widely recognized that it is not possible to remove all the air from the milk,  
4 which will result in an inaccuracy.

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

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

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

17 Yours sincerely

18 Poul Tarp  
19 President POUL TARP A/S

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

1 FLOW COMPUTERS REGULATION IN THE US:

**DANAK**  
PROD Reg. nr. 7025

**FORCE**  
Certification

**EC-Type Examination Certificate**  
Measuring Instrument Directive

**Certificate number: DK-0200-MI005-006**  
Issued by FORCE Certification, Denmark  
EC-notified body number 0200

In accordance with the Directive 2004/22/EC of the European Parliament and Council of March 31<sup>st</sup>, 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: *[Signature]*  
Lene Savstrup Kristensen  
Certification Manager

Processed by: *[Signature]*  
Lars Parmo  
Examiner

The conformity markings may only be affixed to the above type approved equipment. The manufacturer's Declaration of Conformity may only be issued and the notified body identification number may only be affixed on the instrument when the production/product assessment module (D or F) of the Directive is fully complied with and controlled by a written inspection agreement with a notified body. This EC-type examination certificate may not be reproduced except in full, without written permission by FORCE Certification.

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**DANAK**  
PROD Reg. nr. 7025

**FORCE**  
Certification

**DK-0200-MI005-006**

**Appendix to**  
**EC-Type Examination Certificate**  
Measuring Instrument Directive

**Number: DK-0200-MI005-006**  
Issued by FORCE Certification, Denmark  
EC-notified body number 0200

Revision	Issue date	Changes
DK-0200-MI005-006	09-01-2015	First issue
DK-0200-MI005-006	10-08-2015	Second issue

**The measuring system has the following characteristics**

Accuracy class	0.5
Mechanical class	M3
Electromagnetic class	E3
Climatic class	Condensing/open location, H3
Ambient temperature	-25 / +55 °C
Liquid temperature	0 / +50 °C
Liquid pressure max	1 bar
Liquid types	Milk (Raw milk)
Liquid density	1,035 Kg/L at 5 °C +/- 0,02 Kg/L
Liquid conductivity	≥ 5 µS/cm

Flow characteristics for Measuring System, including Minimum Measured Quantity (MMQ), depends on actual flow sensor Proces Data 340 series in combination with Gas Elimination Device (GED) used:

MS/Meter	GED	Qmax [m³/h]	Qmax [L/m]	Qmin [m³/h]	Qmin [L/m]	MMQ [L]	Inlet [mm]
Type	Type						
Type2+4/C51	PTe355	22,2	600	4	67	300	51
Type3/C63	PTe506	80	1334	5	84/(250)*	300/(100)*	63,5
Type3/C76	PTe506	90	1500	12	200	300	75
Type3/C102	PTe506	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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**DK-0200-MI005-006**

**Applied documents**

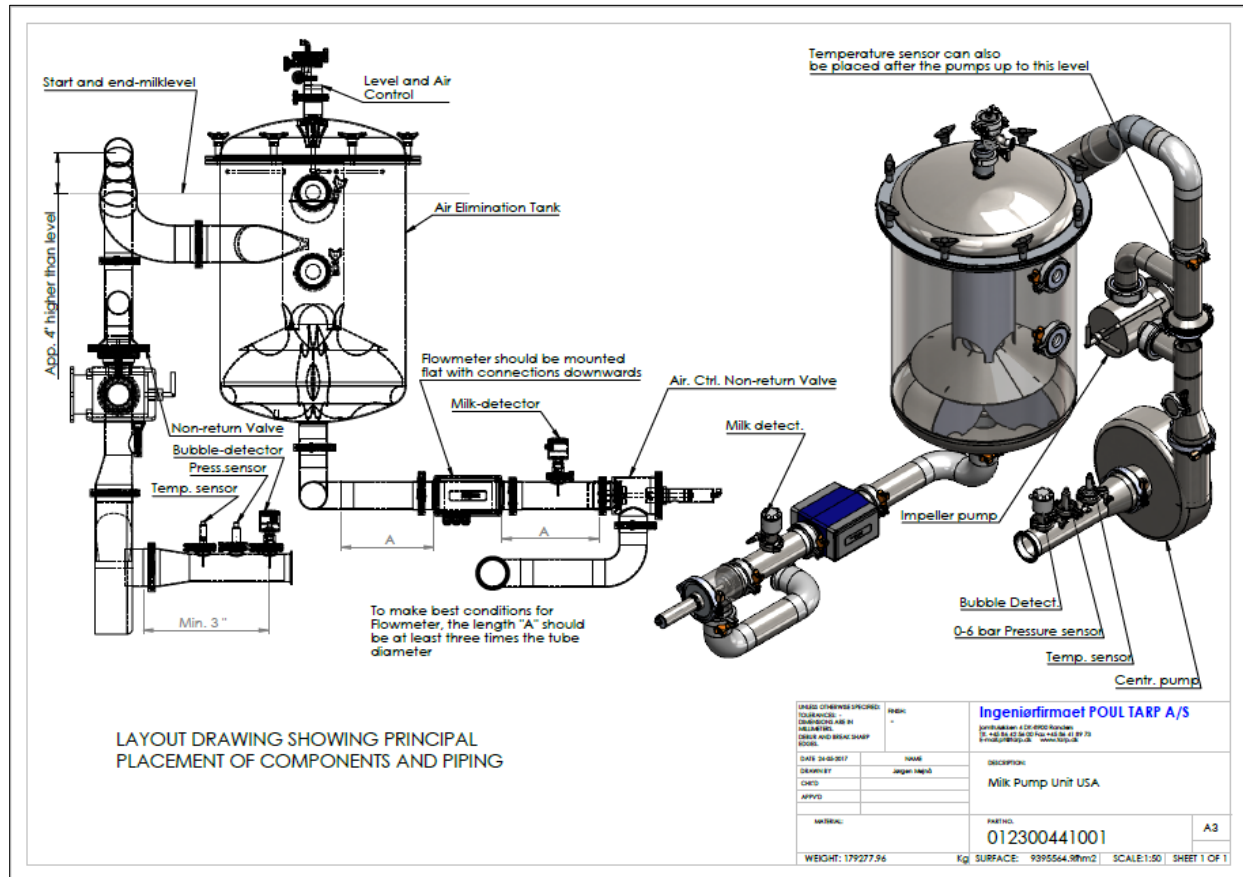
Recommendations	Guides
OIML R117 (1995)	WELMEC Guide 10.5 Marking of fuel dispensers (2006)
OIML R117-1 (2007)	WELMEC Guide 10.6 Sealing of fuel dispensers (2008)
OIML D11 (2004)	
OIML R117-2 Annex – E (CD2)	

**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.

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



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

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

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

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

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 may 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, Chair 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

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

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

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

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

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

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

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

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



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 **Regional Associations' Comments:**

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

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

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

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

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

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

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

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

39 Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to  
 40 [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

### **LPG-15.1 V N.3. Test Drafts.**

#### **Previously LPG-4**

*Note: In 2019 this item was combined with Block 1 “Terminology For Testing Standards” and other items that addressed terminology for standards and the use of “master meters.” Based on comments heard during the 2021 Annual Meeting, the S&T Committee recommended that all items that were combined with Block 1 “Terminology For Testing Standards” that originally appeared as a separate item or a separate block of items on the S&T agenda prior to 2019, be removed from Block 1 “Terminology For Testing Standards” and appear as originally presented.*

*Item LPG-15.1 was removed from Block 1 “Terminology For Testing Standards” and now appears as a separate item on the 2022 Interim Meeting agenda.*

#### **Source:**

Endress + Hauser Flowtec AG USA

#### **Purpose:**

Amend Handbook 44 to allow field reference standards meters to be used to test and place into service dispensers and delivery system flow meters.

#### **Item Under Consideration:**

Amend Handbook 44, LPG and Anhydrous Ammonia Liquid-Measuring Devices as follows:

### **N.3. Test Drafts.**

**N.3.1 Minimum Test -** Test drafts ~~should~~ **shall** be equal to at least the amount delivered by the device in one minute at its normal discharge rate.

(Amended 1982 **and 20XX**)

**N.3.2. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.**

**(Added 20XX)**

#### **Background and Discussion:**

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

Mr. Michael Keilty  
Endress + Hauser Flowtec AG  
970-586-2122, [michael.keilty@us.endress.com](mailto:michael.keilty@us.endress.com)

The use of transfer standards is recognized in Code sections 3.34 Cryogenic Liquid-Measuring Devices Code and 3.38 Carbon Dioxide Liquid-Measuring Devices Code and 3.39 Hydrogen Gas-Measuring Devices – Tentative Code. Transfer standard is only defined for testing cryogenic liquid measuring devices. It has been pointed out that the term transfer standard is not correct and that field reference standard meters may be more appropriate. See new the item under consideration, updated on September 8, 2017.

Field evaluation of LPG meters and CNG dispensers and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using field reference standard meters are more efficient and safer. With CNG and LNG and LPG applications, the field reference standard



1 meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of field reference  
 2 standard meters eliminates return to storage issues. The use of field reference standard meters is easier and faster  
 3 compared to the use of traditional field standards. The cost of using field reference standard meters and transporting  
 4 them is much less than the cost of traditional field provers and standards.

5 Recognition in Handbook 44 will enable States to allow field reference standard meters to place systems into service  
 6 and for field enforcement.

7 Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The State of  
 8 Colorado uses a field reference standard meter to test propane delivery truck meters. The State of Nebraska has used  
 9 a field reference standard meter to test agricultural chemical meters. Other States have asked that there be recognition  
 10 in HB44 in order for their State to allow the use of field reference standard meters.

11 In some applications, field reference standard meters are not more accurate than the meters used in the application.  
 12 For that reason, longer test drafts and possibly more tests may need to be run.

13 The State of California is purported to have conducted a short study of field reference standard meters in the past. The  
 14 conclusion did not lead to wide adoption of the practice.

15 Section 3.37 Mass Flow Meters user requirement U.R.3.8. Return of Product to Storage, Retail Compressed Natural  
 16 Gas Dispensers requires that the natural gas which is delivered into the test container must be returned to storage. This  
 17 is difficult and most often not complied with when the test vessel contents are released to atmosphere. States often  
 18 have difficulties in remote locations finding suitable field reference equipment.

19 The Committee initially considered a proposal to modify paragraph N.3. Test Drafts and to add a new paragraph N.3.2.  
 20 Transfer Standard Test as shown below. Note that, in Fall 2016, Mr. Keilty provided an update to this proposal as  
 21 shown in the Item Under Consideration above.

### 22 **N.3. Test Drafts.**

23 **N.3.1 Minimum Test** – Test drafts should be equal to at least the amount delivered by the device in one  
 24 minute at its normal discharge rate.

25 (Amended 1982)

26 **N.3.2. Transfer Standard Test. – When comparing a meter with a calibrated transfer standard, the**  
 27 **test draft shall be equal to at least the amount delivered by the device in 2 minutes at its maximum**  
 28 **discharge rate.**

29 The submitter recommended that NIST update EPO 28 for CNG dispensers and EPO 26 for LPG Liquid Measuring  
 30 Systems to include transfer standard meter tests. NIST Handbook 105-4 should also be revised to specifically address  
 31 the transfer standard meter and the requirements for use.

32 The S&T Committee might also consider amending Sections 3.30 Liquid-Measuring Devices Code and 3.31 Vehicle-  
 33 Tank Meters Code to allow transfer standard meters.

34 The Committee received written comments on all items in Block 4 and Block 5, as well as LPG-4 and MFM-2  
 35 emphasizing the need for there to be more study and discussion of the issues to assess the ramifications of all the  
 36 proposed changes. The Committee also received written comments from the SMA that it looks forward to further  
 37 information on these items and stating that it is important to be consistent in our use of terms across multiple sections  
 38 of NIST Handbook 44. The Committee agreed to carryover this group of items on its 2019 agenda to allow for further  
 39 discussion and development of these proposals.

NCWM 2019 Interim Meeting: The S&T Committee decided to combine the items on the agenda dealing with the issue of transfer standard (including items already combined into blocks) into one block. Block 1 (New) of the Interim Meeting report now includes Gen-3, Block 1 (original items from the 2019 interim agenda that appeared under Block 1), Block 2, LPG-3 and MFM-5, which were all separate items and blocks of items on the S&T Committee's 2019 Interim Meeting agenda (NCWM Publication 15). Agenda items Gen-3, Block 1, Block 2, LPG-3, and MFM-5 are listed separately on the Interim agenda with a note added beneath each individual item referring the reader to the New B1 items. All items under this New B1 have retained the same numbering system for ease in referring to the appendix for discussion on each item.

2019 NCWM Annual Meeting: Mr. Brett Gurney (NCWM Chairman) commented regarding the formation of a Task Group assigned to further develop this block proposal. The TG is charged with providing definitions for various types of standards (transfer, field, reference, etc.) as well as the criteria to be met by these types of standards. The completion date given to the TG is July 2021. The Committee agreed to the Assigned status for this block of items and looks forward to hearing updates from the TG. The Chair of the task group was:

Mr. Jason Glass  
Kentucky Department of Agriculture  
502-573-0282, [jason.glass@ky.gov](mailto:jason.glass@ky.gov)

NCWM 2020 Interim Meeting: Field Standard TG Chair Jason reported that the Task Group met prior to the Interim meeting and has begun discussion of the items under Block 1. Mr. Glass stated that bi-weekly teleconference meetings were scheduled and that the group was optimistic but had significant work to accomplish.

Mr. Russ Vires (SMA) supports the Scale item, SCL 18.1; in this block, Mr. Dimitri Karimov (Meter Manufacturers Association) supports the Task Group activities, Ms. Tina Butcher (NIST OWM) was encouraged with the progress on terminology and provided an update on the Mass Flow Meter testing reporting that field testing was conducted October 28 to November 1, 2019 and that State and Industry participation included Colorado, Florida, Oregon, Emerson, and Tulsa Gas Technology.

Mr. Kurt Floren (Los Angeles Co., CA) raised concerns with GEN-19.1. regarding the definition of "Standard, Field" and its reference to "stable" standards and how long a standard is expected to be stable, which is typically 1-year, for which he believes should be longer. Mr. Floren also questioned the statement in the definition "tested over a range of environmental and operational conditions that the measuring devices is used..." Mr. Floren noted that he was unsure if all laboratories will have the capabilities to test over this wide range of conditions. Mr. Floren also expressed concerns with the definition "Standard, Transfer" citing that this standard may not meet the fundamental considerations requirement for standards over a long period of time or wide range of environmental conditions.

Mr. Steve Harrington (OR) echoed Mr. Floren's comments. Field Standard TG Chair Glass responded that these are concerns of the TG and these issues will be discussed and considered as the TG develops these items.

During the Committee's work session, the Committee agreed that this item should remain an Assigned item.

NCWM 2021 Interim Meeting: NCWM Field Standard TG Chair, Mr. Jason Glass (KY) provided an update on the Task Group activities. Mr. Glass reported that the field standard Task Group is following the activities of the NIST Master Meter Project and that the Task Group reviewed API specifications for use of master meters as a standard and a test protocol that will be used to ensure uniformity in collecting data on master meters used as field standards. He also reported that the TG does not have a recommendation for this item. Mr. Glass also reported that he would be stepping down as the TG Chair. Mr. Mike Keilty (Endress+Hauser AG) thanked Chair Glass and the TG for their work and requested that Block 1, LPG-15.1, N.3. and Block 1 MFM-15.1, N.3 be removed from Block 1 items and to allow those items to move forward separate from the other Block 1 Items. Mr. Keilty stated that similar language was added to the Hydrogen code and that the proposed language in LPG-15.1 N.3. and MFM-15.1, N.3 will allow for the recognition of master meters as field standards. Mr. Henry Oppermann (WM-Consulting), stated that data is needed to ensure that master meters can be used over a range of conditions. Mr. Bob Murnane (Seraphin) stated that jurisdictions have the ability to use meters and that Block 1 LPG-15.1, N.3 and Block 1 MM-15.1, N.3 should remain

in Block 1 until data is available to support the use of master meters as a standard. Mr. Keilty mentioned that there has been useful dialog regarding master meters in the TG, but that he is concerned that the TG is not close to deciding and he expressed concerns with the TG's focus on the NIST Master Meter Project. Ms. Tina Butcher (NIST OWM) provided an update on the NIST Master Meter Project and noted that States have the regulatory powers to accept or reject a standard. She also mentioned that NIST is working with States to collect data needed to assess master meters and preliminary testing was conducted and data was collected on CNG at Tulsa Gas Technology's facility in fall 2019. Ms. Diane Lee (NIST OWM) noted that NIST OWM feels that it is premature to add more language to the NIST Handbook 44 on master meters without data to support its use.

During the Committee's work session, the Committee agreed to keep all items in Block 1 and that this item should remain with an Assigned status.

NCWM 2021 Annual Meeting: Mr. Glass reported that he would be stepping down as the Field Standard TG Chair. The Committee heard updates from members of the Task Group during open hearings. Mr. Mike Keilty (Endress+Hauser AG) noted that two of the items had been on the agenda since 2015 and requested that they be removed from the block and recommended recognizing the use of master meters. Other comments were to keep the items together until data is analyzed from the NIST Field Reference Standard Work Group to support the use of master meters but that if some items were removed from the block, all items should be removed from the block. Based on comments heard during the 2021 Annual Meeting, the S&T Committee recommended that all items that were included in Block 1 "Terminology For Testing Standards" that originally appeared as a separate item or a separate block of items on the S&T agenda in and prior to 2019, be removed from Block 1 "Terminology For Testing Standards" and appear as originally presented.

During the 2021 Committee work session the Committee recognized that the Task Group has accomplished all it is able to at this point and is recommending the Task Group be disbanded and will make said recommendation to the NCWM Chairman. The Committee agreed to break all items in Block 1 into individual items and designate them all as Developing. The Committee thanks the Task Group and its members for their work.

NCWM 2022 Interim Meeting:

Item under consideration presented to 2022 NCWM Interim meeting as:

**N.3. Test Drafts.**

**N.3.1 Minimum Test** – Test drafts should be equal to at least the amount delivered by the device in 1 minute at its normal discharge rate.  
(Amended 1982)

**N.3.2. Field Reference Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.**  
**(Added 20XX)**

Mr. Keilty shared a presentation on field standard meters during open hearings relevant to both LPG 15.1 and MFM 15.1. The intent of the presentation was to describe initial and ongoing calibration traceability, compare OIML tolerances vs NIST Handbook 44, describe the benefits and show example. An abbreviated copy of the presentation is available on the NCWM website in the interim meeting documents archive. Mr. Keilty commented that he believes LPG 15.1 and MFM 15.1 are fully developed and should receive voting status for the annual meeting. He has updated the proposal to exclude the term "reference" from "field reference standard meter test", as shown above. He requests that the committee provide specific guidance if a developing status is assigned. A comment from industry (Bob Murnane – Seraphin) stated that N.3.2 in the proposal conflicts with the current code which states normal test drafts must be at least one minute at the maximum discharge flow rate of installation conditions. The current wording allows for a test to be conducted at any flow rate for one minute. There was concern from a regulator (Charles Stutesman, Kansas) echoing these concerns. Diane Lee (NIST) requested that more data be made available so that NIST is able to compare worldwide data against test data compiled within the US by NIST. Mahesh Albuquerque (Colorado)

expressed support for this item to receive voting status. Marc Butler (Emerson Micro Motion) expressed confusion at the two notes, thinking that perhaps they conflicted with each other; are they both needed or are they independent? Tina Butcher (NIST) expressed that she recognizes the use and importance of master meters, but is concerned with the purpose of this item. Tina suggests that the statement for use be reworked as test draft criteria is so critical. Tina recommended and offered NIST OWM assistance on this item.

During the S&T Committee work session, the committee recognized the submitters desire that a voting status be recommended but determined that there were too many concerns and confusion expressed. The committee recommends that the submitter develop the item further by aligning language to existing language in Handbook 44, clarifying the purpose to help avoid confusion of the new code on new equipment, and reaching out to NIST OWM or other industry or regulatory officials for feedback.

2022 NCWM Annual Meeting: The committee heard from Tina Butcher NIST, the submitter of the item. She stated that they had addressed items heard at the fall regional meeting and the 2022 interim NCWM meeting. She stated they felt the item as is ready to move forward in tandem with Block 7. The intent is to clarify that it isn't necessary to identify what type of standard is to be used, i.e.: provers aren't referenced in section 3.30. OWM also provided written comments on this item.

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. During opening hearings, the committee heard comments of support for the item to move forward as voting.

Mr. Michael Keilty (Endress + Hauser) Regarding LPG-15.1 and MFM-15.1, he believes the meters can and will meet requirements and supports item as voting.

Mr. Bob Murnane (Seraphin Test Measure) – he also supports LPG-15.1 as voting item.

Ms. Tina Butcher (OWM/NIST) stated NIST has provided written technical analysis. The parties have met and come to an agreement. With changes that have been made and being proposed, she believes all 6 items ready for a vote. She commented that the changes to LPG-15.1 and MFM-15.1 clarify how they will apply, and they will serve the community.

The committee has moved the item forward as voting.

#### **Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Michael Keilty (Endress+Hauser) – Clarified that the Joint source of the item with “Flow USA, Inc.” has changed its company name from Flowtec AG USA. An update was provided on this. Mr. Keilty recapped that last year WWMA S&T committee recommended that these items (LPG-15.1 & MFM-15.1) remain developing, and this was forwarded to the NCWM. At the Southern, the S&T committee proposed these items for a vote, both passed at the Southern. The Central heard comments that this should be moved for voting. At the NCWM interim meeting Mr. Keilty asked the S&T committee to revise the titles to provide clarity; that revised language is now before us. Mr. Keilty continued to note that the NCWM interim & annual committee comments are found in the S&T agenda before you. There is an error in the notes for the 2022 NCWM annual meeting, Ms. Tina Butcher (NIST OWM) is not a submitter of this item. I will provide my comments to the committee by email. In conjunction with this item Mr. Keilty is now proposing to amend LMD-23.1, VTM-23.1 and MLK-23.1(see Block 1, 2022 WWMA S&T agenda). These field standards will be traceable and will increase productivity. I ask the committee to accept LPG-15.1. Please move these items forward as a voting item.

Mr. Robert Murnane (Seraphin Test Measure Company) – Stated: He is not opposed to these meters in any way. Questions for the committee: the purpose is to amend HB44, what does the language in section N.3.2 have to do with the purpose statement? Will Weights and Measures Officials enforce section N.3 or N.3.2 when testing? How will we know which meters are acceptable and which are not? Request that this item be withdrawn and proposes harmonizing the drafts between the two (N.3.1. & N.3.2.). Change N.3. to read that test drafts should be equal to at least the amount

delivered by the device in one minute at the flow rate being tested. Then there is not any need for N.3.2., this is already addressed in the fundamental considerations.

Mr. Matt Douglas (State of California, Division of Measurement Standards) Stated: He did not think this language was helpful and that this item has been on the agenda for 8 years. Mr. Douglas recommended this item for withdrawal.

During open hearings, the committee heard conflicting comments including that the purpose of this item is better addressed in Block 8. The WWMA S&T Committee recommended this item for withdrawal along with the recommendation that the submitter combine their efforts with the submitters of Block 8.

During the voting session comments were received from membership. The submitter of LPG-15.1 requested that the committee reconsider the recommended withdrawal status and to please leave the item with the current developing status.

Mr. Brent Ricks (Montana Department of Labor and Industry Weights and Measures) spoke not to a technical comment on this item but to agenda items that may be fully developed could be voted upon and for the committee to consider this when recommending a status for this item.

Based on the comments heard from the body, the committee entered deliberations. During deliberations, it was determined that the item was fully developed, and the submitter had nothing further to add. The committee recommended a voting status for the item.

Upon returning to the voting session, the recommended status was changed from withdrawal to voting. A vote was put forward to the body resulting in no “yea” votes and 1 “nay” vote.

Mr. Kurt Floren (Los Angeles County, CA) put forward a motion of reconsideration for the vote due to the lack of response from membership during the vote. The motion passed and the vote for LPG-15.1 was recalled, opening the floor for comments on the item.

Mr. Michael Keilty (Endress+Hauser) Recommended a developing status.

Mr. Ed Williams (Ventura County, CA) Supported the recommendation for a developing status.

Mr. Austin Shepherd (San Diego County, CA) Requested clarification on the reasoning for the Committees position.

Clarification from the S&T Committee Chair was provided, the committee recognized that there is language in the history of the item stating that the item may have merit for other jurisdictions.

Mr. Kurt Floren (Los Angeles County, CA) Recommended that the committee consider the needs of other regions when recommending a status.

The committee entered a second deliberation session to assign a status for LPG-15.1. Taking note of the limited participation from the body during the vote to recommend a voting status and along with the consideration of all the comments heard from the floor during the voting session, and all the previous comments and discussions regarding LPG-15.1, the committee concluded that the item should return to the originally proposed recommendation of a withdrawal status.

The S&T Committee returned to the voting session with the committee’s decision to recommend a withdrawal status, the item was included and presented for a vote in the 2022 WWMA Committee’s final report

SWMA 2022 Annual Meeting: Mr. Keilty of Endress+Hauser, the submitter of this item, recommends it move forward as a voting item with the new language.

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

CWMA 2022 Interim Meeting: Michael Keilty – Endress+Hauser, Recollection that CWMA recommended this as a voting item for the 2022 National. In May CWMA voted and approved this item. Larger drafts than 1 minute can be used.

Bob Murnane – Seraphin, Purpose statement does not align with proposed change to N.3. Numerous meters already approved under fundamental considerations, i.e.: the authority lies with the Director to approve devices. Why is the test draft being changed? Regulators must be able to choose whatever draft size they want, specifically for Mass Flow Meters. If the Minimum Measured Quantity is greater than one minute of flow, then some mass flow meters would require larger draft sizes. Several NTEP CCs were referenced in which the MMQ is less than one minute of flow, which would conflict with testing the MMQ.

Craig VanBuren – Michigan, Suggest change in verbiage to address the MMQ / one minute of flow conflict.

The CWMA S&T Committee believes this item is fully developed and recommends voting status. The Committee also believes this should be added to Block 1.

NEWMA 2022 Interim Meeting: Mr. Michael Keilty (Endress Hauser) commented that he introduced this item in 2014 and there has been much documentation and discussion. The goal was to introduce field standard meters and small draft size benefit. Mr. Keilty indicated that he polled some states and he believes that having language in HB44 would enable those states to use field standard meters. Mr. Keilty also noted that he has submitted a letter to the NEWMA S&T Chairman with changes to the purpose statement and other modifications to the language and recommends a voting status. Mr. Bob Murnane (Seraphin Test Measure) asked what changed in the purpose statement and it was shared with the body. Mr. Murnane commented that he believes the Fundamental Considerations already allows State Directors to use field standards and pointed to language in Block 8 that would reinforce that. Mr. Murnane also believes there is an issue with a 1 minute test. Mr. Murnane does not believe this item is needed and urged that submitter to work with submitters of Block 8. Mr. Keilty stated that whenever new technology is available, the conference allows them to be used. He believes the language in this item facilitates the testing of systems already in place and allows 1 minute test to be sufficient. He pointed out that SWMA has voted twice to pass, as has CWMA. Mr. Henry Opperman (W&M Consulting) commented that the Fundamental Considerations allows recognition of other standards that perform at the level of field standards. He questions how we prove that a field standard meets the requirements in the Fundamental Considerations. Even if used, it is still not clear how the states determined they meet the requirements. Ms. Diane Lee (NIST-OWM) commented that NIST is doing additional research on test draft paragraphs. If the purpose of this item is that master meters can be used, it's always been addressed in Fundamental Considerations that State Directors can accept anything. Ms. Lee noted that Block 8 is just clarifying what is needed for selection of appropriate standards. Mr. Murnane indicated that he also called states referenced by Keilty and they are using the Fundamental Considerations for field standards. Mr. Jim Willis (NY) believes this item is redundant, noted that as a Director, he already has the authority through Fundamental Consideration, and recommends withdrawal. Mr. John Mcguire (NJ), Mr. Walt Remert (PA), Mr. James Cassidy (MA) and Mr. Lou Sakin (Holliston, MA) all recommended withdrawal of this item.

After hearing comments from the body, the Committee agrees with the commenters that this item does not have merit and is redundant in nature. The Committee is recommending that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**LPG-22.3            W    S.2.5. Zero-Set-Back Interlock., S.2.5.2. Zero -Set-Back Interlock for Stationary Customer -Operated Electronic Retail Motor-Fuel Devices.**

*NOTE: The submitter requested that this item be withdrawn, and that consideration be given to item LPG-23.1.*

**Source:**

National Propane Gas Association and U-Haul International, Inc.

**Purpose:**

The proposal will address practical issues that propane marketers encounter when trying to comply with the zero-set-back requirements for propane stationary and truck-mounted meters in Handbook 44.

**Item Under Consideration:**

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

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

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

*[Nonretroactive as January 1, 2021]*

(Added 2019)

(Amended 2021)

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

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

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

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

*[Nonretroactive as of January 1, 2017]*

(Added 2016)

**Previous Action:**

2022: Developing

**Original Justification:**

National Propane Gas Association:

This proposal was developed by 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.

In S.2.5, the removal of the vehicle mounted meters from this two-minute requirement is necessary as the initiation of a vehicle mounted meter is performed at the truck prior to moving the delivery hose to the customer tank, sometimes as far as 150 feet from the meter, or in installations with multiple containers that may require continued adjustment of

containers or delivery hose to complete a delivery. This configuration can lead to periods of up to 5 minutes between initial meter engagement and first container filling or between containers being filled on a single delivery.

In revised S.2.6, we are proposing that vehicle mounted meters be allowed periods between meter engagement and product flow of greater than 2 minutes prior to automated time out initiation. A five-minute period is more practical as the initiation of a vehicle mounted meter is performed at the truck prior to moving the delivery hose to the customer tank, sometimes as far as 150 feet from the meter, or in installations with multiple containers that may require continued adjustment of containers or delivery hose to complete a delivery. The configuration on a typical bobtail can lead to periods of up to 5 minutes between initial meter engagement and first container filling or additionally periods of greater than two minutes can transpire between containers being filled on a single delivery.

Addressing proposed new S.2.7, motor fuel, within the context of NFPA 58, refers to any container that has the potential to provide propane to fuel an engine. This can include a multitude of DOT cylinders and ASME containers that are not for the propulsion of an automobile. Current mechanical meter technology utilized in a standard propane dispenser for the filling of portable containers, such as those utilized in NFPA 58 for motor fuel applications or those that do power automobiles, are not capable of being equipped with a zero-set-back interlock and the technology will not be potentially available until 2022, per meter manufacturers.

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

In view of the above information, existing dispenser systems that may only be utilized by qualified trained employees should be permitted to continue operations with the existing meter technology and should not be required to include Zero-Set-Back Interlocks. This should include when the dispenser is removed from one location and installed in another, as long as the original meter remains functional. Existing cabinetry and controls utilized in a standard dispenser cabinet generally include non-digital meters and no electronic controls with the exception of a single switch that operates the pump. These simplistic designs are still effective and should not be prohibited from use in future (new) installations in which the transfer process is attended by trained personnel. Limiting the scope of this section will allow attended dispenser operations which are primarily utilized for filling of portable containers to remain consistent in design and construction. Current use of this technology has not resulted in any known impact to the consumer or over-charge situations. The term "self-operated" is used in other locations in Handbook 44 and would include electronic dispensing devices and meters, which would then be consistent with the prior two sections that are limited to electronic meters.

It is difficult to counter the arguments above. The sheer difficulties that a service person can encounter when a wet hose must be carried over terrain fairly long distances between receiving containers should be sufficient justification to approve this proposal. The counter argument to new S.2.7 would be that the customer may not be able to view the meter to ensure it is set back to zero. The submitter requested that this be a Voting Item in 2022.

#### U-Haul International, Inc.

Motor fuel, within the context of NFPA 58, refers to any container that has the potential to provide propane to fuel an engine. This can include a multitude of DOT cylinders and ASME containers that are not for the propulsion of an automobile. Current mechanical meter technology utilized in a standard propane dispenser for the filling of portable containers, such as those utilized in NFPA 58 for motor fuel applications or those that do power automobiles, are not capable of being equipped with a zero-set-back interlock and the technology will not be potentially available until 2022, per meter manufacturers.

NFPA 58 currently does not allow the public to refuel its automobiles. All automobiles or other containers must be filled by a specially trained employee. A proposed change has been introduced for consideration in the 2023 edition



of NFPA 58 that would permit public refueling of automobiles as long as the dispensing system meets very specific safety requirements, including a specialized nozzle, and is furnished with visible instructions. Upon the acceptance of this new public refueling allowance the propane industry agrees that Zero-Setback-interlocks are needed. These public self-service automotive dispensing systems will be listed to Underwriters Laboratories Standard 495 and will be dedicated to the filling of motor vehicles.

Most propane dispensed is for purposes other than motor-fuel. Pursuant to NFPA 58, this is accomplished by a trained and certified employee dispensing propane, typically using mechanical meters, into cylinders and tanks. The employee is trained and required to manually reset the meter to zero after each transaction and verify the meter is reset prior to initiating a subsequent transaction. This has been and remains an accepted practice for dispensing propane. This process is the industry standard for approximately 97% of all propane used in the United States. *See* U.S. Department of Energy, Alternative Fuels Data Center [afdc.energy.gov/fuels/propane\\_basics.html](https://afdc.energy.gov/fuels/propane_basics.html).

Unlike traditional motor-fuel, such as gasoline or diesel, customers cannot currently dispense propane into their vehicles. If NFPA 58 is amended to allow customers to dispense their own propane into their vehicles and the demand for propane as motor-fuel increases, the market will drive retailers to provide electronic customer-operated retail motor-fuel devices to meet the demand and customer expectations for efficient and expedient fueling transactions. At that time, the electronic customer-operated motor-fuel devices will certainly need to incorporate an automatic zero-set-back interlock. It is simply too early in the process to effectively force mechanical retail motor-fuel devices out of the market for such a small percentage of the retail propane market (approximately 3%).

#### Comments in Favor:

##### **Regulatory:**

- Several regulators voiced support for this item, including adding the 5 minute timeout to each section.

##### **Industry:**

- After hearing comments from the floor, the submitter understands that modifications must be made to the item, in terms of numbering, to line up with the 2022 version of the handbook. The submitter also now feels that a 2-minute time out may be unattainable and believes a 5 minute timeout would be appropriate in each section.

##### **Advisory:**

- 

#### Comments Against:

##### **Regulatory:**

- A regulator voiced concern with the intent and indicated that aspects of this proposal are also included in LPG-22.2 and he is opposed to item, except for the 5- minute timeout being applied.

##### **Industry:**

- 

##### **Advisory:**

- 

#### Neutral Comments:

##### **Regulatory:**

-

**Industry:**

- 

**Advisory:**

- NIST OWM pointed to new numbering in the 2022 version of the handbook and suggested that the item under consideration be renumbered for accuracy. NIST OWM also noted that the automatic timeout is currently 3 minutes in most other specifications and urged the committee to consider if it is necessary in other applications.

**Item Development:**

NCWM 2022 Interim Meeting: During the committee work session, the committee reviewed a document that was provided by the submitter with updated language and paragraph numbering, however, members of the committee concluded the proposal was still not fully developed. The committee agreed to amend the proposal as requested by the submitter. The committee recommended the submitter of this item work with the submitter of LPG-22.2 to harmonize the two proposals.

Following the 2022 Interim Meeting, the submitters of this item and Item LPG-22.2 collaborated on a joint proposal as requested. For this reason, the Committee withdrew Item LPG-22.2. See the Item under Consideration for the new joint proposal.

For more information or to provide comment, please contact:

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And

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[konrad\\_pilatowicz@uhaul.com](mailto:konrad_pilatowicz@uhaul.com)

NCWM 2022 Annual Meeting: The Committee received an update from the submitters that they oppose the item as currently written. The submitters explained that LPG should be dispensed by a trained individual and not “customer operated” and the adaptability for mechanical equipment is not cost effective. The submitters do not see the need for separate requirement for vehicle fueling and bottle filling as the devices can do both and LPG motor fuel is only 3% of the market, therefore emphasis should be placed on the predominant function. After the 2022 Interim Meeting, the Committee received an updated document from the submitters, and the Committee used that document as the current item under consideration. If the submitters are opposed to the item under consideration as written, the Committee as they submit updated language to the regions for further consideration. The Committee has agreed to keep this item as a Developing item.

NCWM 2023 Interim Meeting: The Committee heard from the submitters, Mr. Konrad Pilatowicz (U-Haul International, INC) and Mr. Bruce Swiecicki (National Propane Gas Association) asking for the item to be withdrawn in favor of LPG 23.1. The committee has withdrawn the item.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Mr. Konrad Pilatowicz (U-Haul International, Inc.) – Mr. Pilatowicz commented that the submitter intends to withdraw this item in favor of LPG-23.1.

During open hearings, the submitter confirmed their intention to withdraw this item in preference of LPG-23.1. The WWMA S&T Committee recommends that this item be withdrawn.

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

This item has been replaced with LPG 23.1.

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

NEWMA 2022 Interim Meeting: Mr. Steve Timar (NY), point out that submitter requested to withdraw this item at the WWMA meeting in favor of LPG-23.1. The Committee did not hear any other comments from the floor, nor the submitter.

The Committee is recommending that this item with Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **LPG-23.1 V S.2.5. Zero-Set-Back Interlock**

### **Source:**

National Propane Gas Association and U-Haul International

### **Purpose:**

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

### **Item under Consideration:**

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

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

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

*[Nonretroactive as January 1, 2021]*

(Added 2019) (Amended 2021)

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

**(Added 20XX)**

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

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

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

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

10       [Nonretroactive as of January 1, 2017]

11       (Added 2016)

12       **Previous Action:**

13       2023: New Item

14       **Original Justification:**

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

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

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

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

42       For the minimal amount of retail motor fuel customers that a typical LP-Gas dispenser serves, both U-Haul and NPGA  
43       feel that this proposal represents the most equitable approach to date for balancing the need to ensure fair transactions  
44       and consistent standards with how the LP-Gas industry currently dispenses LP-Gas and LP-Gas's future transportation  
45       applications as envisioned by the proposed changes to NFPA 58 without conducting costly industry-wide retrofits of

existing, functioning multi-use equipment. Handbook 44 needs to work with industry to make technical standards economically feasible lest it risk the advancement of LP-Gas as a viable and clean motor-fuel.

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

The submitter requested that this be a Voting item.

#### Comments in Favor:

##### Regulatory:

- 2023 Interim: Kevin Schnepf (California Division of Measurement Standards) supports item.
- 2023 Interim: Scott Simmons (Colorado Division of Oil and Public Safety) supports item with editorial changes recommended.

##### Industry:

- 2023 Interim: Konrad Pilatowicz (U-Haul International, INC) asked for the item to be moved forward as voting.
- 2023 Interim: Mr. Bruce Sweicicki (National Propane Gas Association) asked for the item to be moved forward as voting.
- 2023 Interim: Mr. Wes Strawn (Red Seal Measurement) sent an amendment to the committee with updated wording.
- 2023 Interim: Dmitri Karimov (Advanced Flow Solutions dba Liquid Controls) supports as a voting item with proposed changes from Mr. Strawn.

##### Advisory:

- 

#### Comments Against:

##### Regulatory:

- 

##### Industry:

- 

##### Advisory:

- 

#### Neutral Comments:

##### Regulatory:

- 

##### Industry:

- 

##### Advisory:

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

**Item Development:**

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

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

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

**Regional Associations’ Comments:**

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

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

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

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**LPG-23.2      V      S.2.6. Automatic Timeout.**

**Source:**

National Propane Gas Association

**Purpose:**

Address practical issues that propane marketers encounter when trying to comply with the zero setback requirements for propane stationary and truck-mounted meters in Handbook 44.

**Item under Consideration:**

Amend Handbook 44, LPG and Anhydrous Ammonia Liquid-Measuring Devices as follows:

*S.2.6. Automatic Timeout.*

**S.2.6.1. Electronic Stationary (Other than Stationary Retail Motor-Fuel Dispensers) ~~and Electronic Vehicle-Mounted Meters~~.** – For individual deliveries, if there is no product flow for three minutes the transaction must be completed before additional product flow is allowed. The three-minute timeout shall be a sealable feature on an indicator.

[Nonretroactive as of January 1, 2021]

(Added 2021) (**Amended 20XX**)

**S.2.6.2. Automatic Timeout Pay-at-Pump Retail Motor-Fuel Devices** – Once a device has been authorized, it must deauthorize within three minutes if not activated. Reauthorization of the device must be performed before any product can be dispensed. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than three minutes.

[Nonretroactive as of January 1, 2022]

(Added 2021)

**S.2.6.3. Electronic Vehicle-Mounted Meters. – For individual deliveries, if there is no product flow for five minutes the transaction must be completed before additional product flow is allowed. The five-minute timeout shall be a sealable feature on the indicator.**

**(Added 20XX)**

#### **Previous Action:**

2023: New Item

#### **Original Justification:**

This proposal was developed by 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.

In S.2.6.1, the removal of the vehicle mounted meters from this three-minute requirement is necessary as the initiation of a vehicle mounted meter is performed at the truck prior to moving the delivery hose to the customer tank, sometimes as far as 150 feet from the meter, or in installations with multiple containers that may require continued adjustment of containers or delivery hose to complete a delivery. This configuration can lead to periods of up to 5 minutes between initial meter engagement and first container filling or between containers being filled on a single delivery.

In revised S.2.6, we are proposing that vehicle mounted meters be allowed periods between meter engagement and product flow of greater than 2 minutes prior to automated time out initiation. A five-minute period is more practical as the initiation of a vehicle mounted meter is performed at the truck prior to moving the delivery hose to the customer tank, sometimes as far as 150 feet from the meter, or in installations with multiple containers that may require continued adjustments of containers or delivery hose to complete a delivery. The configuration on a typical bobtail can lead to periods of up to 5 minutes between initial meter engagement and first container filling or additionally periods of greater than two minutes can transpire between containers being filled on a single delivery.

The submitter acknowledged that the opposition may feel that the change enacted from two to three minutes for the timeout is sufficient. However, it is not. Some sources say the average age of drivers in the propane industry is mid-50's. Those folks do not move as quickly or nimbly as much younger drivers.

The submitter requested that this be a Voting item.

#### **Comments in Favor:**

##### **Regulatory:**

- 2023 Interim: Scott Simmons (Colorado Division of Oil and Public Safety) agreed with Mr. Swiecicki. He asks for everyone to think about a delivery driver having to wade through snow to deliver the

propane. Five minutes is not something that should be a problem and it would be very helpful to the driver.

- 2023 Interim: Kevin Schnepf (California Division of Measurement Standards) supports item as voting. Pointed out that the last sentence should be “an” not “and”.

**Industry:**

- 2023 Interim: Bruce Swiecicki (National Propane Gas Association) asked the committee for item to be voting status. The 5-minute timeout would be helpful.

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Item Development:**

NCWM 2023 Interim Meeting: The committee believes this item is fully developed with the change of “a” to “the” in paragraph S.2.6.3. and has assigned it a voting status.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Mr. Scott Simmons (Colorado Division of Oil and Public Safety) – Was in support of this item for voting. From the bobtail delivery driver perspective this makes sense. The automatic timeout will be beneficial. He did not see any detriment.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) - Agreed with Mr. Simmons’ comments.

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

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

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



CWMA 2022 Interim Meeting: No comments from the floor.

The CWMA S&T Committee recommends this item be withdrawn.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## MLK – MILK METERS

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

#### Source:

Milk Meter Tolerances Task Group

#### Purpose:

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

#### Item Under Consideration:

Amend Handbook 44, Milk Meters Code, as follows:

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

(Amended 1989, 20XX)

<b>Table 1. Tolerances for Milk Meters</b>		
<b>Indication (gallons)</b>	<b>Maintenance Tolerance (gallons)</b>	<b>Acceptance Tolerance (gallons)</b>
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

(Added 1989)

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

1        **(Amended 20XX)**

2        **Previous Action:**

3            2023: New Item

4        **Original Justification:**

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

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

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

14       **Comments in Favor:**

15            **Regulatory:**

- 16            • 2023 Interim: Mr. Matt Curran (Florida Department of Agriculture and Consumer Services)
- 17            recommended item be blocked with VTM 20.2.
- 18            • 2023 Interim: Mr. Kevin Schnepf (California Division of Measurement Standards) Agreed with Mr.
- 19            Curran.

20            **Industry:**

- 21            •

22            **Advisory:**

- 23            • 2023 Interim: Ms. Tina Butcher (OWM/NIST) saw no issues with blocking the item.

24        **Comments Against:**

25            **Regulatory:**

- 26            •

27            **Industry:**

- 28            •

29            **Advisory:**

- 30            •

31        **Neutral Comments:**

32            **Regulatory:**

- 33            •

34            **Industry:**

- 35            •

36            **Advisory:**

•

**Item Development:**

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

**Regional Associations' Comments:**

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

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

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

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

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

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

CWMA 2022 Interim Meeting: Doug Musick – Kansas, The current tolerance table has a specified tolerance for a specified draft size. The percentage calculations for them do not match. The percentage tolerance changes for the same meter based on draft size. Updating the tolerance will make it uniform with other liquid tolerance tables.

Michael Keilty – Endress+Hauser, The sizes of provers for this testing are not common. They are difficult to find.

The CWMA S&T Committee believes this item is fully developed and recommends voting status.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**MFM – MASS FLOW METERS**

**MFM-15.1 V N.3. Test Drafts.**

**Previously MFM-2**

*Note: In 2019 this item was combined with Block 1 “Terminology For Testing Standards” and other items that addressed terminology for standards and the use of “master meters.” Based on comments heard during the 2021 Annual Meeting, the S&T Committee recommended that all items that were combined with Block 1 “Terminology For Testing Standards” that originally appeared as a separate item or a separate block of items on the S&T agenda prior to 2019, be removed from Block 1 “Terminology For Testing Standards” and appear as originally presented.*

*Item MFM-15.1 was removed from Block 1 “Terminology For Testing Standards” and now appears as a separate item on the 2022 Interim Meeting agenda.*

**Source:**

Endress + Hauser Flowtec AG USA

**Item Under Consideration:**

Amend Handbook 44, Mass Flow Meters Code as follows:

**N.3. Test Drafts.**

**N.3.1. Minimum Test** – The minimum test shall be one test draft at the maximum flow rate of the installation and one test draft at the minimum flow rate. More tests may be performed at these or other flow rates. (Also see T.3. Repeatability.)

**(Amended 20XX)**

**N.3.2. Field Standard Meter Test.** – **The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested except for tests of the minimum measured quantity specified for the meter.**

**(Added 20XX)**

**Background/Discussion:**

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

Mr. Michael Keilty  
Endress + Hauser Flowtec AG USA  
970-586-2122, [michael.keilty@us.endress.com](mailto:michael.keilty@us.endress.com)

The use of transfer standards is recognized in Code sections 3.34 Cryogenic Liquid-Measuring Devices Code and 3.38 Carbon Dioxide Liquid-Measuring Devices Code and 3.39 Hydrogen Gas-Measuring Devices – Tentative Code. Transfer standard is only defined for testing cryogenic liquid measuring devices. It has been pointed out that the term transfer standard is not correct and that field reference standard meters may be more appropriate. See new the item under consideration, updated on September 8, 2017.

Field evaluation of LPG meters and CNG dispensers and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using field reference standard meters are more efficient and safer. With CNG and LNG and LPG applications, the field reference standard meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of field reference standard meters eliminates return to storage issues. The use of field reference standard meters is easier and faster compared to the use of traditional field standards. The cost of using field reference standard meters and transporting them is much less than the cost of traditional field provers and standards.

Recognition in Handbook 44 will enable States to allow field reference standard meters to place systems into service and for field enforcement.

Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The State of Colorado uses a field reference standard meter to test propane delivery truck meters. The State of Nebraska has used a field reference standard meter to test agricultural chemical meters. Other States have asked that there be recognition in HB44 in order for their State to allow the use of field reference standard meters.

In some applications, field reference standard meters are not more accurate than the meters used in the application. For that reason, longer test drafts and possibly more tests may need to be run.

The State of California is purported to have conducted a short study of field reference standard meters in the past. The conclusion did not lead to wide adoption of the practice.

Section 3.37 Mass Flow Meters user requirement U.R.3.8. Return of Product to Storage, Retail Compressed Natural Gas Dispensers requires that the natural gas which is delivered into the test container must be returned to storage. This is difficult and most often not complied with when the test vessel contents are released to atmosphere. States often have difficulties in remote locations finding suitable field reference equipment.

In the fall of 2016, Mr. Keilty provided an update to the Item under Consideration. That update appears in the agenda. The previous proposed Item under Consideration was as follows:

### **N.3. Test Drafts.**

**N.3.1 Minimum Test** – Test drafts should be equal to at least the amount delivered by the device in one minute at its normal discharge rate.

(Amended 1982)

**N.3.2. Transfer Standard Test.** – **When comparing a meter with a calibrated transfer standard, the test draft shall be equal to at least the amount delivered by the device in 2 minutes at its maximum discharge rate.**

The submitter recommends that NIST update EPO 28 for CNG dispensers and EPO 26 for LPG Liquid Measuring Systems to include transfer standard meter tests. NIST Publication R 105-4 should also be revised to specifically address the transfer standard meter and the requirements for use.

The S&T Committee might also consider amending Sections 3.30 Liquid-Measuring Devices Code and 3.31 Vehicle-Tank Meters Code to allow transfer standard meters.

The Committee received written comments on all items in Block 4 and Block 5, as well as LPG-4 and MFM-2 emphasizing the need for there to be more study and discussion of the issues to assess the ramifications of all the proposed changes. The Committee also received written comments from the SMA that it looks forward to further information on these items and stating that it is important to be consistent in our use of terms across multiple sections of Handbook 44. The Committee agreed to carryover this group of items on its 2019 agenda to allow for further discussion and development of these proposals.

NCWM 2019 Interim Meeting: The S&T Committee decided to combine the items on the agenda dealing with the issue of transfer standard (including items already combined into blocks) into one block. Block 1 (New) of the Interim Meeting report now includes GEN-3, Block 1 (original items from the 2019 interim agenda that appeared under Block 1), Block 2, LPG-3, and MFM-5, which were all separate items and blocks of items on the S&T Committee's 2019 Interim Meeting agenda (NCWM Publication 15). Agenda items GEN-3, Block 1, Block 2, LPG-3, and MFM-5 are listed separately on the Interim agenda with a note added beneath each individual item referring the reader to the New B1 items. All items under this New B1 have retained the same numbering system for ease in referring to the appendix for discussion on each item.

NCWM 2019 Annual Meeting: Mr. Brett Gurney (NCWM Chairman) commented regarding the formation of a Task Group assigned to further develop this block proposal. The TG is charged with providing definitions for various types of standards (transfer, field, reference, etc.) as well as the criteria to be met by these types of standards. The completion date given to the TG is July 2021. The Committee agreed to the Assigned status for this block of items and looks forward to hearing updates from the TG. The Chair of the task group was:

Mr. Jason Glass  
Kentucky Department of Agriculture  
502-573-0282, [jason.glass@ky.gov](mailto:jason.glass@ky.gov)

NCWM 2020 Interim Meeting: Field Standard TG Chair, Jason Glass reported that the Task Group met prior to the Interim meeting and has begun discussion of the items under Block 1. Mr. Glass stated that bi-weekly teleconference meetings were scheduled and that the group was optimistic but had significant work to accomplish.

Mr. Russ Vires (SMA) supports the Scale item, SCL 18.1; in this block, Mr. Dimitri Karimov (Meter Manufacturers Association) supports the Task Group activities, Ms. Tina Butcher was encouraged with the progress on terminology and provided an update on the Mass Flow Meter testing reporting that field testing was conducted October 28 to November 1, 2019 and that State and Industry participation included Colorado, Florida, Oregon, Emerson, and Tulsa Gas Technology.

Mr. Kurt Floren (Los Angeles Co., CA) raised concerns with GEN-19.1. regarding the definition of “Standard, Field” and its reference to “stable” standards and how long a standard is expected to be stable, which is typically 1-year, for which he believes should be longer. Mr. Floren also questioned the statement in the definition “tested over a range of environmental and operational conditions that the measuring devices is used...” Mr. Floren noted that he was unsure if all laboratories will have the capabilities to test over this wide range of conditions. Mr. Floren also expressed concerns with the definition “Standard, Transfer” citing that this standard may not meet the fundamental considerations requirement for standards over a long period of time or wide range of environmental conditions.

Mr. Steve Harrington (OR) echoed Mr. Floren’s comments. Field Standard TG Chair Glass responded that these are concerns of the TG and these issues will be discussed and considered as the TG develops these items.

During the Committee’s work session, the Committee agreed that this item should remain an Assigned item.

NCWM 2021 Interim Meeting: NCWM Field Standard TG Chair, Mr. Jason Glass (KY) provided an update on the Task Group activities. Mr. Glass reported that the field standard Task Group is following the activities of the NIST Master Meter Project and that the Task Group reviewed API specifications for use of master meters as a standard and a test protocol that will be used to ensure uniformity in collecting data on master meters used as field standards. Mr. Glass also reported that the TG does not have a recommendation for this item. Mr. Glass also reported that he would be stepping down as the TG Chair. Mr. Mike Keilty (Endress+Hauser AG) thanked Chair Glass and the TG for their work and requested that Block 1, LPG-15.1, N.3. and Block 1 MFM-15.1, N.3 be removed from Block 1 items and to allow those items to move forward separate from the other Block 1 Items. Mr. Keilty stated that similar language was added to the Hydrogen code and that the proposed language in LPG-15.1 N.3. and MFM-15.1, N.3 will allow for the recognition of master meters as field standards. Mr. Henry Oppermann (W&M Consulting), stated that data is needed to ensure that master meters can be used over a range of conditions. Mr. Bob Murnane (Seraphin) stated that jurisdictions have the ability to use meters and that Block 1 LPG-15.1, N.3 and Block 1 MM-15.1, N.3 should remain in Block 1 until data is available to support the use of master meters as a standard. Mr. Keilty mentioned that there has been useful dialog regarding master meters in the TG, but that he is concerned that the TG is not close to deciding and he expressed concerns with the TG’s focus on the NIST Master Meter Project. Ms. Tina Butcher (NIST OWM) provided an update on the NIST Master Meter Project and noted that States have the regulatory powers to accept or reject a standard. She also mentioned that NIST is working with States to collect data needed to assess master meters and preliminary testing was conducted and data was collected on CNG at Tulsa Gas Technology’s facility in fall 2019. Ms. Diane Lee (NIST OWM) noted that NIST OWM feels that it is premature to add more language to the NIST Handbook 44 on master meters without data to support its use.

During the Committee’s work session, the Committee agreed to keeps all items in Block 1 and that this item should remain with an Assigned status.

NCWM 2021 Annual Meeting: Mr. Glass reported that he would be stepping down as the Field Standard TG Chair. The Committee heard updates from members of the Task Group during open hearings. Mr. Michael Keilty noted that two of the items had been on the agenda since 2015 and requested that they be removed from the block and recommended recognizing the use of master meters. Other comments were to keep the items together until data is analyzed from the NIST Field Reference Standard Work Group to support the use of master meters but that if some items were removed from the block, all items should be removed from the block. Based on comments heard during the 2021 Annual Meeting, the S&T Committee recommended that all items that were included in Block 1 “Terminology For Testing Standards” that originally appeared as a separate item or a separate block of items on the S&T agenda in and prior to 2019, be removed from Block 1 “Terminology For Testing Standards” and appear as originally presented.

During the 2021 Committee work session the Committee recognized that the Task Group has accomplished all it is able to at this point and is recommending the Task Group be disbanded and will make said recommendation to the NCWM Chairman. The Committee agreed to break all items in Block 1 into individual items and designate them all as Developing. The Committee thanks the Task Group and its members for their work.

NCWM 2022 Interim Meeting: Item under consideration presented to 2022 NCWM Interim meeting as:

### **N.3. Test Drafts.**

**N.3.1 Minimum Test** – The minimum test shall be one test draft at the maximum flow rate of the installation and one test draft at the minimum flow rate. More tests may be performed at these or other flow rates. (See T.3. Repeatability.)

(Amended 1982 **and 20XX**)

**N.3.2. Field Reference Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.**

**(Added 20XX)**

Mr. Keilty shared a presentation on field standard meters during open hearings relevant to both MFM 15.1 and LPG 15.1. The intent of the presentation was to describe initial and ongoing calibration traceability, compare OIML tolerances vs NIST Handbook 44, describe the benefits and show example. An abbreviated copy of the presentation is available on the NCWM website in the interim meeting documents archive. Mr. Keilty commented that he believes MFM 15.1 and LPG 15.1 are fully developed and should receive voting status for the annual meeting. He has updated the proposal to exclude the term “reference” from “field reference standard meter test”, as shown above. He requests that the committee provide specific guidance if a developing status is assigned. A comment from industry (Bob Murnane – Seraphin) stated that N.3.2 in the proposal conflicts with the current code which states normal test drafts must be at least one minute at the maximum discharge flow rate of installation conditions. The current wording allows for a test to be conducted at any flow rate for one minute. There was concern from a regulator (Charles Stutesman, Kansas) echoing these concerns. Diane Lee (NIST) requested that more data be made available so that NIST is able to compare worldwide data against test data compiled within the US by NIST. Mahesh Albuquerque (Colorado) expressed support for this item to receive voting status. Marc Butler (Emerson Micro Motion) expressed confusion at the two notes, thinking that perhaps they conflicted with each other; are they both needed or are they independent? Tina Butcher (NIST) expressed that she recognizes the use and importance of master meters, but is concerned with the purpose of this item. Tina suggests that the statement for use be reworked as test draft criteria is so critical. Tina recommended and offered NIST OWM assistance on this item.

During the S&T Committee work session, the committee recognized the submitters desire that a voting status be recommended but determined that there were too many concerns and confusion expressed. The committee recommends that the submitter develop the item further by aligning language to existing language in Handbook 44, clarifying the purpose to help avoid confusion of the new code on new equipment, and reaching out to NIST OWM or other industry or regulatory officials for feedback.

2022 NCWM Annual Meeting: The committee heard comments from, Michael Keilty with Endress+Hauser Flow USA, the submitter of the item. The submitter voiced frustration that this item was developing because two regions (SWMA and CWMA) recommended it as voting and the WWMA recommended withdrawal without a reason. The submitter testified that at one regional meeting a jurisdiction gave a presentation on how easy the technology was to use. He fails to understand some groups show opposition to this item. He ask that the item be moved to voting at the next meeting and urged states to support it. The submitter also provided written comments to the committee.

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. During opening hearings, the committee heard comments of support for the time to move forward as voting. Mr. Michael Keilty (Endress + Hauser) Regarding LPG-15.1 and MFM-15.1, he believes the meters can and will meet requirements and supports item as voting. Mr. Bob Murnane (Seraphin Test Measure) – he also supports

MFM-15.1 as voting item. Mrs. Tina Butcher (OWM/NIST) stated NIST has provided written technical analysis. The parties have met and come to an agreement. With changes that have been made and being proposed, she believes all 6 items ready for a vote. She commented that the changes to LPG-15.1 and MFM-15.1 clarify how they will apply, and they will serve the community. The committee removed the word “Reference” from N.3.2. and has moved the item forward as voting.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Mr. Robert Murnane (Seraphin Test Measure Company) – Asked what does adding the language do? What data has been provided to support the change to 1 minute? Is it acceptable for Weights and Measures Officials to be prohibited from testing mass flow meters using any draft size equal to or greater than the MMQ over the range of flow rates? Currently code allows for conducting tests specified by the manufacture of the meter. This proposal would increase the size of the drafts. Will HB44 have to be changed every time a new field standard is introduced? The proposed item is not necessary and requests that this item be withdrawn from consideration.

Mr. Jan Konijnenburg (NIST Associate) – Stated: the position of NIST OWM: the purpose of this item (and LPG-15.1) is better addressed in Block 8 and opposes this item as it is written.

Mr. Michael Keilty (Endress+Hauser) – Commented on Mr. Murnane’s comments: Mr. Murnane has submitted comments in June and Mr. Keilty wants to respond to those comments. Whenever there is a new technology, we must write codes. It is appropriate to make changes to HB44. You have to refer to HB44 to see if a meter is acceptable. These devices will be traceable and vetted by the director or meteorologist. The MMQ test is not done normally. I looked at the certificates that were issued and 3 of the certificates are for the same meter, used by two companies in the U.S. it is impractical and unsafe to try to collect an MMQ sample at the maximum flow rate. I will forward my comments to the committee in an email. Recommends that this item move forward as a voting item.

Mr. Scott Wagner (State of Colorado) – Commented on section N.3.2. transfer test, the concern is that the 2-minute test draft might affect the EPO for testing CNG meters and would make it restrictive.

MR. Robert Murnane (Seraphin Test Measure Company) – Stated: How does the item support the purpose? An MMQ test would be prohibited by this code amendment. The test equipment available will change the volume of the test draft.

Mr. Matt Douglas (State of California, Division of Measurement Standards) – Stated: I do not think this language is helpful. This item has been on the agenda for 8 years and recommends this item be withdrawn.

During open hearings, the committee heard conflicting comments including that the purpose of this item is better addressed in Block 8. WWMA S&T Committee recommended this item for withdrawal, along with the recommendation that the submitter combine their efforts with the submitters of Block 8.

During the voting session comments were received from membership. The submitter requested that the committee reconsider the recommended withdrawal status and to please leave the item with the current developing status.

Based on the comments heard, the committee entered deliberations. During deliberations, it was determined that the item was fully developed, and the submitter had nothing further to add. The committee concluded that the item should remain with the recommendation for withdrawal.

SWMA 2022 Annual Meeting: Mr. Keilty, Endress+Hauser, stated that the purpose statement was left out of the proposal when it moved from Block 8. It has now been added. He also submitted new language for N.3.2.

**N.3.2. Field Standard Meter Test.-The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested except for tests of the minimum measured quantity specified for the meter.**



The SWMA S&T Committee recommends this item move forward as a Voting Item with the language above included.

CWMA 2022 Interim Meeting: Michael Keilty – Endress+Hauser, Recollection that CWMA recommended this as a voting item for the 2022 National. In May CWMA voted and approved this item. Larger drafts than 1 minute can be used.

Bob Murnane – Seraphin, Purpose statement does not align with proposed change to N.3. Numerous meters already approved under fundamental considerations, i.e.: the authority lies with the Director to approve devices. Why is the test draft being changed? Regulators must be able to choose whatever draft size they want, specifically for Mass Flow Meters. If the Minimum Measured Quantity is greater than one minute of flow, then some mass flow meters would require larger draft sizes. Several NTEP CCs were referenced in which the MMQ is less than one minute of flow, which would conflict with testing the MMQ.

Craig VanBuren – Michigan, Suggest change in verbiage to address the MMQ / one minute of flow conflict.

The CWMA S&T Committee believes this item is fully developed and recommends voting status. The Committee also believes this should be added to Block 1.

NEWMA 2022 Interim Meeting: Mr. Michael Keilty (Endress Hauser) commented that he introduced this item in 2014 and there has been much documentation and discussion. The goal was to introduce field standard meters and small draft size benefit. Mr. Keilty indicated that he polled some states and he believes that having language in HB44 would enable those states to use field standard meters. Mr. Keilty also noted that he has submitted a letter to the NEWAM S&T Chairman with changes to the purpose statement and other modifications to the language and recommends a voting status. Mr. Bob Murnane (Seraphin Test Measure) asked what changed in the purpose statement and it was shared with the body. Mr. Murnane commented that he believes the Fundamental Considerations already allows State Directors to use field standards and pointed to language in Block 8 that would reinforce that. Mr. Murnane also believes there is an issue with a 1-minute test. Mr. Murnane does not believe this item is needed and urged that submitter to work with submitters of Block 8. Mr. Keilty stated that whenever new technology is available, the conference allows them to be used. He believes the language in this item facilitates the testing of systems already in place and allows 1 minute test to be sufficient. He pointed out that SWMA has voted twice to pass, as has CWMA. Mr. Henry Opperman (W&M Consulting) commented that the Fundamental Considerations allows recognition of other standards that perform at the level of field standards. He questions how we prove that a field standard meets the requirements in the Fundamental Considerations. Even if used, it is still not clear how the states determined they meet the requirements. Ms. Diane Lee (NIST-OWM) commented that NIST is doing additional research on test draft paragraphs. If the purpose of this item is that master meters can be used, it's always been addressed in Fundamental Considerations that State Directors can accept anything. Ms. Lee noted that Block 8 is just clarifying what is needed for selection of appropriate standards. Mr. Murnane indicated that he also called states referenced by Keilty and they are using the Fundamental Considerations for field standards. Mr. Jim Willis (NY) believes this item is redundant, noted that as a Director, he already has the authority through Fundamental Consideration, and recommends withdrawal. Mr. John McGuire (NJ), Mr. Walt Remmert (PA), Mr. James Cassidy (MA) and Mr. Lou Sakin (Holliston, MA) all recommended withdrawal of this item.

After hearing comments from the body, the Committee agrees with the commenters that this item does not have merit and is redundant in nature. The Committee is recommending that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## HGM – HYDROGEN GAS-MEASURING DEVICES

### HGM-23.1 D UR.3.8. Safety Requirement

**Source:**

Quong and Associates, Inc.

**Purpose:**

Add safety requirement for hydrogen gas measuring devices.

**Item under Consideration:**

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

*UR 3.8 Safety Requirement –All hydrogen gas-measuring devices subject to this code shall maintain verification of testing demonstrating conformance with the latest version of SAE J2601 Fuel Protocols for Light Duty Gaseous Hydrogen Surface Vehicles, as determined by the latest version of ANSI/CSA HGV 4.3 “Test Methods for Hydrogen Fueling Parameter Evaluation.”*  
*(Nonretroactive as of January 1, 10XX)*

**Previous Action:**

2023: New Item

**Original Justification:**

The proper fueling of hydrogen vehicles is critical to ensure that the vehicle and high pressure tank is not damaged. Unlike other gases, such as compressed natural gas, hydrogen heats as a vehicle is fueled due to the reverse Joule-Thompson effect. This means that the fueling rate and temperature of the hydrogen must be carefully controlled, or damage can occur to the vehicle hydrogen tanks. The hydrogen industry has done considerable work in developing standard fueling protocols in SAE J2601 ([https://www.sae.org/standards/content/j2601\\_202005/](https://www.sae.org/standards/content/j2601_202005/)) and validation methods in ANSI/CSA HGV 4.3 (<https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/>) to ensure that the vehicles are fueled correctly and safely.

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

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

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

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

The submitter provided the following links:

SAE J2601: [https://www.sae.org/standards/content/j2601\\_202005/](https://www.sae.org/standards/content/j2601_202005/) (copyrighted)

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

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

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

EVSE Pre\_Rule Wkshop Shared Deck.pdf

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

#### Comments in Favor:

##### Regulatory:

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

##### Industry:

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

##### Advisory:

- 

#### Comments Against:

##### Regulatory:

- 

##### Industry:

- 

##### Advisory:

- 

#### Neutral Comments:

##### Regulatory:

- 2023 Interim: Mr. Matt Curran (Florida Dept of Agriculture and Consumer Services) echoed Mrs. Butcher’s comments.

##### Industry:

-

**Advisory:**

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

**Item Development:**

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

**Regional Associations' Comments:**

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

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

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

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

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## EVF – ELECTRIC VEHICLE FUELING SYSTEMS

### EVF-21.1 W A.1. General

#### Source:

ABB, BTCPower, Electrify America, Edison Electric Institute, EVConnect, EVgo, Greenlots, Rivian, Siemens, Tesla, Tritium

#### Purpose:

To provide clarity on how Handbook 44, Sec. 3.4 tentative code will apply to existing EVSE that are in the ground before it becomes effective by identifying which elements are non-retroactive.

#### Item Under Consideration:

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

**A.1. General** – This code applies to devices, accessories, and systems used for the measurement of electricity dispensed in vehicle fuel applications wherein a quantity determination or statement of measure is used wholly or partially as a basis for sale or upon which a charge for service is based.

**A.1.1 Effective Dates for DC EVSE – All DC EVSE used for commercial purposes and put into service on or before January 1, 2023 are exempt from this standard for a period of 10 years from the date put into service. Comply**

**A.1.2 Effective Dates for AC EVSE – All AC EVSE used for commercial purposes and put into service on or before January 1, 2022 are exempt from this standard for a period of 10 years from the date put into service.**

#### Previous Action:

2021: Developing

2022: Developing

#### Original Justification:

While it is important to ensure that consumers are receiving accurate and transparent information regarding the accuracy of EV charging stations, the cost to retrofit existing stations that often do not include an integrated meter, especially DCFC where commercial DC metering technology is not readily available today, will be cost prohibitive. In CA Initial Statement of Reasons (ISOR) for adopting specifications and tolerances requirement for commercial EVSE, CA estimated that it costs approximately \$4,500 to upgrade existing Level 2 stations and \$20,000 to upgrade existing DCFC. To put this into context, CA DMS utilized 2015 DOE data stating that the average commercial Level 2 EVSE costs between \$3,000-\$6,000 and the average DCFC up to \$40,000 or more. The retrofit costs would represent a significant investment amount that does not seem warranted. The ISOR is available here: [https://www.cdfa.ca.gov/dms/pdfs/regulations/EVSE\\_ISOR.pdf](https://www.cdfa.ca.gov/dms/pdfs/regulations/EVSE_ISOR.pdf). According to DOE AFDC station locator there are 23,000 level 2 station with 66,000 connectors in the U.S. and 3,700 DCFC stations with 14,000 connectors. Being conservative and utilizing just the number of stations, it would cost \$92M to upgrade the existing Level 2 station in the U.S. today and \$74M to upgrade the existing DCFC stations, a number that is expected to grow as more stations are deployed. Placing this excessive upgrade burden on manufacturers and network operators is not feasible and an alternative pathway needs to be explored to ensure consumer transparency and EVSE accuracy for existing stations without requiring extensive retrofits. This number also does not include the amount of public funding across various states that has been invested in these EVSE that would prematurely potentially be ripped out and replaced.

It could also have the unintended consequence that the EV industry stops charging for charging services at existing sites or shut them down if the investment in retrofits is greater than the benefit of continuing to operate. Stranded assets across the country are a valid concern and should not be taken lightly. It is important to not prematurely replace EVSE in the field until the useful life of the system has been obtained. Spending a significant amount of capital to

upgrade existing stations rather than investing in new infrastructure does not appear aligned with EV deployment goals. Therefore, it is recommended that there is consideration for making sure requirements are non-retroactive and there is a phase in timeline for existing stations. The language utilized above is similar to what CA DMS implemented, which was the first state to adopt a version of Handbook 44 Sec 3.4 for EVSE. The date for DC EVSE is set at January 1, 2023 to match California's timeline but also because this is when DC metering technology is expected to be commercially available in the market and integrated into DC EVSE by most EVSE manufacturers that are either working on their own product or with third party meter manufacturers.

In general, it appears that there is some openness to considering how legacy EVSE that are in the ground today should be treated when considering that DC metering technology integrated into the EVSE was not commercially available when many of these stations were developed. The main concern that has been raised is regarding whether there should be an overall exemption for existing EVSE to the measurement provisions in HB 44 Sec 3.4 or whether existing EVSE should be exempt from certain requirements in the subsections of Sec 3.4 that are not feasible to attain. In reviewing the subsections of Sec 3.4, the proposal submitters determined that it would not be feasible to meet most subsections of Sec 3.4 with equipment that is in the ground with the exception of S.5 Marking (except S.5.2) and S.6 printing requirements. To ensure there is not confusion between which stations were in the ground prior to dates referenced above, EVSE owners and operators will need to work with local weights and measures officials on a self-reporting mechanisms or some other mechanism for tracking station service dates. CA will be the first state that will need to determine how this process will operate in the field given it has already adopted the exemption noted above and compliance for new AC stations is effective January 1, 2021. On the consumer side, EVSE operators and owners today can provide certain provisions to ensure the accuracy of the commercial transaction that can be facilitated outside of having a meter integrated into the EVSE. For instance, some owners and operators may be able to utilize the accuracy that is traceable via the measurement technology in the EV that accounts for any losses and ensure the consumer is being accurately and fairly billed for what he or she is receiving.

The submitter requested voting status for this item in 2021.

#### Comments in Favor:

##### Regulatory:

- 2021 Interim: Mr. Samuel Ferris (California) supported Developing status but noted that an exemption from requirements in the handbook is not common and that the life span of the equipment may only be seven to ten years.
- 2022 Interim: A regulator from Nevada supports developing status.
- 2022 Interim: A regulator from New York supports developing status and looks forward to reasonable modifications of the proposal by the submitter. He does not favor a 10-year grace period and wishes for a permanent code status.

##### Industry:

- 2021 Interim: Ms. Francesca Wahl (Tesla) and Mr. Keith Bradley (Electrify America) supported Developing status.
- 2021 Interim: Ms. Francesca Wahl (Tesla) supported this item.
- 2021 Interim: Mr. Kevin Miller (Charge Point) expressed concerns with allowing an exemption for 10-years and equipment should be able to meet the requirements and supports a Developing status for this item.
- 2021 Annual: Ms. Francesca Wahl (Tesla) noted that she will be working to incorporate feedback and will work with the EVF National Work group to develop an updated proposal. Ms. Wahl also provided a letter to the S&T Committee concerning the Developing status for this item.
- 2022 Interim: A member of the submitting group recommends developing status and provided background and stated they are working on revised draft for proposal. The submitters worked with NIST OWM and EVFE Subgroup for feedback. The commentor stated a revised proposal will be developed and noted there are significant modifications from the original proposal.

- 2022 Interim: A member of industry representing Electrify America, commented section 3.40 in Handbook 44 was developed before the company was established. A revised proposal is expected to be submitted. Recommends the item remain a developing item.
- 2022 Interim: A member of industry representing EVgo, a joint submitter recommends developing status.

**Advisory:**

- 2022 Interim: No Comments

**Comments Against:**

**Regulatory:**

- 2022 Interim: A regulator from California DMS recommends withdraw, however stated a developmental status is acceptable.
- 2022 Interim: A regulator from New York would like to see a permanent code in the area EVFSs and stated the 10-year exempt period is not acceptable. The commentor stated he is supportive of seeing reasonable changes from the joint submitters.
- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) supports a status of Withdrawn for the item.

**Industry:**

- 2022 Interim: A member of industry representing ChargePoint is not in support of this item and recommends withdraw. He stated the proposal signals to the market things are in flux and supports removal of the proposal and tentative code status. The industry member noted the recent passage of the law providing \$7.8 billion in funding to invest in U.S. EV charging.
- 2023 Interim: Ms. Francesca Wahl (Tesla) commented on behalf of the submitters and requested the item be assigned a status of Withdrawn.
- 2023 Interim: Mr. Jared Ballew (ChargePoint) supports a status of Withdrawn for the item.

**Advisory:**

- 2021 Interim: Ms. Diane Lee (NIST OWM) noted that the proposal is not clear as written and expressed concerns with an exemption for 10 years.
- 2021 Annual: Ms. Juana Williams (NIST OWM), stated that it was unclear as to the exact type of use that entitles an EVSE to an exemption to NIST HB 44 requirements. Ms. Williams also pointed out that the exemption would allow a generation of devices to operate for 10-years without have to comply with the requirements and could be viewed as competitively unfair to traditional or other alternative vehicle fueling applications.
- 2022 Interim: An advisory member representing NIST OWM stated the current proposal conflicts with the general code for the term retroactive. The representative stated the submitters of the item discussed an alternative proposal with NIST OWM and they are awaiting a final draft of this alternative proposal.

**Neutral Comments:**

**Regulatory:**

- 2022 Interim: No Comments

**Industry:**

- 2022 Interim: No Comments

**Advisory:**

- 2022 Interim: No Comments

**Item Development:**

NCWM 2021 Interim Meeting: The committee assigned Developing status for this item. For more information or to provide comment, please contact:

Ms. Francesca Wahl  
Tesla  
650-435-0422, [fwahl@tesla.com](mailto:fwahl@tesla.com)

The Committee suggests that the submitters of this item consider the responses to the proposal from the regional meetings, NIST, OWM and EVFS work group and update the item under consideration to address the comments and as necessary prepare a revised proposal for the EVFS work group to address the concerns with this item.

NCWM 2022 Interim Meeting: The Committee maintained developing status for this item. The Committee suggests the submitters take into consideration the comments provided during open hearings and prepare a revised draft proposal to NIST OWM, the EVFE Subgroup, etc. to provide a comprehensive proposal to membership.

NCWM 2022 Annual Meeting: The Committee heard an update from Ms. Francesca Wahl (Tesla) on behalf of the joint submitters where she provided a combined update to items EVF 21.1 and EVF 21.5. The workgroup has met on multiple occasions since the NCWM 2022 Interim meeting in efforts develop these two items for vote. Ms. Wahl commented there are specifics in both items that need further discussion and development. Examples include, but are not limited to, timelines and effective dates, along with addressing tolerance values as they relate to existing equipment. Ms. Wahl stated efforts are being made to develop the items for vote in the next cycle.

NCWM 2023 Interim Meeting: The Committee has withdrawn this item based on the recommendations from the submitters, along with similar comments heard during open hearings supporting the withdraw of the item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Francesca Wahl (TESLA) – Ms. Wahl commented the USNWG has been making progress on the subject. She noted the group has made some significant modifications along with submitting item EVF-23.6. A formal vote on the item was not taken by the workgroup. Ms. Wahl noted the comments expressed apply to both EVF 21.1 and EVF-21.5. A recommendation for items EVF-21.1 and EVF-21.5 to remain developing was made by the Ms. Wahl.

Mr. Kurt Floren (County of Los Angeles, CA) – Mr. Floren questioned the justification of this item, including the 10-year exemption. He opposed the item and encouraged the committee to propose nothing more than to keep it developmental.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf recommended the item be withdrawn for the reasons mentioned. He further commentated that a 10-year exemption is not warranted, is not applicable for these devices, and does not belong in the handbook.

Mr. Jose Arriaga (Orange County, CA) – Mr. Arriaga commented the item should be withdrawn and further evaluated. He concluded the 10-year exemption is unnecessary.

During open hearings comments were heard questioning the lack of justification for a 10-year exemption. The WWMA S&T Committee agrees that a 10-year exemption is not justified, as there are currently available devices which meet the requirements. The Committee recommends that this item be withdrawn.

SWMA 2022 Annual Meeting: Scheleese Goudy of Electrify America, the submitter of this item, requested that it be withdrawn.

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



CWMA 2022 Interim Meeting: Francesca Wahl – Tesla, EVF-23.6 is a resubmittal of this item. Request this remains developing.

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

NEWMA 2022 Interim Meeting: Ms. Francesca Wahl (Tesla) commented that there is no status update from the group of submitters and requested to keep the item as developing. Ms. Juana Williams (NIST-OWM) pointed out that this proposal as worded grants a 10 year exemption for both AC and DC systems. The EVSE Subgroup is aware there are multiple alternate proposals addressing this item. Ms. Williams asks submitters to work with the EVSE Subgroup. Mr. John McGuire (NJ) stated that a 10 year exemption is too long and unnecessary, and recommend withdrawal or developing. Mr. Jim Willis (NY) requested that this item be withdrawn.

After hearing comments from the floor, the Committee does not believe this item has merit. The Committee agrees that a blanket 10 year exemption for devices is not appropriate and recommends that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **EVF-21.5      W      T.2. Load Test Tolerances.**

### **Source:**

ABB, BTCPower, Electrify America, Edison Electric Institute, EVConnect, EVgo, Greenlots, Rivian, Siemens, Tesla, Tritium

### **Purpose:**

To create separate metering requirements for DC EVSE due to significant technology differences and challenges between AC and DC systems.

### **Item Under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

## **T.2. Load Test Tolerances.**

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

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

**T.2.2. DC EVSE Load Test Tolerances.** – **The tolerances for DC EVSE load tests:**

(a) **Devices installed prior to January 1, 2033**

i. **Acceptance Tolerance: 2.5 %; and**

ii. **Maintenance Tolerance: 5.0 %**

(b) **Devices installed January 1, 2033 or later**

i. **Acceptance Tolerance: 1.0 %; and**

ii. **Maintenance Tolerance: 2.0 %**

### **Previous Action:**

2021: Developing

2022: Developing

**Original Justification:**

Proposed changes to the text to differentiate alternating current (AC) EVSE from direct current (DC) EVSE. Metering for DC architected systems is considerably more complicated and in ways that the original drafting of this provision never contemplated. For example, the tentative code when initially written never contemplated 350kW EVSE or liquid cooled cabling from the charging post to the connector. As such, it is necessary to separate the implementation dates of some of the specifications, tolerances, and other technical requirements. DC metering solutions are still being researched and developed and are not yet commercially available to be integrated into DC chargers at scale and at reasonable cost. While the supply chain for the physical meters themselves is slowly catching up, the metering system in a DC EVSE, particularly high-power DC EVSE that utilize liquid-cooled cables, goes beyond the physical meter itself which is incorporated in the main housing of the EVSE. For example, measurements may also need to be taken at the connector end of the dispenser and software and algorithms must be developed, validated, and integrated into the EVSE system to allow for accurate metering of kWh delivered to the vehicle. Implementing more complex metering systems needed for DCFC requires significant design and manufacturing changes to DC EVSE.

The proposed tolerances account for the fact that these systems are still in development and are untested. The proposed timeline provides the industry with enough time to develop, test, validate, and deploy reliable DC metering system technology. This timeline is also consistent with the timeline approved by the State of California which accounts for the vast majority of the EVSE market. EVSE manufacturers are working diligently to meet the California timeline and are confident that it can be met.

While it is important to ensure that consumers are receiving accurate and transparent information regarding the accuracy of EV charging stations, it is also important that the technology to deliver high accuracy is available and reliable.

There is concern about both the proposed timeline and the accuracy requirement. Some are concerned that the accuracy specification of 2.5% acceptance and 5% maintenance is too high and does not provide sufficient consumer confidence that all charge sessions are equal regardless of provider and station. The proposers would note that this is a new and evolving technology where charging providers place a premium on customer experience as they compete for this growing market. Thus far, customers have not registered complaints about lack of transparency. Some are concerned that the timeline for instituting a metering regime is too far into the future. The proposers acknowledge the few years it will take to have reliable DC metering systems commercially available at scale but are working as quickly as possible to develop and integrate these systems into their chargers. Some are also concerned that the metering requirements have been in a place for several years already and therefore the EVSE community should not need more years to develop solutions.

The proposers note that current DC EVSE technology was never contemplated by the existing metering regime and DC technology, particularly high-power DC EVSE, were not in existence at the time the original specifications were set. For example, the first 350kWh EVSE with liquid cooled cables weren't deployed in the US until 2018.

The submitter requested voting status for this item in 2021.

**Comments in Favor:**

**Regulatory:**

- 2021 Interim: Recommended Developing status.
- 2022 Interim: A regulator from Nevada supports developing status.

**Industry:**

- 2021 Interim: Mr. Michael Krauthamer (AFTE) and Mr. Keith Bradley (Electrify America), supported the item and recommended Developing status.

- Annual 2021: The submitters requested to maintain Developing status.
- 2022 Interim: A member of the submitting group recommends the item remain developing. The commentor stated the group will be submitting a revised proposal addressing comments and feedback received.

**Advisory:**

- 2022 Interim: No comments

**Comments Against:**

**Regulatory:**

- 2022 Interim: A regulator from California DMS recommends the item to be withdrawn.
- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) supports a status of Withdrawn for the item.

**Industry:**

- Interim 2021: Mr. Samuel Ferris (CA) recommended a Developing status for this item. Mr. Kevin Miller (Charge Point) recommended that this item be withdrawn and noted that his devices meet the tolerance in NIST HB 44.
- 2022 Interim: A member of industry representing ChargePoint recommends withdraw of this item due to no details of the 2022 alternate proposals recently developed by the submitters.
- 2023 Interim: Ms. Francesca Wahl (Tesla) commented on behalf of the submitters and requested the item be assigned a status of Withdrawn.
- 2023 Interim: Mr. Jared Ballew (ChargePoint) supports a status of Withdrawn for the item.

**Advisory:**

- 2022 Interim: An advisory member representing NIST OWM reiterated 2021 comments against blanket exemptions and dual tolerances yet awaits the rework of alternate proposals recently developed by the submitters that would be ready to be revisited in future EVFE Subgroup meetings. The member encourages the submitters to work with NIST OWM on the final draft of any proposed changes.

**Neutral Comments:**

**Regulatory:**

- 2022 Interim: No comments

**Industry:**

- 2022 Interim: No comments

**Advisory:**

- 2022 Interim: No comments

**Item Development:**

2021 Interim Meeting: The Committee assigned Developing status for this item. For more information or to provide comment, please contact:

Mr. Asaf Nagler  
ABB  
202-639-4075, [asaf.nagler@us.abb.com](mailto:asaf.nagler@us.abb.com)

NCWM 2022 Interim Meeting: During the committee work session this item was assigned Developing status. The Committee suggests the submitters take into consideration the comments provided during open hearings. The Committee recommends the submitter work with NIST OWM on the final draft of their 2022 alternate proposal for review and comments.

NCWM 2022 Annual Meeting: The Committee heard an update from Ms. Francesca Wahl (Tesla) on behalf of the joint submitters where she provided a combined update to items EVF 21.1 and EVF 21.5. The workgroup has met on multiple occasions since the NCWM 2022 Interim meeting in efforts develop these two items for vote. Ms. Wahl commented there are specifics in both items that need further discussion and development. Examples include, but are not limited to, timelines and effective dates, along with addressing tolerance values as they relate to existing equipment. Ms. Wahl stated efforts are being made to develop the items for vote in the next cycle.

NCWM 2023 Interim Meeting: The Committee has withdrawn this item based on the recommendations from the submitters, along with similar comments heard during open hearings supporting the withdraw of the item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Francesca Wahl (TESLA) – Ms. Wahl commented the USNWG has been making progress on the subject. She noted the group has made some significant modifications along with submitting EVF-23.6. A formal vote on the item was not taken by the workgroup. Ms. Wahl noted the comments expressed apply to both EVF 21.1 and EVF-21.5. A recommendation for items EVF-21.1 and EVF-21.5 to remain developing was made by Ms. Wahl.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf commented the item does not have merit, given the state of current technology. Mr. Schnepf recommends the item be withdrawn.

Mr. Kurt Floren (County of Los Angeles, CA) – Mr. Floren agreed with Mr. Schnepf's comments.

During open hearings comments were heard the item was outdated and not applicable given the state of current technology. The WWMA S&T Committee recommends that this item be withdrawn.

SWMA 2022 Annual Meeting: Ms. Goudy of Electrify America, the submitter of this item, requested that it be withdrawn.

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

CWMA 2022 Interim Meeting: Francesca Wahl – Tesla, EVF-23.6 is a resubmittal of this item. Request this remains developing.

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

NEWMA 2022 Interim Meeting: Ms. Francesca Wahl (Tesla), on behalf of submitters, indicated there has been no movement on this item and noted there are new proposals as part of the EVSE Subgroup. Mr. Keith Bradley (Electrify America) recommends this item be withdrawn. Ms. Juana Williams (NIST-OWM) indicated that devices already can meet requirements in this paragraph, but EVSE Subgroup has reviewed proposal and did not reach a consensus. Mr. Jason Flint (NJ) and Mr. Jim Willis (NY) recommended that the item be withdrawn.

After hearing comments from the floor, the Committee does not believe this item has merit and there are other proposals that deal with this subject. The Committee is requesting that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**EVF-23.1 V S.2.5.1. Money-Value Divisions Digital, S.5.2.(b) EVSE Identification and Marking Information, S.5.3.(d) Abbreviations and Symbols; J, S.8.(a) MMQ, N.1. No Load Test, T.5. No Load Test, N.2. Starting Load Test, T.6. Starting Load, and Appendix D—Definitions; megajoule (MJ)**

**Source:**

NIST USNWG EVF&S-EVFE Subgroup

**Purpose:**

Further refine electrical vehicle fueling systems code requirements in NIST Handbook 44 *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices* Section 3.40 Electric Vehicle Fueling Systems Code to: (1) remove the “megajoule” unit of measurement definition and all references to the term cited in the design specifications; (2) base the computation of the total sales price on a more appropriate quantity interval that does not exceed 0.01 kWh rather than a 0.1 kWh; (3) decrease the permissible sizes of the minimum measured quantity (MMQ) to those that are more appropriate quantities for AC and DC systems deliveries and result in a shorter duration for the light load test procedure; and (4) no longer require an accuracy test and the applicable test tolerances at no load and at starting load.

**Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

**The EVFE Subgroup developed recommendations for modifying the code by removing the definition of the unit of measurement for the “megajoule” from the handbook:**

~~megajoule (MJ).—An SI unit of energy equal to 1 000 000 joules (J). [3.40]~~

**S.2.5.1. Money-Value Divisions Digital.** — An EVSE with digital indications shall comply with the requirements of paragraph G-S.5.5. Money-Values, Mathematical Agreement, and the total price computation at the end of a transaction shall be based on quantities not exceeding ~~0.5 MJ or~~ 0.01 kWh.

(Amended 202X)

**S.8. Minimum Measured Quantity (MMQ).** — The minimum measured quantity shall satisfy the conditions of use of the measuring system as follows:

(a) Measuring systems shall have a minimum measured quantity not exceeding ~~2.5 MJ or;~~

(1) 0.5 kWh for AC EVSE; and

(2) 1.0 kWh for DC EVSE.

**Note:** To minimize the duration of required testing, manufacturers may want to consider limiting the declared MMQ to the level of 0.1 kWh for AC EVSE.

(Amended 202X)

**S.5.2. EVSE Identification and Marking Information.**

(b) maximum ~~current~~ deliverable amperes;

**S.5.3. Abbreviations and Symbols.**

(d) ~~JkWh~~ = joulekilowatt hour.

~~**N.1. No Load Test.**—A no load test may be conducted on an EVSE measuring system by applying rated voltage to the system under test and no load applied.~~

~~**T.5. No Load Test.** An EVSE measuring system shall not register when no load is applied.~~

~~**N.2. Starting Load Test.** A system starting load test may be conducted by applying rated voltage and 0.5 ampere load.~~

~~**T.6. Starting Load.** An EVSE measuring system shall register a starting load test at a 0.5 ampere (A) load.~~

Renumber paragraph N.3. Minimum Test Draft (Size) through N.6. Repeatability Tests to become N.1. through N.4., respectively.

**Previous Action:**

2023: New Item

**Original Justification:**

The EVFE Subgroup proposes deleting all references to the “megajoule” unit of measurement in the method of sale regulation for retail sales of electrical energy as a vehicle fuel. This modification will align the unit of measurement recognized for electrical energy vehicle fueling equipment (i.e., the kilowatt-hour) in corresponding legal metrology requirements in NIST Handbook 44 Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices Section 3.40 Electric Vehicle Fueling Systems Code and corresponding international documentary standards.

While objections to the proposed modifications may surface the group is not currently aware of any and these matters would be brought to light during the August through October 2022 comment period. The EVFE Subgroup also notes that the additional paragraphs it has recommended for modification are not recent developments but are the result of information gathered through testing carried out over the past six years and input from OEMs on EVSEs and from jurisdictions conducting tests and type evaluation of devices in field installations and laboratory environments; therefore, this proposal is the result of advances in the operating capacity of EVSEs which indicate that modifications to multiple paragraphs are warranted. Removing the “megajoule (MJ)” unit of measurement from the handbook does not conform to the practice in place for applying the concept of primary use of SI (metric) measurements recommended in the Omnibus Trade and Competitiveness Act of 1988.

Although it appears that trade practice is limited to use of the kilowatt-hour unit of measurement for electrical energy deliveries to an EV battery; if that practice were to change the “joule” could be placed back into the handbook.

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

**Comments in Favor:**

**Regulatory:**

- 2023 Interim: Mr. Craig VanBuren (Michigan Department of Agriculture) supports a Voting status with the edits submitted by Ms. Tina Butcher (NIST OWM).
- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) supports a Voting status with the edits submitted by Ms. Tina Butcher (NIST OWM).
- 2023 Interim: Mr. Hal Prince (Florida Department of Agriculture and Consumer Services) supports a Voting status with the edits submitted by Ms. Tina Butcher (NIST OWM).

**Industry:**

- 2023 Interim: Mr. Bradley (Electrify America) supports a Voting status with the edits submitted by Ms. Tina Butcher (NIST OWM).

**Advisory:**

- 2023 Interim: Ms. Tina Butcher (NIST OWM) commented on the recommended language submitted by the NIST USNWG EVF&S-EVFE Subgroup. Ms. Butcher remarked on the letter submitted by the work group to the committee which recommended the addition of “at the end of the transaction” to clarify in paragraph S.2.5.1. the point in the transaction when mathematical agreement must occur and the replacing of “joule” with “kilowatt-hour” and “current” with “amperes” in all applicable sections (to also include paragraphs S.5.3. and S.5.2., respectively). Ms. Butcher also referred to a related Method of Sale requirement on the L&R agenda when addressing this item.

**Comments Against:****Regulatory:**

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**Industry:**

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**Advisory:**

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**Neutral Comments:****Regulatory:**

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**Industry:**

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**Advisory:**

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**Item Development:**

NCWM 2023 Interim Meeting: The Committee considered and agreed on further edits from the NIST USNWG EVF&S-EVFE Subgroup, which included the additional language of “at the end of the transaction” to clarify in paragraph S.2.5.1. the point in the transaction when mathematical agreement must occur and replacing of “joule” with “kilowatt-hour” and “current” with “amperes” in all applicable sections (i.e., paragraphs S.5.3. and S.5.2., respectively). The Committee has assigned a Voting status to this item.

Paragraphs (a), (b), and (c) listed below originally appeared in the Item Under Consideration section of this proposal. The committee agreed that this explanatory text should be moved out of the that section to clarify this information should have been part of the original justification section of the proposal.

- (a) The computed total price for the sale of electrical energy shall be based on an EVSE using a quantity interval that does not exceed 0.01 kWh rather than 0.1 kWh or in units of the megajoule. The EVFE Subgroup also recommends removing the megajoule unit of measurement from paragraph S.2.5.1. Money-Value Divisions Digital.
- (b) The EVFE Subgroup recommends modifying paragraph S.8. Minimum Measured Quantity (MMQ) to recognize an MMQ of 0.1 kWh which is very common among EVSE that have already been type approved. For ANSI C12 American National Standard for Electricity Meters—0.1, 0.2, and 0.5 Accuracy Classes compliant meters meter constants of 0.001 kWh are common. In these meters the meter is expected to be fully accurate at deliveries of only a single watthour (i.e., 0.001 kWh). Dispensing a larger amount of energy

to determine accuracy is not needed. Additionally, the EVFE Subgroup recommends paragraph S.8 specify an MMQ not to exceed 1.0 kWh as a more appropriate quantity for DC systems and include a new note to encourage a smaller MMQ for EVSEs which in the case of AC systems will result in a shorter time to conduct a test by a factor of five.

- (c) The EVFE Subgroup also recommends removing the term and abbreviation for the “joule” unit of measurement, the No Load Test and Starting Load Test notes and their corresponding tolerances from the code requirements because these conditions are never encountered by a customer. An EVSE never operates at no load for any significant time. The Starting Load Test should not be required because the EVSE never operates at 0.5A.

#### **Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Ms. Scheleese Goudy (Electrify America) – Stated: Generally okay with this item. She doesn’t recall if there was a consensus on the 0.01 kWh. The pinging of the back-end system could go past the capabilities of the charger and there is no added benefit to the customer. We suggest that the 0.01-kilowatt hour be removed.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Commented: DMS Can stand in support of the item and recommend that the 0.01 kWh issue be addressed.

Ms. Francesca Wahl (TESLA) - Seconded the comments regarding the 0.01 recommendation.

Mr. Chris King (Siemens) – Agreed with TESLA.

During open hearings, comments were heard supporting a voting status with exception of the “0.01 kWh” edit in the section S.2.5.1. portion of the proposal. The WWMA S&T Committee believes that this item has merit, and recommends that this item be assigned a voting status with the following edit:

**S.2.5.1. Money-Value Divisions Digital.** – An EVSE with digital indications shall comply with the requirements of paragraph G-S.5.5. Money-Values, Mathematical Agreement, and the total price computation shall be based on quantities not exceeding ~~0.5 MJ or 0.01 kWh~~ **0.1 kWh**.  
**(Amended 202X)**

The WWMA S&T Committee requests the submitter address the formatting of their proposal to meet NCWM standard editing requirements.

SWMA 2022 Annual Meeting: Ms. Goudy of Electrify America submitted the updated wording, which is newly adopted by the NIST workgroup as of October 2022. She recommends moving this item forward as a voting item with the following wording:

**S.2.5.1. Money-Value Divisions Digital.** – An EVSE with digital indications shall comply with the requirements of paragraph G-S.5.5. Money-Values, Mathematical Agreement, and the total price computation **at the end of a transaction** shall be based on quantities not exceeding ~~0.5 MJ or 0.01 kWh~~.

The SWMA S&T Committee recommends this item move forward as a Voting Item with the above wording.

CWMA 2022 Interim Meeting: Scheleese Goudy – Electrify America, Opposed to the 0.01 kWh statement of S.2.5.1. This is unreasonable for the communication network system which would have to work in the background to “ping” at this rate.

Francesca Wahl – Tesla, Remove the 0.01 kWh change and move everything else forward as voting.

Craig VanBuren – Michigan, The difference between 0.1 kWh and 0.01 kWh is not significant: approximately 0.4 cents. Supports moving forward with that change.



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

**S.2.5.1. Money-Value Divisions Digital.** – An EVSE with digital indications shall comply with the requirements of paragraph G-S.5.5. Money-Values, Mathematical Agreement, and the total price computation shall be based on quantities not exceeding ~~0.5 MJ or 0.9~~ kWh.

**(Amended 202X)**

NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) explained that 0.1kWh for DC could be an issue due to communication speeds. Mr. Bradley suggested modifying the language to “...total price computation at the end of the transaction”. Ms. Juana Williams (NIST-OWM) indicated that the EVSE Subgroup is making further modifications to this item., Ms. Francesca Wahl (Tesla) agreed with the language modification suggested by Mr. Bradley. Mr. Lou Sakin (Holliston, MA) recommended that this item be developing.

After hearing comments from the floor, the Committee believes the item has merit. The Committee recommends that the item be given a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **EVF-23.2      W      S.2.7. Indication of Delivery**

### **Source:**

Siemens Industry Inc., Smart Infrastructure eMobility

### **Purpose:**

Provide consistent treatment of AC and DC chargers on the topic of Indication of Delivery.

### **Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

**S.2.7. Indication of Delivery.** – The EVSE shall automatically show on its face the initial zero condition and the quantity delivered (up to the capacity of the indicating elements). All AC and DC EVSE are exempt from this requirement until January 1, 2028.

### **Previous Action:**

2023: New Item

### **Original Justification:**

At the 2022 NCWM, the conference recognized that for DC chargers, the vast majority of commercially deployed DC chargers do not have the Indication of Delivery specified in HB 44, and EV drivers are easily able to use them and pay for the charging by using a smart phone app. The same facts apply to AC chargers.

Most of the industry has not provided AC or DC chargers with an Indication of Delivery, because HB 44 was not adopted by any of the states until recently (FL in November 2021, with the advent of NTEP certification for AC chargers). The impact of additional states adopting NTEP certification without the proposed amendment would mean that customers would be precluded from purchasing most brands of AC chargers. The effect would be to greatly reduce both customer choice and competition, resulting in higher prices for AC chargers and slower deployment, which, in turn, would slow EV adoption. Having fewer manufacturers competing in the market would also exacerbate AC charger lack of availability due to supply chain issues. The NCWM in July 2022 recognized these problems and decided to adopt the language regarding DC chargers.

The opposing arguments would be, first, that there are, in fact, some AC chargers that have the Indication of Delivery on their face – but these are limited and much more expensive. Second, that the industry could have anticipated the requirement; however, no state formally adopted HB 44 until FL did so in legislation in February 2021 – and even that legislation delayed the adoption further, until the NTEP certification program was put in place in November 2021.

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

**Comments in Favor:**

**Regulatory:**

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**Industry:**

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**Advisory:**

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**Comments Against:**

**Regulatory:**

- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) recommends an assigned status of Withdrawn. Mr. Schnepf added there are over 14 EV devices that meet this display requirement and added there is no benefit to consumers in adopting this item.
- 2023 Interim: Mr. Steve Timar (New York Department of Agriculture and Markets) recommends an assigned status of Withdrawn.

**Industry:**

- 2023 Interim: Mr. Jared Ballew (ChargePoint) believes the item does not have merit, as there are many AC EVSE devices installed that meet this display requirement. Mr. Ballew recommends the item be assigned a Withdrawn status.

**Advisory:**

- 2023 Interim: Ms. Tina Butcher (NIST OWM) recommends the item be assigned a Withdrawn status.

**Neutral Comments:**

**Regulatory:**

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**Industry:**

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**Advisory:**

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**Item Development:**

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and agrees the item does not have merit, as there are AC EVSE devices that meet the requirement. The committee has withdrawn this item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Chris King (Siemens) – Stated: The voting item was approved at the NCWM. It all comes down to customer choice as well as cost. Most models do not have this indicator. All of them provide the info to the customer through an app and it has worked well for years. We support extending this exemption to the face of all AC and DC EVSE. The models that do have this are 2 to 3 times more expensive. Allowing this change would reduce costs for customers buying this EVSE.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Stated: California already has this requirement for AC EVSE's. Mr. Schnepf cautioned the body; they are proposing a device that puts the onus on the customer. This is wrong. There are 16 devices already approved that meet the requirements. I recommend withdrawal.

Ms. Francesca Wahl (TESLA) – Agreed with Siemens.

During open hearings, comments were heard that there are AC EVSE devices approved and in use that meet the current requirement. The WWMA S&T Committee recommends withdrawal of this item.

SWMA 2022 Annual Meeting: Mr. Prince, State of Florida, stated that this has been addressed and the item should be withdrawn.

Ms. Goudy of Electrify America stated that this would modify a brand-new proposal and should be withdrawn.

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

CWMA 2022 Interim Meeting: Francesca Wahl – Tesla, No direct position. Generally supportive of the consistency. The justification section for this item in the agenda is not accurate. The current version is online.

Craig VanBuren – Michigan Recommend developing.

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

NEWMA 2022 Interim Meeting: Ms. Francesca Wahl (Tesla) stated that she believes there is merit for discussion but additional details would be helpful. Ms. Juana Williams (NIST-OWM) pointed out there are AC systems that meet this requirement and are already type-approved in California. Mr. Jason Flint (NJ) and Mr. Jim Willis (NY) suggested that this item be given a developing status.

After hearing comments from the floor, the Committee believes that this item has merit. The Committee recommends that this item be given a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**EVF-23.3      W      S.2.7. Indication of Delivery**

**Source:**

Power Measurements LLC

**Purpose:**

Reduce the exemption for DC EVSE from 2028 to 2025.

**Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

**S.2.7. Indication of Delivery.** – The EVSE shall automatically show on its face the initial zero condition and the quantity delivered (up to the capacity of the indicating elements). All DC EVSE are exempt from this requirement until January 1, ~~2028~~2025.

**Previous Action:**

2023: New Item

**Original Justification:**

The requirement for a display has been in the code since its inception in 2016. On December 31, 2015 (just before HB44 3.4 was published with tentative status) there were only 2,377 DC EVSE installed. Of these 1,790 were from a single provider, Tesla. By December 31, 2017 (two years after the code was published) there were only 3,708 DC EVSE of which 2,883 were Tesla. At that point in time the only manufacturer not producing EVSE which complied with the display requirement in S.2.7 was Tesla. They remain the only noncompliant supplier today, seven years after the code was initially published. There is no technological reason for Tesla not to provide a display on their EVSE.

People have argued that retrofitting DC EVSE with displays would be extremely expensive. First manufacturers have had seven years to comply with the display requirement. All but one have complied. Non-compliance was a conscious business decision to ignore the requirement. Second, Tesla generally places multiple chargers at each location and at each location has a data/control device for the entire installation. Since HB44 allows a single information kiosk for multiple EVSE it would be quite economical to put in a single display pedestal for all EVSE installed at a single location.

Tesla has an elegant customer experience where the charging transaction is authorized, and all of the information desired by the customer is displayed on the vehicle's display. That provides a good driver experience but does not allow testing of the EVSE as per the Handbook. Tesla has recently announced that it intends to begin offering charging to non-Tesla EVSE. Those vehicles will not have access to the data provided on a Tesla display.

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

**Comments in Favor:**

**Regulatory:**

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**Industry:**

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**Advisory:**

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**Comments Against:**

**Regulatory:**

- 2023 Interim: Mr. Craig VanBuren (Michigan Department of Agriculture) supports withdraw of the item. He added NCWM membership worked to an agreeable proposal in July 2022 which passed at the annual meeting.
- 2023 Interim: Mr. Hal Prince (Florida Department of Agriculture and Consumer Services) recommends the item be withdrawn, agreeing to Mr. VanBuren's and Ms. Wahl's comments.

**Industry:**

- 2023 Interim: Ms. Francesca Wahl (Tesla) supports the withdraw of this item. She added the date change was approved by the NCWM membership in July 2022, and there is no justification to move

the date. Ms. Wahl referred to previous recommendations and noted that three regional associations recommended a Withdrawn status.

**Advisory:**

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**Neutral Comments:**

**Regulatory:**

- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) recommends an Informational status, allowing for information gathering and discussion to address technological advances with the Committee and NCWM membership. Mr. Schnepf added that California has already experienced consumer complaints and is worth discussing further.

**Industry:**

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**Advisory:**

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**Item Development:**

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and has withdrawn this item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Ms. Francesca Wahl (TESLA) – Commented: We believe this item should be withdrawn. Two months ago, the 2028 date was adopted. There is no real merit in moving up to the 2025 date.

Ms. Scheleese Goudy (Electrify America) – Agreed with TESLA.

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) - Stood to support this item. DMS thinks that 2028 exemption is too long, technology can already meet the requirements and supports a voting status.

Mr. Chris King (Siemens) - Supported the comments of TESLA.

During open hearings comments were heard that there are already devices which meet the current requirement. The WWMA S&T Committee believes that this item has merit, is fully developed, and recommends that this item be assigned a voting status.

SWMA 2022 Annual Meeting: Mr. Prince, State of Florida, stated that this has been addressed and the item should be withdrawn.

Ms. Goudy of Electrify America stated that this item would modify a brand-new proposal and it should be withdrawn.

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

CWMA 2022 Interim Meeting: Francesca Wahl – Tesla, Withdraw. No additional justification as to why the date should be changed. No supporting data.

Craig VanBuren – Michigan, Withdraw. Both industry and regulators worked in good faith to come to this consensus of a 5 year time allowance. Federal administration has indicated that this would be contended if it passed.

Scheelese Goudy – Electrify America Withdraw

The CWMA S&T Committee recommends this item be withdrawn.

NEWMA 2022 Interim Meeting: Ms. Juana Williams (NIST-OWM) stated that the EVSE Subgroup has no recommendation at this time. Ms. Francesca Wahl (Tesla) recommends withdrawal. She noted that at the 2022 NCWM Annual meeting, the EVSE code was fully adopted as enforceable, and no justification was made within this proposal to roll back the date to 2025. Mr. Keith Bradley (Electrify America), Marc Paquette (VT), Mr. James Cassidy (MA), and Mr. Jim Willis (NY) all agree with the statements of Ms. Wahl and agree with a withdrawal status.

After hearing comments from the floor, the Committee does not believe this item has merit. The submitter did not provide reasoning to roll back the date to 2025. The Committee is recommending that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

**Source:**

Power Measurements LLC

**Purpose:**

Update the details of the recommended tests in HB44 3.40 to better conform to current practice and Pub 14 instructions.

**Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

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

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

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

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

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

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

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

And

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

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

**(1) For AC EVSE**

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

**(2) For DC EVSE**

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

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

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

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

(a) For AC systems:

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

- (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; and

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

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

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

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

(i) A point at less than 30A;

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

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

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

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

(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:**

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

For DC systems three test points are proposed:

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

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

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

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

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

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

#### Comments in Favor:

##### Regulatory:

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##### Industry:

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##### Advisory:

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#### Comments Against:

##### Regulatory:

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##### Industry:

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##### Advisory:

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#### Neutral Comments:

##### Regulatory:

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

##### Industry:

- 2023 Interim: Mr. Keith Bradley (Electrify America) commented to one of the challenges in testing low current with the testing equipment. He expressed concerns with N.5.1.(b)(1)(i) and recommends a Developing status to evaluate the Note section.

- 2023 Interim: Ms. Francesca Wahl (Tesla) commented the item needs further development and recommends the submitter work with the NIST USNWG EVFE Subgroup on developing the item.

**Advisory:**

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

**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. The Committee discussed and changed the title to clarify the intent of the proposal.

**Regional Associations' Comments:**

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

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

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

Mr. Kevin Schnepf (State of California, Division of Measurement Standards) – Mr. Schnepf commented there is some concern about the language for specifications and tolerances. Mr. Schnepf recommends this item be assigned to a work group. 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 USNWG to address the comments heard during open hearings and that they work to develop one proposal by combining language from EVF-23.7.

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

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

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

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

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

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

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

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

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**EVF-23.5      W      S.5.2. EVSE Identifications and Marking Requirements, N.5.2. Accuracy Testing, and T.2. ~~Load~~ Accuracy Test tolerances.**

**Source:**

Power Measurements LLC

**Purpose:**

Update the tolerances for DC EVSE and change the effective date to January 1, 2024. Make the new tolerance retroactive effective January 1, 2025.

**Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

**S.5.2. EVSE Identification and Marking Requirements.** – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and indelibly 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).(Amended 2021), and

(f) For EVSEs subject to a tolerance of 5% (see paragraph T.2.1.) a notice shall be conspicuously, legibly, and indelibly displayed, in a position plainly visible to a person accessing a charging port of the EVSE which states:

**NOTICE:**

**“This charger operates at a tolerance of 5 percent versus  
chargers which operate at a tolerance of 2 percent.”**

**EVSEs subject to a tolerance of 1 % Acceptance and 2% Maintenance Tolerance are not  
required to be marked with such a statement.**

And

**N.5.2. Accuracy Testing.** – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

(b) For DC systems (see note):

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

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

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

And

**T.2. ~~Load~~ Accuracy Test Tolerances.**

**T.2.1. EVSE ~~Load~~ Accuracy Test Tolerances.** – The tolerances for EVSE ~~load~~ accuracy tests for all AC EVSE and for DC EVSE installed on or after January 1, 2025 are:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

**For DC EVSE installed prior to January 1, 2025 tolerances for the accuracy tests are:**

(a) Acceptance Tolerance: 5.0 %; and

(b) Maintenance Tolerance: 5.0 %.

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

(Amended 2022)

**Original Justification:**

This topic has been discussed in the NIST Working Group numerous times. Most recently it appeared that the group was obtaining consensus on the language presented here. Industry has reported that their testing of existing systems suggests that they would comply with the proposed error limits of +/- 5% without requiring any infield upgrades. Since thousands of new DC EVSE are planned under current Federal programs it is very important to have some known level of accuracy for all EVSE in the field. The 5% level for all systems installed prior to January 1, 2025 is a reasonable approach that should have no negative effects on the industry. Delaying a specified accuracy to 2028 opens the market up to inequities and fraud.

This proposal has significant financial advantage to industry. Under it all systems installed before January 1, 2025 would be permanently grandfathered in at the +/- 5% tolerance levels until they were retired or had a repair which required recertification.

The time frame discussed most recently in the NIST WG was for this change to be effective January , 2024. That was to some extent predicated on getting this change into the code in 2023. In this submission the date has been delayed to January 1, 2025 to allow everyone to be fully prepared for its implementation.

The principal argument made against this requirement has been that systems cannot be made to comply in a reasonable time or for a reasonable amount of investment. More recent testing of existing systems has shown that with the relaxed tolerance of +/- 5% the vast majority of systems already installed would qualify.

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

#### **Comments in Favor:**

##### **Regulatory:**

- 2023 Interim: Mr. Craig VanBuren (Michigan Department of Agriculture) supports the item as voting with editing and recommends that one of the two items (EVF-23.5 or EVF-23.6) moves forward to a Voting status.

##### **Industry:**

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##### **Advisory:**

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#### **Comments Against:**

##### **Regulatory:**

- 2023 Interim: Mr. Hal Prince (Florida Department of Agriculture and Consumer Services) commented on the 2028 date, providing support for this date which was voted on during the 2022 NCWM Annual meeting. Mr. Prince commented he favors item EVF-23.6, although adding he may be supportive of the item if the date exemption was not struck, Pub 15, page S&T-274, line 11.
- 2023 Interim: Mr. Mahesh Albuquerque (Colorado Division of Oil and Safety) agreed with Mr. Hal Prince's comments, expressing his preference for item EVF-23.6.

##### **Industry:**

- 2023 Interim: Mr. Keith Bradley (Electrify America) referred to the letter submitted and recommends withdraw of the item. Mr. Bradley commented on the 5% tolerance proposed does not included legacy devices. He added there is no available equipment to test these devices.
- 2023 Interim: Ms. Francesca Wahl (Tesla) agreed with Mr. Bradley's comments and recommends withdraw of the item. Ms. Wahl added the need for clarification on the dates in the item. Ms. Wahl added the 2028 was based on the lack of test equipment to test DC EVSEs.

##### **Advisory:**

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#### **Neutral Comments:**

##### **Regulatory:**

- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) suggested that the submitters of this item (EVF-23.5) and EVF-23.6 work together to develop a single proposal and agrees with Ms. Butcher to amend language to address accuracy and marking requirements.

**Industry:**

- 2023 Interim: Mr. Perry Lawton (TESCO) commented on TESCO's capability to test DC EVSEs with certified equipment. Mr. Lawton added the TESCO TS 400 testing standard is ready to test DC EVs.

**Advisory:**

- 2023 Interim: Ms. Tina Butcher (NIST OWM) referred to the written comments submitted by NIST OWM and commented the item has merit and recommends the submitters of this item (EVF 23.5) along with EVF 23.6 work together to develop a single proposal, to address accuracy and marking requirements. Ms. Butcher added the two dates of 2025 and 2028 should be clarified.

**Item Development:**

NCWM 2023 Interim Meeting: The Committee considered the comments heard during open hearings and decided to withdraw the item. The committee moved forward with EVF-23.6 as a Voting item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Ms. Francesca Wahl (TESLA) – Ms. Wahl commented TESLA opposes this item and proposed this item looks to moving up the date that was recently adopted at the July 2022 NCWM, from 2028 to 2025. Ms. Wahl proposed this item be combined and harmonized with EVF-23.6. Ms. Wahl recommended a withdrawal status.

Ms. Scheleese Goudy (Electrify America) – Ms. Scheleese commented Electrify America agrees with TESLA's comments.

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-23.6.

The WWMA S&T Committee recommends that this item be blocked with item EVF-23.6. The WWMA S&T Committee recommends the new blocked items be assigned a developing status.

SWMA 2022 Annual Meeting: Mr. Prince, State of Florida, stated that this issue has been addressed and that this item should be withdrawn.

Ms. Goudy of Electrify America stated that this item should be withdrawn.

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

CWMA 2022 Interim Meeting: Francesca Wahl – Tesla, Withdraw. This is already covered in EVF-23.6. The NIST USNWG does not agree with this. This is another proposal to try to move up the already agreed upon 2028 date.

Craig VanBuren – Michigan, Withdraw

Scheleese Goudy – Electrify America, Withdraw

The CWMA S&T Committee recommends this item be withdrawn.

NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) and Ms. Francesca Wahl (Tesla) requested that this item be withdrawn. Ms. Juana Williams (NIST-OWM) commented that the EVSE Subgroup has not had the time to vet this item and requested that it be developing. Mr. Marc Paquette (VT) noted that there are currently no traceable standards to test DC devices and requested a developing status. Mr. Lou Sakin (Holliston, MA), Mr. John

McGuire (NJ), and Mr. Walt Remert (PA) agreed with Mr. Paquette's comments and also requested that the item have a developing status.

After hearing comments from the floor, the Committee believes that this item has merit. The Committee recognizes the current limitations in testing DC devices. The Committee is recommending that this item be assigned a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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

### **Source:**

Florida Department of Agriculture and Consumer Services; Electrify America; Tesla; EVGo, Siemens

### **Purpose:**

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

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

### **Item under Consideration:**

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

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

- (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 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.**

**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.

The proposal would require a charger that is subject to the 5% tolerance to display a marking, with specified language, informing customers and inspectors of that fact. But the proposal leaves open the possibility that a given manufacturer might achieve the 1%/2% tolerance earlier, and then would specify that capability for

a given model. Devices in that model would not have to be marked as 5% devices; but if they are not marked that way, they would of course be subject to the 1%/2% level as for new chargers.

## B. The basic justification

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

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

One indication of the relatively mature state of AC metering is that NIST has long provided ordinary-course calibration services for AC watt-hour meters that operate at 60 Hertz, within ranges of 69 to 480 volts and 0.5 to 30 amps (sufficient to cover typical AC chargers).<sup>5</sup> DC metering technology, by contrast, has been “in research and development.”<sup>6</sup> When section 3.40 was adopted, the accuracy tolerances of 1.0% (acceptance) and 2.0% (maintenance) were predictive and aspirational for DC chargers. As of November 2019, when California adopted its own regulation based on section 3.40, meters and chargers meeting that standard were not yet generally commercially available.<sup>7</sup> Meanwhile, NIST calibration services for DC watt-hour meters are non-standard, and are available only up to 240 volts and 5 amps<sup>8</sup>—far below the levels needed for testing DC chargers.

Argonne National Lab has studied the availability of DC metering technology. Our understanding is that its draft report (not yet finalized, so far as we are aware) concludes that there are now on the market (at least in principle) meters for use in DC chargers that can meet a 1% acceptance / 2% maintenance tolerance. It is reasonable to conclude that the 1% / 2% tolerance will be achievable in general. The current proposal is focused on how to handle the chargers that are installed before that point. Previously installed chargers will not in general be able to satisfy a 1% / 2% accuracy tolerance. To be clear, we do not suggest that every existing charger would be more than 2% inaccurate. Indeed, it would not genuinely be possible

<sup>3</sup> Idaho National Laboratory, “Plugged In: How Americans Charge Their Electric Vehicles,” p.14, <https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf>.

<sup>4</sup> 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.

<sup>5</sup> [https://shop.nist.gov/ccrz/ProductDetails?sku=56200C&cccl=en\\_US](https://shop.nist.gov/ccrz/ProductDetails?sku=56200C&cccl=en_US).

<sup>6</sup> Cal. Dep’t of Food & Agriculture, Final Statement of Reasons on Electric Vehicle Fueling Systems, p.23 (Nov. 1, 2019).

<sup>7</sup> Id.

<sup>8</sup> [https://shop.nist.gov/ccrz/ProductDetails?sku=56110S&cccl=en\\_US](https://shop.nist.gov/ccrz/ProductDetails?sku=56110S&cccl=en_US).

1 to make that assessment, given the lack of NIST-traceable measurement apparatus to test fast DC chargers  
2 in the field.

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

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

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

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<sup>9</sup> 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.

<sup>10</sup> [https://www.cdca.gov/dms/pdfs/regulations/EVSE\\_ISOR.pdf](https://www.cdca.gov/dms/pdfs/regulations/EVSE_ISOR.pdf).

without a detailed model-by-model study and detailed model-by-model installation data across manufacturers. The upper end of cost would be simply the cost of replacing a charger, which many operators would find preferable to physical reconfiguration of charger internals anyway. The International Council on Clean Transportation (“ICCT”) reported in 2019 that fast DC chargers cost between \$75,000 and \$140,000 per charger, for the charger itself.<sup>11</sup> Installation costs range from \$18,000 per charger (for six 150 kW chargers at a site) to \$65,000 per charger (for one 350 kW charger at a site).<sup>12</sup> The total cost (installation and equipment) for a 4-charger site would be roughly \$720,000. That said, some amount of the installation cost represents upgrades to electrical supply lines and basic site construction, costs that would not be incurred anew to replace equipment. So for a rough estimate, it is appropriate to use the lowest cost estimate from the ICCT, which is \$17,692 (the cost per charger for a large site of 50 kW chargers). With that figure, replacing a 4-charger site of 350 kW chargers would cost roughly \$630,000, or \$157,000 per charger.

4. Based on data on the existing charge base from the National Renewable Energy Laboratory’s Alternative Fuels Data Center (“AFDC”), we can assume there will be about 36,000 “pre-2024” DC chargers.<sup>13</sup> These are only a fraction of the overall chargers that will be installed nationwide over the coming decade, but bringing them into compliance with a 1%/2% tolerance will be highly costly. Taking out the 30% that are in California (which already has regulations with a 5.0% maintenance tolerance, for all post-2023 DC chargers), retrofitting all of those at the \$20,000 cost would total \$720 million. If meter replacement is not possible and those chargers must all be replaced, the total would be \$5.6 billion. The actual cost of bringing the pre-2024 chargers to compliance with a 2.0% maintenance tolerance would be somewhere between these numbers.<sup>14</sup>
5. The January 2024 date moves faster than the California regulation. Under the California regulation, the 1% / 2% tolerance would not come into force until 2033. It appears that meters capable of that tolerance are now available on the market. The submitters propose January 2024 as the date for distinguishing “legacy” from “new” chargers, because the existence of these meters on the market is not all that is needed. Manufacturers have to access the meters, design products incorporating them; revise production lines; test the new products to ensure they are safe and reliable; and obtain third-party certifications (such as from Underwriters Laboratory) of the revised products. After those steps, a manufacturer can begin delivering a revised product to operators. Installation of a charger is not simply a matter of placing it on a counter; charging sites involve construction work, leading to the secure attachment of a charger to a specially built concrete pad. In other words, from the first delivery of a new model of charger to the first installations of those chargers also takes time. The January 2024 date is appropriate for expecting new chargers to incorporate meters that were available a few years before that date.
6. The proposal focuses on installation before January 2024, rather than using the concept of retroactive/non-retroactive that is more common in Handbook 44, because non-retroactive is ordinarily based on when a device is placed in service. Many states do not yet regulate EV chargers and consequently have no placed-in-service process. In these states, “placed in service” would not

<sup>11</sup> 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](https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf).

<sup>12</sup> Id. at 4 tab. 4.

<sup>13</sup> 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](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.

<sup>14</sup> 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.

be a well-defined concept, and regulators might not have good ways to determine when a device was placed in service. Installation is a reasonably well-defined process, and it should be possible to identify when a given charger was installed. California's regulation has differing status for pre-2023 and post-2023 chargers, and it bases that line on installation.

7. The proposal also specifies 5.0% as the acceptance tolerance, not just the maintenance tolerance. As a practical matter in field inspections, the acceptance tolerance for pre-2024 chargers will not be important. Section 3.40 (as amended at the 2022 NCWM meeting) exempts DC chargers from the accuracy tolerance until 2028. When they become subject to accuracy tolerances, no pre-2024 charger will be at the point of acceptance. The proposal specifies an acceptance tolerance for clarity in type evaluations, which ordinarily evaluate device models against the applicable acceptance tolerance.
8. The exemption until 2028 adopted at the 2022 meeting does not eliminate the need for this proposal. When DC chargers are subject to accuracy tolerance requirements, pre-2024 chargers will still need to meet the applicable tolerance or be retrofitted or replaced. The 2028 time frame is unreasonably soon to do that, given the cost estimates above. California estimated that chargers have an effective 10-year lifespan.<sup>15</sup> This estimate is highly uncertain, in part because it was based in part on older AC chargers. Newer DC chargers, using more advanced technology for significantly more expensive equipment, are likely to have usable lifetimes greater than 10 years. The proposal recognizes that, nonetheless, there is a tradeoff between the cost of retrofitting or replacing devices, and the value of tighter tolerances. Some number of chargers will fail and need replacement earlier than 10 years, thus reducing the number that eventually need to be retrofitted or replaced to comply with tighter accuracy tolerances. Overall, the proposal uses the same 10-year period that several states have already adopted.<sup>16</sup> Notably, the effect is significantly more stringent than in the California regulation. Under California's rule, a charger installed before 2023 is subject to no standards for 10 years, and then becomes subject to standards in 2033; a replacement of the charger in 2032 would be subject to the 5.0% maintenance tolerance. A charger installed in 2023 (and that hypothetical 2032 installation) would be subject to the 5.0% tolerance indefinitely, with no end point. Our proposal, by contrast, would make a pre-2024 charger subject to the 5.0% tolerance once the 2028 compliance dates kick in but only until 2034, at which point the charger would have to be retrofitted, replaced, or otherwise brought to the 1%/2% tolerance.

### C. Potential objections

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

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

<sup>15</sup> Cal. Dep't of Food & Agriculture, Final Statement of Reasons, p.6.

<sup>16</sup> 4 Cal. Code of Regulations § 4002.11; Rev. Code Wash. § 19.94.190(6).

addition, there are already parallel, differing tolerances for EV chargers. If the proposal is not adopted, pre-2023 chargers in California will have no tolerance at all until 2033; post-2023 chargers will have a 5.0% maintenance tolerance for the indefinite future; and chargers elsewhere in the country, including in states neighboring California, will have the existing Handbook 44 tolerances. The proposal shifts the line between differing tolerances, but the situation of differing tolerances for the same application is already in place without the proposal.

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

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

## Comments in Favor:

### Regulatory:

- 2023 Interim: Mr. Craig VanBuren (Michigan Department of Agriculture) supports the item as voting with submitted edits.
- 2023 Interim: Mr. Hal Prince (Florida Department of Agriculture and Consumer Services) supports the item as Voting, adding the EVF-23.5 is not complete and is missing needed language. Mr. Prince expressed the item is critical and is willing to work with the NIST USNWG EVFE Subgroup to move the item forward.
- 2023 Interim: Mr. Mahesh Albuquerque (Colorado Division of Oil and Safety) supports developing the item with suggestive edits, striking language in T.2.2.(b).

### Industry:

- 2023 Interim: Mr. Keith Bradley (Electrify America) commented on the 5% tolerance proposed in the item. Mr. Bradley referenced the October 15, 2022 letter submitted to the Committee and added the item does not create a conflict with the tolerances and the 2028 date.
- 2023 Interim: Ms. Francesca Wahl (Tesla) agreed with Mr. Bradley’s comments and supports a Voting status.

### Advisory:

- 

## Comments Against:

### Regulatory:

-

**Industry:**

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**Advisory:**

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**Neutral Comments:****Regulatory:**

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

**Industry:**

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**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.

**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.

**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.

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

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

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

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

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

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

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

**S.5.2. EVSE Identification and Marking Requirements.** – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and indelibly 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 Limits, DC EVSEs Installed Prior to 2024. - A DC EVSE installed prior to 2024 shall be marked with the following unless it is certified to the tolerances of T.2.2(b):**

**NOTICE:**

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

**(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.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

27 **EVF-23.7 D ~~N.1. No Load Test, N.2. Startin Load Test,~~ N.5.2. Accuracy Testing, And**  
28 **Appendix D: maximum deliverable amperes.**

29 **Source:**  
30 Electrify America

31 **Purpose:**  
32 The proposal would have the testing conducted at the contemplated 10%. Because it is unlikely that tests would  
33 actually be at precisely 10%, the proposal would allow testing in a small range slightly above 10%.

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

36 **~~N.1. No Load Test. A no load test may be conducted on an EVSE measuring system by~~**  
37 **~~applying rated voltage to the system under test and no load applied.~~**

38 **~~N.2. Starting Load Test. A system starting load test may be conducted by applying rated~~**  
39 **~~voltage and 0.5 ampere load.~~**

**N.5.2. Accuracy Testing.** –The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

(a) For AC systems:

- (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes ~~(expressed as MDA) as determined from the pilot signal~~ for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.
- (2) Accuracy test of the EVSE system at a load ~~not greater than~~ between 10 % and 20% of the maximum deliverable amperes ~~(expressed as MDA) as determined from the pilot signal~~ for a total energy delivered of at least the minimum measured quantity (MMQ).

(b) For DC systems (see note):

- (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes ~~current (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard~~ for a total energy delivered of at least twice the minimum measured quantity (MMQ).
- (2) Accuracy test of the EVSE system at a load ~~between not more than~~ between 10 % and 20% of the maximum deliverable amperes ~~(expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard~~ for a total energy delivered of at least the minimum measured quantity (MMQ).

All DC EVSE are exempt from this requirement until January 1, 2028.  
(Amended 2022)

Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient provided that it is greater than 30% of the maximum deliverable amperes of the EVSE system.

Appendix D:

maximum deliverable amperes. - The value in amperes, marked on an EVSE pursuant to paragraph S.5.2. EVSE Identification and Marking Requirements, of the maximum current that the EVSE can provide.

**Previous Action:**

New item in 2023

**Original Justification:**

The accuracy tests in section 3.40 contemplate testing an EV charger at two points, one at relatively low current and power, and the other at relatively high current and power. The low point was evidently intended to be at 10% of a charger's maximum current. It is likely that charger manufacturers have designed chargers with that 10% in mind as the "low" point of accuracy tests. But the code does not actually state that testing should be *at* 10%. It says testing can be at a current *less than* 10%. This formulation is problematic because it encompasses any current less than 10%. Zero is less than 10%, and 0.1 A is less than 10% even though it is less than the amount at which the code requires a charger to first register a load.

Even currents larger than these, but less than 10%, would be unnecessarily difficult for an accuracy test. The problem is that low currents are an area where accuracy is particularly difficult. For example, one common metering

configuration is to measure the current being delivered by means of a shunt resistor, which generates a voltage from the high current passing through it. These resistors necessarily have very low resistances, because they are necessarily dissipating power in accordance with the resistance. A typical resistor in an EV charger metering setup might be 100 micro-ohms. For a 500 amps full-scale current in a DC charger, that resistor would be dissipating 25 watts of power - thus, a much larger resistor is not a practical option. At, say, 10 amps of delivered current, the voltage generated across the resistor would be 1 millivolt. A 1% measurement of that 1 millivolt would be 10 microvolts. At that level, a range of noise sources become quite significant, such as thermal EMF in the resistor itself and induced EMFs from the presence within the charger cabinet of voltages up to 480 volts ac or 950 volts dc, as well as any offsets or noise in the circuitry measuring the transduced voltage. The net result is that it is very challenging to achieve high accuracy at low currents in a device designed to handle and measure high currents. For reasons like these, the draft international (OIML) standard specifies that an accuracy test should be conducted *at* a given minimum current, rather than (like current Handbook 44) at any current *up to* that minimum.

Meanwhile, low currents are the levels least significant for transactional accuracy. At low current, a charger is delivering energy at a relatively low rate. As a practical matter, an EV will charge at the maximum rate possible in the circumstances. As the battery reaches a higher state of charge, it will draw less power from the EV, but only a small proportion of the overall energy will be delivered at low rates, precisely because the rates are low. Suppose, as a simplified example, an EV charges for 30 minutes at 300 amps and 30 minutes at 15 amps (at a voltage of 400 volts). The EV will have received 60 kWh in the first part of the session, and only 3 kWh in the second part. The low-current period of charging contributes relatively little to the accuracy/inaccuracy of the overall transaction.

Thus, it is important for Handbook 44 to set a minimum current for accuracy tests. Because the point of 10% of the maximum deliverable amperes is already in the code and has probably been used as a design basis for chargers, the proposal would keep that as the low-current point. The overall concept would be for testing to occur *at* 10% of maximum deliverable amperes, rather than *up to* 10%. But it is impractical to specify a single point. An inspection that does not achieve a test at precisely the 10% should not, as a consequence, be an invalid inspection. To make this practical, the proposal would have the low-end test occur in a range of currents, namely 10% to 20% of the charger's maximum.

The code presents a similar problem for DC chargers tested using EVs as loads. The code allows an EV to be used as the load, rather than using a controlled load that draws the loads specified in the code. But the code provides no specifications about how to use an EV in this sort of test. So it is possible that a tester could use an EV that is, say, at 95% state of charge in the battery, and that would arrive at the charger and draw very low levels of current (sometimes called a "trickle charge"). For the reasons discussed above, that sort of test would not be a productive test of the meaningful accuracy of the charger. The code should set a minimum current for an EV-based test to be usable. The proposal would have that minimum be 30% of the charger's maximum. It is set at more than 10% because the EV-based test uses a single test point, which should therefore be somewhere in the middle of the charger's range.

The proposal would also add a definition of "maximum deliverable amperes." This quantity is the same as used in the existing code as the basis for the 10% figure, but it is not currently defined. The definition would state that maximum deliverable amperes means the amount marked on the charger. (The code already requires that amount to be marked.) This amount might be less than the manufacturer's specification for the potential maximum of the device, if for example the installation limits the charger to a particular amount, or the installer has selected a configuration with a lower maximum. But the maximum deliverable amount is a quantity that is fixed at installation, and marked on the charger. The current code suggests that maximum deliverable amperes is the amount that the charger communicates to a vehicle or test apparatus. That approach is confusingly ambiguous, because the charger might for various reasons sometimes communicate a lower available current than its marked maximum. The proposal clarifies that for accuracy tests based on a percentage of maximum current, the "maximum" being used is the maximum marked on the device.

These concepts have been discussed in the U.S. National Work Group's subgroup on EV charging. There is general consensus in favor of the proposal, but there has not been a quorum to vote formally in favor of it.

Finally, the proposal would eliminate the no-load and starting-load tests. These tests take unnecessary time, because an inspector has to wait to verify that a load of zero genuinely produces no response and a starting load of just 0.5 amps produces a response. Meanwhile, these tests are not meaningful for the transactional accuracy of an EV charger. In the process of establishing a handshake that the EV charger is connected to a vehicle, the charger might provide minute test amounts of current, so that a truly zero load is not pertinent to any real transaction; and these minute test currents may well be above 0.5 amps, so that this threshold is also not pertinent to transactions. It would be possible to verify that a charger does not register an energy delivery when no transaction is started, but that test would be redundant of verifying that the charger starts at zero. Meanwhile, 0.001 kWh (the minimum resolution under Handbook 44) corresponds to roughly 3 to 5 hundredths of a cent, so that verifying the registration of such tiny amounts given a tiny current is not helpful for the overall transactional accuracy.

The submitter is not aware of objections that would be raised to this proposal. The concept is consistent with the discussions at the U.S. National Work Group based on information from testing over the past six years, and input from regulators and industry.

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

**Comments in Favor:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- 2023 Interim: Mr. Ed Williams (Ventura County Agricultural Commissioner, CA) commented the language needs clarification on the maximum deliverable amperes and suggested the current language may be restrictive since there is a prescriptive range to test within.

**Industry:**

- 2023 Interim: Mr. Keith Bradley (Electrify America) commented it is difficult to test EVSE devices at low current and has the least impact to the commercial transaction. Mr. Bradley stated it is more appropriate to have a range and recommends striking language in Pub 15, page S&T-287, lines 6-7. Mr. Bradley added this item is needed to address low limit testing.

**Advisory:**

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**Neutral Comments:**

**Regulatory:**

- 2023 Interim: Mr. Kevin Schnepf (State of California, Division of Measurement Standards) agrees with Ms. Butcher's comments and recommends the submitter work with the NIST USNWG EVFE Subgroup for item development.

**Industry:**

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**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.

**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.

CWMA 2022 Interim Meeting: Scheleese Goudy – Electrify America, Low end test was meant to be at 10% but as written would allow anything less than 10 %. Less than 10 % is unnecessarily difficult. Little energy will be delivered at these low rates. Greater inaccuracies below 10 %. Move forward as voting. Note the change on N.5.2.1.(b)(2) to "between 10 % and 20%".

Francesca Wahl – Tesla, Moving forward as voting.

Loren Minich – Kansas, P 252 Line 10, remove the “of” before the range.

Craig VanBuren – Michigan, Agrees. Ready for voting with recommended changes.

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

**N.1.No Load Test.** – A no load test may be conducted on an EVSE measuring system by applying rated voltage to the system under test and no load applied.

**N.2.Starting Load Test.** – A system starting load test may be conducted by applying rated voltage and 0.5-ampere load.

**N.5.2.1. Accuracy Testing.** – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

(a) For AC systems:

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

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

(b) For DC systems (see note):

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

(2) Accuracy test of the EVSE system at a load of not more than between 10 % and 20% and 20 % of the maximum deliverable amperes (expressed as MDA) as determined from the digital communication message from the DCEVSE to the test standard for a total energy delivered of at least the minimum measured quantity (MMQ).

Note: For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient provided that it is greater than 30% of the maximum deliverable amperes of the EVSE system.

And

Appendix D:

maximum deliverable amperes. - The value in amperes, marked on an EVSE pursuant to paragraph S.5.2. EVSE Identification and Marking Requirements, of the maximum current that the EVSE can provide.

NEWMA 2022 Interim Meeting: Mr. Keith Bradley (Electrify America) stated that the core problem is testing at low currents. Mr. Bradley believes that “10%-20%” is better than “up to 10%” as no currently installed charger will be able to do less than 10%. Currently, the HB doesn’t qualify what the test procedure is for testing device using an EV. Ms. Juana Williams (NIST-OWM) indicated that the removal of “no load test” and “starting load test” is consistent with other proposals viewed by the EVSE Subgroup. Ms. William also questioned how an inspector will know they

reached 10% and 85% if there is no pilot signal or information coming from digital communications with the system. Mr. Williams also noted that a definition being tied to marking requirement is not typically done. Mr. Keith Bradley (Electrify America) explained that an inspector would know max deliverable amps as it should be marked on the device, know the current as displayed by the testing apparatus, then compare. Mr. Jason Flint (NJ) recommended that the item be developing.

After hearing comments from the floor, the Committee believes the item has merit. The Committee is recommending a Developing status

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **GMA – GRAIN MOISTURE METERS 5.56 (A)**

### **GMA-19.1 D Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Method for All Grains and Oil Seeds.**

#### **Source:**

NTEP Grain Analyzer Sector

#### **Purpose:**

Reduce the tolerances for the air oven reference method.

#### **Item Under Consideration:**

Amend Handbook 44, Grain Moisture Meter Code 5.56 (a) as follows:

**T.2.1. Air Oven Reference Method.** – Maintenance and acceptance tolerances shall be as shown in Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance. (Amended 2001)

<b>Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method</b>		
<b>Type of Grain, Class, or Seed</b>	<b>Tolerance</b>	<b>Minimum Tolerance</b>
<b>Corn, oats, rice, sorghum, sunflower</b>	<b>0.05 of the percent moisture content</b>	<b>0.8 % in moisture content</b>
<b>All other cereal grains and oil seeds</b>	<b>0.04 of the percent moisture content</b>	<b>0.7 % in moisture content</b>

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<b><u>Table T.2.1.</u></b> <b><u>Acceptance and Maintenance Tolerances Air Oven Reference Method</u></b> <b><u>for All Grains and Oil Seeds</u></b>	
<b><u>Tolerance</u></b>	<b><u>Minimum Tolerance</u></b>
<b><u>0.03 of the percent moisture content</u></b>	<b><u>0.5 % in moisture content</u></b>

(Amended 2001 **and 20XX**)

**Background/Discussion:**

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

Mr. Karl Cunningham  
 Illinois Department of Agriculture  
 217-785-8301, [karl.cunningham@illinois.gov](mailto:karl.cunningham@illinois.gov)

Samples and list of grains that AMS, FGIS request from states to include in their ongoing calibration program. States and other interested parties wanted to verify that corn samples from their state were included in the calibration data for NTEP meters because of variations states reported between UGMA meter and other meter technologies on corn samples.

During the 2016 Grain Analyzer Sector Meeting, numerous instances of inconsistent moisture meter measurements involving grain shipments from U.S. interior facilities to U.S. export port facilities were reported. The Sector received a suggestion that if the UGMA can make better measurements, then the Sector should consider reducing the applicable tolerances in HB 44. At the 2016 and 2017 Grain Analyzer Sector meetings Mr. Charlie Hurburgh (Iowa State University) agreed to chair a GA Sector Task Group to review the current HB 44 tolerance with both UGMA meters and Non-UGMA meters. During the 2018 meeting Mr. Hurburgh reported that based on data he analyzed from Iowa State Weights and Measures Grain Inspection reports, UGMA meters read closer to the reference air oven moisture results than non-UGMA meters.

It was also noted during the 2018 NTEP Grain Analyzer Sector meeting that the current tolerances were developed in 1991 and have not been changed to coincide with the change in technology for these devices; and this action is needed for grain industry risk management.

Prior to the 2019 NCWM Interim Meeting, all four regional weights and measures associations agreed to forward the proposal as a voting item on the Interim Agenda. However, following the regional meetings, additional data was submitted to the Sector which indicates a need to consider developing different tolerance for some grain types. Through a subsequent ballot, and a majority vote, the Sector agreed to recommend changing the status of the item to developing to provide the Sector time to consider additional data and changes to its original proposal.

**NCWM 2019 Interim Meeting:** The NCWM S&T Committee heard comments to agenda item GMA-3. Mr. Loren Minnich (KS) commented that he spoke with Ms. Diane Lee (NIST OWM) and she reported that one state was concerned with the application of the reduced tolerances to all grain types, specifically grains with hulls or husks. Mr. Minnich suggested that this item be assigned a “Developing” status to allow for more research into this issue. The committee also received written comments from NIST, OWM (see NIST, OWM Analysis posted on the NCWM Website). During the 2019 Interim Meeting, the S&T Committee considered the comments during the opening hearing and comments submitted prior to the meeting and assigned a “Developing” status for this item.



NCWM 2019 Annual Meeting: Ms. Diane Lee (NIST OWM) provided an update on the history of the item. Ms. Lee noted that the NTEP Grain Analyzer Sector will review data from Arkansas at its 2019 meeting intended to assure that proposed changes to the tolerances can be applied to all grains. Ms. Lee speaking on behalf of the Sector stated that the Developing status assigned to this item is appropriate.

NCWM 2020 Interim Meeting: The Committee heard from Ms. Diane Lee (NIST OWM) who stated that when this item was initially submitted the GMM Sector agreed to reduce tolerance based on data that was limited to corn and soybeans. Following the review of the initial data, additional data from Long Grain Rough Rice was reviewed and the sector agreed that additional data was needed on other grains to include oats, rice, and barley, prior to changing the tolerances. Ms. Lee requested that the item remain developing status as additional data is collected.

During the Committee's work session, the committee agreed to retain this item as Developing to allow the submitter to continue working with members of the grain analyzer sector to collect additional data.

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

NCWM 2021 Annual Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that additional data is needed to assess the proposed tolerances. Ms. Lee requested that this item remain Developing. During the Committee's work session, the Committee agreed to a Developing status for this item.

NCWM 2022 Interim Meeting: The Committee heard comments from Ms. Diane Lee (NIST OWM) who noted that additional data is needed to assess the proposed tolerances. Ms. Lee added that states would be submitting more data. Ms. Lee requested that this item remain Developing. During the Committee's work session, the Committee agreed to a Developing status for this item.

NCWM 2022 Annual Meeting: The Committee heard updates from Ms. Tina Butcher, NIST OWM. The original intent of this item was to apply the proposed tolerance to corn and soybeans, however, other grains were identified for areas of study. The Grain Sector was working with States to collect additional data; however, the pandemic has slowed the process. The Grain Sector is requesting additional time to collect this data. The Committee has agreed to maintain a Developing status for this item.

NCWM 2023 Interim Meeting: The S&T Committee heard comments from the floor during open hearings. Mrs. Tina Butcher (OWM/NIST) commented that COVID has put a hamper on the collection of data that is needed for the study. Request that the item remain developing. The committee left the item Developing.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: No additional data or update was received by the committee. The WWMA S&T Committee recommends withdrawal and encourages the submitter to reintroduce the item when sufficient data is available.

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

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

CWMA 2022 Interim Meeting: Doug Musick – Kansas, Remain developing, waiting on data.

Ivan Hankins – Iowa, 0.5 % tolerance is fair and should move forward to voting.

The CWMA S&T Committee recommends this remains a Developing item to allow time to collect additional data

NEWMA 2022 Interim Meeting: Ms. Diane Lee (NIST-OWM) indicated the need for more data on more grains. This proposal is seeking to lower tolerances due to better technologies of UGMA meters. However, according to data submitted by North Carolina, grains are failing at the proposed tolerances. Ms. Lee requests more time so more states can submit data.

The Committee is recommending that this item retain a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**GMA-23.1 V N.1.3. Meter to Like-Type Meter Method Transfer Standards and Table T.2.2. Acceptance and Maintenance Tolerances Meter to Like-Type Meter Method**

**Source:**

NTEP Grain Analyzer Sector

**Purpose:**

Clarify what is meant by the term Meter to Like Type Meter in the Grain Moisture Meter Code 5.56(a).

**Item under Consideration:**

Amend NIST Handbook 44 Grain Moisture Meters Code as follows:

**N.1.3. Meter to Like-Type Meter Method Transfer Standards.** – Properly standardized reference meters using National Type Evaluation Program approved calibrations shall be used as transfer standards. A reference meter shall be of the same **typemodel family, as defined by the National Type Evaluation Program Certificate of Conformance**, as the meter under test. Tests shall be conducted side-by-side using, as a comparison medium, grain samples that are clean and naturally moist, but not tempered (i.e., water not added). (Added 2001) (Amended 20XX)

And

**T.2.2. Meter to Like-Type Meter Method.** – Maintenance and acceptance tolerances shall be as shown in Table T.2.2. Acceptance and Maintenance Tolerances Meter to Like-Type Meter Method. The tolerances shall apply to all types of grain and seed. (Added 2001)

Table T.2.2. Acceptance and Maintenance Tolerances Meter to Like-Type Meter Method	
Sample Reference Moisture	Tolerance
Up to 22 %	0.5 % in moisture content

(Added 2001)

**Note: Like-Type as described in paragraph N.1.3.**

**(Added 20XX)**

**Previous Action:**

2023: New Item

**Original Justification:**

During the 2017 Grain Analyzer Sector meeting there was a discussion on Meter to like-type meter testing and the definition of a liker-type meter. There was discussion on test procedures for meter to like-type meter testing. It was noted that there may be only about two states using this type of test method and that it may be due to the cost of obtaining like-type meters to perform the test. A question was raised as to what is considered a like-type meter and it was explained that like-type meant that the make and model were the same. Suggestions were made to include a definition for like-type in NIST HB 44 and to consider documenting test procedures for meter to like-type meter testing.

During the 2018 grain analyzer sector meeting, the sector discussed industry and State weights and measures programs that used meter to like-type meter testing and master meter test methods. Kansas reported that reference meters are used to collect moisture results on samples. The samples are then taken to the field to compare to commercial field moisture meters. It was also reported that most State weights and Measures that use a meter-to-meter test method for testing field meters do not use a meter to like-type meter testing program which is specified in NIST HB44. The Perten representative reported that Perten uses three layers of master meters when calibrating their devices. It was noted that an analysis of the failure rate for meter-to-meter test methods should be investigated and an analysis of all the issues for meter-to-meter test methods is needed along with test methods for this type of field testing.

During the 2022 grain analyzer sector meeting the GA sector reviewed data from States and the NTEP laboratory and discussed what was considered like-type for this test method. Data collected in the NTEP program shows a bias between meters of different type, therefore adding an error to the test results when a meter of unlike type is used to test another meter. The GA sector agreed that like-type based on the current data available must be interpreted as the same model family, as defined by the National Type Evaluation Program Certificate of Conformance. As such the Sector agreed to add language to Section 5.56(a) paragraphs N.1.3 and T.2.2. to clarify the definition of like type.

The submitter acknowledged that some states may be using a meter-to-meter test method that is not a meter to like-type meter method.

The submitter requests Voting status.

**Comments in Favor:****Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 2023 Interim: Mrs. Tina Butcher (OWM/NIST) supports the proposed changes. She asked the committee to correct the item title in their report so that it matches HB44. Change “Meter to Like-Meter” to “Meter to Like-Type Meter”.

**Comments Against:****Regulatory:**

- 

**Industry:**

- 

**Advisory:**

•

**Neutral Comments:**

**Regulatory:**

•

**Industry:**

•

**Advisory:**

•

**Item Development:**

NCWM 2023 Interim Meeting: The committee updated the title and the T.2.2. note per recommendations from the NIST OWM Analysis. The committee has made this a voting item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: The WWMA S&T Committee believes that this item has merit and recommends this item remain developing to allow for input and adjustments. The WWMA S&T Committee also requests the submitter address the formatting of their proposal to meet NCWM standard editing requirements.

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

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

CWMA 2022 Interim Meeting: Loren Minnich – Kansas, This clarifies which meter can be used in this application. Supports as voting.

Ivan Hankins – Iowa, Support as voting.

The CWMA S&T Committee believes this item is fully developed and recommends voting status.

NEWMA 2022 Interim Meeting: Ms. Diane Lee (NIST-OWM) noted that questions came up as to what is considered “like-type” and if inspectors could use any and all models of a device listed on a Certificate of Conformance. In this situation “like-type” would mean model family. NIST has not made a full assessment on this item.

The Committee is recommending that this item be given a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**MDM – MULTIPLE DIMENSION MEASURING DEVICES**

**MDM-22.1 W S.1.7. Minimum Measurement.**

**Source:**

Parceltool P/L

**Purpose:**

Exempt mobile tape based MDMD devices from the 12D minimum measurement.

**Item Under Consideration:**

Amend Handbook 44, Multiple Dimension Measuring Devices Code as follows:

**S.1.7. Minimum Measurement.** – Except for entries of tare and mobile tape based MDMD devices, the minimum measurement by a device is 12 d. The manufacturer may specify a longer minimum measurement. For multi-interval devices, this applies only to the first measuring range (or segment) of each measurement axis (length, width, and height).  
(Amended 2017 and 20XX)

**Previous Action:**

2022: Developing

**Original Justification:**

The 12 d minimum measurement is designed for instruments that use an internal rounding function to round the actual measurement up or down to the nearest value of d before being displayed. For measurement of 12 d, or less, the potential error in the measurement is considered too large and therefore the specification of the 12 d minimum measurement is in place.

Measurements below 12 d are commonplace when using a mobile tape (tape measure) type of device for determining measurements. An accepted practice for this type of device is for the Measurement to be rounded up to the nearest whole unit of measurement (e.g., 1 inch) before being used to calculate any charges.

The submitter requested that this be a Voting Item in 2022.

**Comments in Favor:****Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Comments Against:****Regulatory:**

- 2023 Interim: A regulator commented that there have been no changes or additional justification from the submitter of the proposal since it was submitted. Recommends withdrawal.

**Industry:**

- 2022 Interim: Russ Vires (SMA); SMA opposes the item.
- 2023 Interim: A member of industry opposes this item as it has no additional justification for the proposal and recommended withdrawal.

**Advisory:**

- 2023 Interim: An advisory member commented that there have been no changes or additional justification from the submitter of the proposal since it was submitted. Recommends withdrawal.

**Neutral Comments:**

**Regulatory:**

- 2022 Interim: Matt Douglas (California Division of Measurement Standards) suggested that the submitter submit data and work with the MDMD sector to develop the item.

**Industry:**

- 

**Advisory:**

- 2022 Interim: Darrel Flocken (NCWM, NTEP); Explained the device they are seeking this change for is a tape measure and they may have misunderstood what they are asking for. This was first proposed in 2019 and was withdrawn. There appears to be no new justification.

**Item Development:**

NCWM 2022 Interim Meeting: During the committee work session, the committee determined that more input was needed from the submitter. This item has been assigned to the submitter for further development. For more information or to provide comment, please contact:

Tony Bauer  
Parceltool P/L  
+61-439-89-2468, [tbauer@cubical.com](mailto:tbauer@cubical.com)

2022 NCWM Annual Meeting: The committee heard no comments from the developer of the item.

NCWM 2023 Interim Meeting: The committee received no updates, input, or communication from the submitter since the proposal was submitted. The committee finds that this item does not have merit and the proposal has been withdrawn.

**Regional Associations' Comments:**

WWMA 2021 Annual Meeting: No additional data or update was received by the committee.

The WWMA S&T Committee recommends that this item be withdrawn.

SWMA 2021 Annual Meeting: Dr. Curran, State of Florida, stated that this item was not needed.

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

CWMA 2022 Annual Meeting: Loren Minnich – Kansas Withdraw.

The CWMA S&T Committee recommends this item be withdrawn.

NEWMA 2022 Annual Meeting: Ms. Diane Lee (NIST-OWM) noted that this item has been on the agenda before and NIST-OWM recommends withdrawing. Mr. Jason Flint (NJ) indicated that in the past, the submitter has not been available to answer questions regarding this proposal, and he recommended that the item be withdrawn.

After hearing comments from the floor, the Committee does not believe that this item has merit. The Committee is recommending that this item be Withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**OTH – OTHER ITEMS**

**OTH-16.1            V    Electric Watthour Meters Tentative Code**

**Source:**

NIST, Office of Weights and Measures

**Purpose:**

- 1) Make the weights and measures community aware of work being done within the NIST U.S. National Work Group (USNWG) on Electric Vehicle Fueling and Submetering to develop proposed requirements for electric watthour meters used in submeter applications in residences and businesses;
- 2) Encourage participation in this work by interested regulatory officials, manufacturers, and users of electric submeters.
- 3) Allow an opportunity for the USNWG to provide regular updates to the S&T Committee and the weights and measures community on the progress of this work;
- 4) Allow the USWNG to vet specific proposals as input is needed.

**Item Under Consideration:**

Add Non-Utility Electricity-Measuring Systems Code to Handbook 44, as follows:

# NIST Handbook 44 Device Code Requirements for Non-Utility Electricity-Measuring Systems

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### SECTION 3.XX. - NON-UTILITY ELECTRICITY-MEASURING SYSTEMS – TENTATIVE CODE

This tentative code has only a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code. Officials wanting to conduct an official examination of a Non-Utility Electricity-Measuring System (NUEMS) are advised to see paragraph G-A.3. Special and Unclassified Equipment.

(Tentative Code Added 20XX)



**NUEMS Acronym and Definition:** As used throughout this code, a Non-Utility Electricity-Measuring System or “NUEMS” is defined as an electricity measuring system comprised of all the metrologically relevant components required to measure electrical energy, store the result, and report the result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured quantities.

**Safety Note:** This code does not specifically discuss Safety. It is essential that all personnel working with the devices covered by this code and associated electrical equipment be properly trained and adhere to all applicable safety standards, regulations, and codes. See also General Code Paragraph G-N.1. Conflict of Laws and Regulations.

## **A. Application**

**A.1. General.** – This code applies to measuring systems used in non-utility sales of electric energy wherein the sale is based in whole or in part on one or more measured quantities.

**A.2. Exceptions.** – This code does not apply to:

- (a) The use of any measuring system owned, maintained, and/or used by a utility.
- (b) Measuring systems used solely for delivering electric energy in connection with operations in which the amount delivered does not affect customer charges or compensation.
- (c) Electric vehicle fueling systems. (See 3.40. Electric Vehicle Fueling Systems Code)
- (d) Transactions not subject to weights and measures authority.

**A.3. Additional Code Requirements.** – In addition to the requirements of this code, Non-Utility Electricity-Measuring Systems shall meet the requirements of Section 1.10. General Code.

**A.4. Type Evaluation.** – The National Type Evaluation Program (NTEP) will accept for type evaluation only those measuring systems that have received safety certification by a nationally recognized testing laboratory (NRTL) and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code.

**A.5. NUEMS Type Notation.** – Code sections and subsections with an [ES] notation apply to External Sensor NUEMS only. Code sections and subsections with a [IS] notation apply to Internal Sensor NUEMS only. Code sections and subsections without [ES] or [IS] notation apply to both NUEMS types.

## **S. Specifications**

### **S.1. Indicating and Recording Elements.**

**S.1.1. Units.** – Units for any indicated or recorded measurements shall be as follows:

Active Energy: kilowatt-hours (kWh)

**S.1.1.1. Numerical Value of Quantity-Value Divisions.** – The value of an increment shall be equal to a decimal multiple or submultiple of 1.

Examples: quantity-value divisions may be 10; or 0.01; or 0.1; etc.

1       **S.1.1.2. Digital Indications.** – An indication shall include the display of a number for all places that are  
2       displayed to the right of the decimal point and at least one place to the left. Otherwise, leading zeros are not  
3       required.

4       **S.1.2. Nominal Capacity.** – *A device shall have a minimum capacity indication of five digits of resolution.*  
5       *[Nonretroactive as of January 1, 20XX]*

6       **S.1.3. NUEMS Indications.**

7       **S.1.3.1. Primary Indicating Element.** – Each NUEMS shall be equipped with a primary indicating  
8       element that includes a display visible and accessible after installation which clearly indicates the number of  
9       kilowatt-hours measured by the NUEMS.

10       **S.1.3.2. Test Output.** – Each NUEMS within a system shall have either: (1) a location for the reading of  
11       the accumulated value; (2) a pulse output (visible and/or infrared pulse), an electrical pulse output in the form  
12       of a closure (relay or electronic such as an open drain field effect transistor (FET)) which provides a pulse at  
13       an interval of  $K_t$  Watt-Hours per pulse; or (3) other means for viewing accumulated values. The value of  $K_t$   
14       shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any specified test condition.

15       **S.1.3.3. Segments.** – A segmented digital indicating element shall have an easily accessible provision for  
16       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 which  
22       NUEMS is associated with the currently displayed information.

23       **S.1.3.6. NEUMS With External Sensors Located Remotely from the Pulse Output or Display.** – For  
24       NUEMS with external sensors located remotely from either the pulse output or display which can be installed  
25       as described in paragraph UR.2.4.8. External Sensors Located Remotely from the Pulse Output or Display,  
26       means shall be provided to allow either the pulse output or display to be remotely used.

27       **S.1.3.7. NUEMS With a Register Ratio.** For NUEMS with a register ratio, the register ratio shall be  
28       indicated on the front of the registers that are not an integral part of the NUEMS nameplate. Means shall be  
29       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 based  
33       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 (e.g.,  
35       data change audit trail) or physically applying security seals in such a manner that undetected access to  
36       metrologically significant mechanisms and parameters is prevented. Specifically, after sealing no adjustment or  
37       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

(c) any wiring connection which affects the measurement.

When applicable, any adjusting mechanism shall be readily accessible for purposes of affixing a security seal. Audit trails shall use the format set forth in Table S.2.3. Categories of Device and Methods of Sealing.

<b>Table S.2.3.</b> <b>Categories of Device and Methods of Sealing</b>	
<b>Categories of Device</b>	<b>Method of Sealing</b>
<b>Category 1:</b> No remote configuration capability.	Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.
<b>Category 2:</b> Remote configuration capability, but access is controlled by physical hardware.  The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.	The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information.
<b>Category 3:</b> Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).  The device shall clearly indicate that it is in the remote configuration mode and record such message or shall not accumulate kWh while in this mode.	An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. ( <b>Note:</b> Does not require 1000 changes to be stored for each parameter.)

**S.2.4. NUEMS Watthour Registration Retention.** – The NUEMS shall retain the total accumulated watthour registration and shall not be affected by electrical, mechanical or temperature variations, radio-frequency interference, power failure, or any other environmental influences to the extent that accuracy is impaired. This also applies to other billable quantities.

**S.3. Markings.** – The following identification and marking requirements are in addition to the requirements of Section 1.10 General Code, paragraph G-S.1. Identification.

**S.3.1. Location of Marking Information.** – The marking information may be placed either internally or externally (as specified in paragraphs S.3.2. Device Identification and Marking Requirements and S.3.3. External Sensor Identification and in the associated tables) provided:

- i. the information is permanent and easily read; and accessible for inspection;

- ii. the information is on a portion of the device that cannot be readily removed or interchanged (e.g., not on a service access panel). A readily removable cover is an acceptable location for the required information provided: (1) the information is permanently marked elsewhere on the device or is readily accessible through other means such as through an electronic display; or (2) a unique marking on the removable cover can be matched with what is programmed into or permanently marked on the meter, thus linking that marking (and any other markings) included on the cover with that specific device.
- iii. accessing the information does not require accessing an area with live exposed voltages greater than 40 V.

The use of a key or tool to access internal marking information is permitted for retail electricity-measuring devices. Where possible, clear covers should be used to enable viewing of internally marked information.

**S.3.2. Device Identification and Marking Requirements.** – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each device shall have the following information conspicuously, legibly, and indelibly marked on the nameplate or register.

**S.3.2.1. Device Identification and Marking Requirements of Meter with External Sensors** – Sensor input connection with intended polarity shall be physically marked on the meter when direction-sensitive.

**S.3.2.2. Device Identification and Marking Requirements, Internal Sensor (IS) NUEMS.** – The following markings shall be physically marked on an Internal Sensor (IS) NUEMS:

- (a) AC voltage range or rating in VAC;
- (b) Watthour test constant ( $K_h$ ) or Watthour test constant ( $K_t$ );
- (c) Register ratio ( $R_r$  or  $K_r$ ) for meters with a rotating disc and multiplier (if greater than one) preceded by “multiply by” or “mult by” or “ $K_r$ ”;
- (d) Number of wires (W);
- (e) Form designation (FM) (for A-base and socket NUEMS only); and
- (f) Current Class (CL).

**S.3.2.3. Device Identification and Marking Requirements of Meters, External Sensor (ES) NUEMS.** –In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, External Sensor (ES) NUEMS shall have the following legibly, and indelibly marked on the meter as shown in:

- Tables S.3.2.3.a. Device Identification and Marking Requirements of Meter – External Sensor (ES) NUEMS; and
  - Table S.3.2.3.b. Descriptors for Table S.3.2.3.a. Device Identification and Marking Requirements of Meter – External Sensor (ES) NUEMS.
- (a) service type or service configuration.

<b>Table S.3.2.3.a.</b> <b>Device Identification and Marking Requirements for External Sensor (ES) NUEMS</b>		
	<b>Physical Marking</b>	<b>Electronic Display<sup>*,**</sup></b>
Manufacturer or Distributor name, initials, or trademark (1)	<b>R</b>	<b>D</b>
Model Prefix (2)	<b>O</b>	<b>D</b>
Model (3)	<b>R</b>	<b>D</b>
Serial Number Prefix (4)	<b>O</b>	<b>D</b>
Serial Number (5)	<b>R</b>	<b>D</b>
NTEP CC Number with Prefix (6)	<b>R</b>	<b>D</b>
<i>NUEMS Voltage Input Rating (7) Nonretroactive as of January 1, 2024.</i>	<b>O</b>	<b>D</b>
<i>Voltage Sensor Rating (8) Nonretroactive as of January 1, 2024.</i>	<b>O</b>	<b>D</b>
<i>Voltage Sensor Ratio (9) Nonretroactive as of January 1, 2024.</i>	<b>O</b>	<b>D</b>
<i>NUEMS Current Input (10) Nonretroactive as of January 1, 2024.</i>	<b>O</b>	<b>D</b>
<i>Sensor Primary Current Rating (11) Nonretroactive as of January 1, 2024.</i>	<b>O</b>	<b>D</b>
$K_h$ or $K_t$ (12)	<b>O</b>	<b>D</b>
Bi-directional (13)	<b>O</b>	<b>D</b>
Temperature Range if narrower than $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ( $-4\text{ }^{\circ}\text{F}$ to $+122\text{ }^{\circ}\text{F}$ ) (14)	<b>O</b>	<b>D</b>
<b>R</b> Required to be marked on the NUEMS <b>O</b> Required to be marked on the NUEMS only if information is not available on a display <b>D</b> 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.		
<p><sup>**</sup>“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.</p> <p><sup>**</sup>Instructions on how to view required markings shall be marked on the device or provided in the NTEP CC.</p> <p><b>General:</b></p> <ul style="list-style-type: none"> <li>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.</li> <li>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.</li> </ul>		

<b>Table S.3.2.3.b.</b> <b>Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS</b>	
<b>1. Manufacturer's Identification.</b>	Marked per General Code paragraph G-S.1. Identification.
<b>2. Manufacturer's Model Prefix.</b>	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).
<b>3. Manufacturer's Model Identifier.</b>	Marked per General Code paragraph G-S.1. Identification.
<b>4. Serial Number Prefix.</b>	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).
<b>5. Serial Number.</b>	Also see General Code paragraph G-S.1. Identification.
<b>6. NTEP Certificate of Conformance Number and Prefix.</b>	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.
<b>7. NUEMS Voltage Input Rating (<math>V_{nom}</math>).</b>	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.
<b>8. Voltage Sensor (<math>V_{nom}</math>).</b>	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.
<b>9. Voltage Sensor Ratio.</b>	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.
<b>10. NUEMS Current Input (Input <math>I_{nom}</math> or <math>I_{max}</math>).</b>	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.
<b>11. Sensor Primary Current Rating (Sensor <math>I_{nom}</math>).</b>	The nominal current input through the sensor.
<b>12. Kh or Kt.</b>	Watt-hour test constant.
<b>13. Bi-Directional.</b>	Marking via a "Separate Document" is permissible only if instructions for accessing that information is described in an accompanying NTEP Certificate of Conformance.
<b>14. Temperature Range if Narrower Than <math>-20\text{ }^{\circ}\text{C}</math> to <math>+50\text{ }^{\circ}\text{C}</math> (<math>-4\text{ }^{\circ}\text{F}</math> to <math>+122\text{ }^{\circ}\text{F}</math>):</b>	If the device is rated for use over a range that is narrower than and within $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ( $-4\text{ }^{\circ}\text{F}$ to $+122\text{ }^{\circ}\text{F}$ ), this must be physically and/or electronically marked.

**S.3.3. Device Identification and Marking Requirements – External Sensors.** – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each external sensor that is non-integral with the meter shall have the following conspicuously, legibly, and indelibly marked on a permanent identification label as shown in Table S.3.3.a. Device Identification and Marking Requirements - External Sensors and in Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements - External Sensors.

<b>Table S.3.3a.</b> <b>Device Identification and Marking Requirements - External Sensors</b>			
	<b>Physical Marking on Sensor</b>	<b>Electronic Display</b>	<b>Separate Document (Hard Copy or Electronic)</b>
Manufacturer name, initials, trademark (1)	<b>R</b>	<b>D</b>	<b>D</b>
Model Prefix (2)	<b>O</b>	<b>D</b>	<b>D</b>
Model (3)	<b>R</b>	<b>D</b>	<b>D</b>
Serial Number Prefix “S/N” (4)	<b>O ‡</b>	<b>D ‡</b>	<b>D ‡</b>
Serial Number (5)	<b>O ‡</b>	<b>D ‡</b>	<b>D ‡</b>
NTEP CC Prefix and Number (6)	<b>O †</b>	<b>D †</b>	<b>D †</b>
True Ratio (7)	<b>O</b>	<b>D</b>	<b>D</b>
Maximum Primary Current (8)	<b>O</b>	<b>D</b>	<b>D</b>
Rated Frequency (Hz) (9)	<b>O</b>	<b>D</b>	<b>D</b>
Maximum Safety Voltage Rating (10)	<b>O</b>	<b>D</b>	<b>D</b>
Polarity (11)	<b>O</b>	<b>D</b>	<b>D</b>
<b>R</b> Required to be marked on the device <b>O</b> Required to be marked on the device if information is not available on a display or in printed form <b>D</b> Required when data is displayed on an electronic display or printed document <b>‡</b> Required only when a specific sensor must be matched to a specific meter input to meet accuracy specifications <b>†</b> Required only when a sensor has separate approval from the metering system as a whole.			
<b>Notes:</b> <ul style="list-style-type: none"> <li>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.</li> <li>For requirements and details on application, see Table S.3.3.b. Descriptors for External Sensor Marking Requirements.</li> <li>“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.</li> </ul>			
<b>Summary:</b> 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.			

<b>Table S.3.3.b.</b> <b>Descriptors for Device Identification and Marking Requirements - External Sensors</b>	
<b>1. Manufacturer's Identification.</b>	Marked per General Code paragraph G-S.1. Identification.
<b>2. Manufacturer's Model Prefix.</b>	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).
<b>3. Manufacturer's Model.</b>	Marked per General Code paragraph G-S.1. Identification.
<b>4. Serial Number Prefix.</b>	<b>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).</b>
<b>5. Serial Number.</b>	Also see General Code paragraph G-S.1. Identification.
<b>6. NTEP Certificate of Conformance Prefix and Number.</b>	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. Identification.
<b>7. True Ratio.</b>	<p>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 or a unit-less ratio. The number of digits is the number needed to express the values.</p> <p>Examples of sensor ratio markings include:</p> <p>200A:5A  400A:0.3V  480V:120V  CT Turns Ratio 4:1  VT Ratio 4:1</p> <p>An example of a sensor ratio designation which includes a unit-less ratio:  480V:120V = 4:1.</p>
<b>8. Maximum Primary Current.</b>	The maximum primary current at which the sensor can be safely and accurately operated.
<b>9. Rated Frequency.</b>	A sensor shall be marked with its rated frequency if other than 40Hz to 400Hz.
<b>10. Maximum Safe Operating Voltage.</b>	<p>A sensor shall be marked with a Maximum Safe Operating Voltage if it is less than 600VAC.</p> <p>Examples of sensor maximum safe operating voltage ratings:</p> <ul style="list-style-type: none"> <li>• 250 Vac</li> <li>• 250 VAC</li> <li>• 50 V</li> </ul> <p><b>Note:</b> The maximum safe operating voltage rating marking may not be higher than the voltage to which the device was verified during type evaluation.</p>
<b>11. Polarity Marking.</b>	The sensor shall be marked to indicate proper orientation when the accuracy of the NUEMS is affected by orientation.



**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)
- (l) Y = WYE Power Supply
- (m) IEEE = Institute of Electrical and Electronics Engineers
- (n) B = Burden
- (o) BIL = Basic Lightning Impulse Insulation Factor
- (p) Kt = Watthour Test Constant
- (q) AC = Alternating Current (i.e., VAC)
- (r) J = Joule
- (s) Wh = Watthour
- (t) kWh = Kilowatt-hour
- (u) Δ = Delta Power Supply
- (v) SD = Soft Data
- (w) PD = Printable Data

**N. Notes**

**N.1. NUEMS No-Load Test.** – A NUEMS no-load test shall be conducted by applying rated voltage to the NUEMS under test and no current load applied. This test shall be conducted during type evaluation and may be conducted during field testing as deemed necessary. The test duration shall be ten minutes.

**N.2. NUEMS Starting Load Test.**– A NUEMS starting load test shall be conducted by applying rated voltage at a load of 0.25% of the Current Class (CL) or the Sensor Primary Current Rating at unity power factor. The rated voltage. The test shall be conducted during type evaluation and may be conducted during field testing as deemed necessary.

**N.3. Minimum Test Duration.** – Full and light load tests shall require at least a one-minute test and at least one watt-hour test constant.

**N.4. NUEMS Test Loads.**

(a) Internal Sensor (IS) NUEMS shall be balanced-load tested, and may be single-element tested, for NUEMS accuracy at full and light loads.

(b) External Sensor (ES) NUEMS shall be single-element tested for system accuracy at full and light loads. NUEMS testing shall be accomplished by applying the test load to the sensor(s) with the voltage circuits energized. When it is not feasible to test the system by injecting a primary current, testing using customer load shall be sufficient for field verification.

(c) The reference voltage phases (A, B, or C) at the NUEMS shall be the same phase as the load.

**N.5. Test of a NUEMS.**

(a) Each NUEMS submitted for test shall have the necessary components required to test such as meter, sensor(s), indicators(s), system software, etc. Testing may be performed in the field.

(b) The test load applied for a full load test shall be 15 % of either the Current Class (CL) or the Sensor Primary Current Rating.

(c) The test load applied for a light load test shall be conducted at 1.5 % to 3% of either the Current Class (CL) or the Sensor Primary Current Rating.

(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 of a for a 0.5 power factor lagging setting shall be conducted at 3% to 6 % 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.

(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.** – For NUEMS with a Kt/Kh output, the NUEMS shall not emit more than one Kt/Kh pulse. For NUEMS without a pulse output, the register indication shall not change by more than 0.05 % of the energy at Current Class (CL) or the Sensor Primary Current Rating at unity power factor and rated voltage. Also see Note N.1. NUEMS No-Load Test.

**T.3. NUEMS Starting Load Test.** – The watthour 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. 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.

<b>Table T.4. Tolerances for NUEMS</b>		
	<b>Tests Conducted at Unity Power Factor</b>	<b>Tests Conducted at 0.5 Lagging Power Factor</b>
<b>Acceptance Tolerances</b>	1.0 %	2.0 %
<b>Maintenance Tolerance</b>	2.0 %	3.0 %

**T.5. Repeatability.** – When multiple load tests are conducted at the same load condition, the range of the load test results shall not exceed 25 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

## **UR. User Requirements**

### **UR.1. Selection Requirements.**

**UR.1.1. Customer Indicating Element, Accessibility.** – For systems in which the primary indicating element is not reasonably accessible to the customer, such as one of the following shall be provided.

- (a) Console display which is accessible to the customer on which the customer can unambiguously select the NUEMS output associated with this load.
- (b) Remote display which is provided to customer as a part of the system.
- (c) At the option of the customer, through an application that provides readings in real time.

**UR.1.2. Submeter Required.** – When a tenant is not directly served by the serving utility, and charges for electric energy are not included in the fixed periodic rent charges, a dedicated NUEMS that measures only the energy used at the discretion of the tenant shall be used.

**UR.1.3. Suitability of Equipment.** – A NUEMS shall be suitable for use on its electrical system.

**UR.1.3.1. Service Applications.** - A NUEMS shall accurately measure all loads 5 percent or greater of the electric service capacity of the tenant. Service capacity shall be determined by the master thermal overload protectors to the tenants' service or by the rated capacity of the wiring and its circuits used to provide power from the service panel to the tenant.

$$Annual\ Max = \sum_{phases} [(Phase\ Voltage * Current\ Class)/1000] * HoursPerYear$$

**UR.1.3.2. Maximum Quantity-Value Division.** - The maximum quantity-value division shall not exceed the minimum increment to be used in billing.

**UR.1.4. Current Sensor.** – The current sensor output shall be correctly matched to the meter current input.

## **UR.2. Installation Requirements.**

**UR.2.1. Manufacturer's Instructions.** – A device shall be installed in accordance with the manufacturer's instructions, and the installation shall be sufficiently secure and rigid to maintain this condition.

**UR.2.2. Load Range.** – A device shall be installed so that the current and voltage will not exceed the maximum continuous ratings of the NUEMS. Means to limit current and/or voltage shall be incorporated in the installation if necessary.

**UR.2.3. Regulation Conflicts and Permit Compliance.** – If any provision of this section (UR.2. Installation Requirements) is less stringent than that required of a similar installation by the National Electrical Code®, as amended and adopted by the Local Authority having Jurisdiction, the installation shall be in accordance with the National Electric Code.

The installer of any new NUEMS service shall obtain all necessary permits and shall conform to all applicable regulations.

## **UR.2.4. NUEMS Installation Requirements.**

**UR.2.4.1. Certification.** – It is the responsibility of the owner of a NUEMS to obtain written certification for each device from the appropriate regulatory agency.

The required certification shall meet the requirements of that agency and should identify the address, space, or number, of the premise served by the NUEMS connection; be signed by an agency representative; and shall clearly state the:

- installation is on a tariff schedule that qualifies for NUEMS use,
- billing format, rates, and charges conform to all applicable tariff rules,
- date of such determination, and

- designee's name and title if performed by a designee, and

The certification shall be provided prior to a NUEMS being used for commercial purposes.

**UR.2.4.2. NUEMS Test Features.** – All NUEMS shall be provided with test features to facilitate common tests methods used in the electrical submetering industry.

**UR.2.4.3. Safety Mechanism.** – NUEMS installations that are equipped with current transformers with a current output that is not self-limiting shall have a mechanism installed to allow the meter to be connected to or removed for safe testing without the risk of dangerous voltages that can result from secondary open circuit CTs.

**UR.2.4.4. Metered Circuits (Submeter Load Service).** – For NUEMS with separate line and load service connections, all electricity used by a tenant shall be taken exclusively from the load service of the tenant's NUEMS. This service and its associated NUEMS shall accurately measure the tenant's load and be capable of being used only at the discretion of the tenant.

**UR.2.4.5. Dedicated Tenant NUEMS Service.** – A NUEMS shall serve only the space, lot, building, room, suite, stall, slip, or premise occupied by the tenant.

**UR.2.4.6. NUEMS Tenant Premise Identification.** – Tenant premise identification shall be clearly and permanently shown on or at the NUEMS, and on all separate components of a NUEMS, including, but not limited to, current sensor(s), modem(s), and transmitter(s) if equipped. Remote indications and all printed indications shall be readily identifiable and readily associated with the tenant's premise. Printed indications shall also include time and date information. For field configured systems the information shall be after actual configuration is established.

**UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Display, External Sensor (ES) NUEMS.** – When required markings are provided via an electronic display the owner/operator of the NUEMS is responsible for providing means for viewing this information on the site at the time of inspection or on request. See also Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS.

**UR.2.4.8. External Sensors Located Remotely From the Pulse Output or Display.** - If the NUEMS is installed in such a way that testing cannot be conducted by a single inspector from a reasonable testing position, then means shall be provided to allow the pulse output or display to be remotely used at the sensor location. For example, a portable device that receives the pulse by radio/WiFi and provides the pulse as a dry contact closure to the test equipment.

### UR.3. Use of Device.

**UR.3.1.Recorded Representations.** – A record, either printed or electronic, providing the following information on electrical energy usage shall be available at the end of the billable interval:

- (a) the total quantity of the energy delivered with unit of measure;
- (b) the total computed price of the energy sale;
- (c) the unit price of the energy.

For systems capable of applying multiple unit prices for energy during the billable interval, the following additional information is required:

- (1) A schedule of the rate time periods and the unit price applied for each
- (2) the total quantity of energy delivered during each;
- (3) the total purchase price for the quantity of energy delivered during each rate time period.

#### Appendix D. Definitions

The following definitions are proposed for addition to NIST Handbook 44 Appendix D, Definitions at the time when the status of this Tentative Code is changed from “tentative” to “permanent.” Until such time that the status of the code is designated as “permanent,” these proposed definitions will remain in this section of the Tentative Code.

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

#### A

**active energy.** – The integral of active power with respect to time. Typically measured in units of kilowatt-hours (kWh), or watt-hours.

$$E(T) = \int_0^T v(t) \cdot i(t) \cdot dt \quad \text{Eq. 1}$$

Where T is much greater than the period of the AC line frequency.

**alternating current (AC).** – An electric current that reverses direction in a circuit at regular intervals. [3.XX]

**ampere.** – The practical unit of electric current. It is the quantity of current caused to flow by a potential difference of one volt through a resistance of one ohm. One ampere is equal to the flow of one coulomb of charge per second. One coulomb is the unit of electric charge equal in magnitude to the charge of  $6.24 \times 10^{18}$  electrons. [3.XX]

**audit trail.** – An electronic count and/or information record of the changes to the values of the calibration or configuration parameters of a device. [1.10, 2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]  
(Added 1993)

#### B

**balanced load.** – Balanced load is used to indicate equal currents in all phases and relatively equal voltages between phases and between each phase and neutral (if one exists); with approximately equal watts in each phase of the load. [3.XX]

**basic lightning impulse insulation level (BIL).** – A specific insulation level expressed in kilovolts of the crest value of a standard lightning impulse. (Example: BIL = 10 Kv) [3.XX]

**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]

**energy flow.** – The flow of energy between line and load terminals (conductors) of a NUEMS. Flow from the line to the load terminals is considered energy delivered. Energy flowing in the opposite direction (i.e., from the load to line terminals) is considered as energy received. [3.XX]

**equipment, commercial.** – Weights, measures, and weighing and measuring devices, instruments, elements, and systems or portion thereof, used or employed in establishing the measurement or in computing any basic charge or payment for services rendered on the basis of weight or measure. As used in this definition, measurement includes the determination of size, quantity, value, extent, area, composition (limited to meat and poultry), constituent value (for grain), or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award. [1.10, 2.20, 2.21, 2.22, 2.24, 3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.38, 3.XX, 4.40, 5.51, 5.56.(a), 5.56.(b), 5.57, 5.58, 5.59]

(Added 2008)

**event counter.** – A nonresettable counter that increments once each time the mode that permits changes to sealable parameters is entered and one or more changes are made to sealable calibration or configuration parameters of a device. [2.20, 2.21, 3.30, 3.37, 3.39, 3.XX, 5.54, 5.56(a), 5.56(b), 5.57]

(Added 1993)

1 **event logger.** – A form of audit trail containing a series of records where each record contains the number from the event  
2 counter corresponding to the change to a sealable parameter, the identification of the parameter that was changed, the time  
3 and date when the parameter was changed, and the new value of the parameter. [2.20, 2.21, 3.30, 3.37, 3.39, 3.XX, 5.54,  
4 5.56(a), 5.56(b), 5.57]  
5 (Added 1993)

## 6 **F**

7 **form designation (FM).** –An alphanumeric designation denoting the circuit arrangement for which the NUEMS is  
8 applicable and its specific terminal arrangement. The same designation is applicable to equivalent NUEMS for all  
9 manufacturers. (Example: FM 2S) [3.XX]

## 10 **H**

11 **hertz (Hz).** – Frequency or cycles per second. One cycle of an alternating current or voltage is one complete set of  
12 positive and negative values of the current or voltage. [3.XX]

## 13 **K**

14 **kilowatt (kW).** – A unit of power equal to 1,000 watts. [3.XX]

15 **kilowatt-hour (kWh).** – A unit of energy equal to 1,000 watthours. [3.XX]

## 16 **L**

17 **line service.** – The service terminals or conductors connecting the (NUEMS) to the power source. [3.XX]

18 **load service.** – The service terminals or conductors connecting the (NUEMS) to the electrical load (e.g., vehicle,  
19 tenant, etc.). [3.XX]

20 **load, full.** – A test condition with rated voltage, current at 100% of test amps level, and power factor of 1.0. [3.XX]

21 **load, light.** – A test condition with rated voltage, current at 10% of test amps level, and power factor of 1.0. [3.XX].

## 22 **M**

23 **master meter, electric.** – A (NUEMS) owned, maintained, and used for commercial billing purposes by the serving  
24 utility. All the electric energy served to a submetered service system is recorded by the master meter. [3.XX]

25 **metrological components.** – Elements or features of a measurement device or system that perform the measurement  
26 process or that may affect the final quantity determination or resulting price determinations. This includes accessories  
27 that can affect the validity of transactions based upon the measurement process. The measurement process includes  
28 determination of quantities; the transmission, processing, storage, or other corrections or adjustments of measurement  
29 data or values; and the indication or recording of measurement values or other derived values such as price or worth  
30 or charges. [3.XX]

## 31 **N**

32 **non-utility electricity measuring system (NUEMS).** – An electricity measuring system comprised of all the  
33 metrologically relevant components required to measure electrical energy, store the result, and report the result  
34 used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured.



## O

**ohm.** – The practical unit of electric resistance that allows one ampere of current to flow when the impressed potential is one volt. [3.XX]

## P

**percent error.** – Percent error is calculated as follows:

percent error = (NUEMS reading – standard reading)/standard reading x 100  
[3.XX]

**power factor (PF).** – The ratio of “active power” to “apparent power” in an AC circuit. It describes the efficient use of available power. [3.XX]

**primary indicating or recording elements.** – The term “primary” is applied to those principal indicating (visual) elements and recording elements that are designed to, or may, be used by the operator in the normal commercial use of a device. The term “primary” is applied to any element or elements that may be the determining factor in arriving at the sale representation when the device is used commercially. (Examples of primary elements are the visual indicators for meters or scales not equipped with ticket printers or other recording elements and both the visual indicators and the ticket printers or other recording elements for meters or scales so equipped.) The term “primary” is not applied to such auxiliary elements as, for example, the totalizing register or predetermined-stop mechanism on a meter or the means for producing a running record of successive weighing operations, these elements being supplementary to those that are the determining factors in sales representations of individual deliveries or weights. (See “indicating element” and “recording element.”) [1.10, 3.XX]

## R

**reactive power.** – For sinusoidal quantities in a two-wire circuit, reactive power is the product of the voltage, the current, and the sine of the phase angle between them, using the current as the reference. [3.XX]

**register ratio (R<sub>r</sub>).** – The number of revolutions of the gear meshing with the worm or pinion on the rotor shaft per complete rotation of the fastest (most sensitive) wheel or dial pointer. [3.XX]

**remote configuration capability.** – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device. [2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]  
(Added 1993)

**retail device.** – A measuring device primarily used to measure product for the purpose of sale to the end user. [3.30, 3.32, 3.37, 3.39, 3.XX]  
(Amended 1987 and 2004)

## S

**sensor ratio.** – The stated ratio of the primary circuit current or voltage compared to the secondary circuit current or voltage. (Example: CSR = 200 : 0.1) [3.XX]

**serving utility.** – The utility distribution company that owns the master meter and sells electric energy to the owner of a submeter system. [3.XX]

**starting load.** – The minimum load above which the device will indicate energy flow continuously. [3.XX]

1 **submeter.** – A meter or meter system downstream of the electric master meter. [3.XX]

2 **T**

3 **tenant.** – The person or persons served electric energy from a non-utility electricity-measuring system (NUEMS).  
4 [3.XX]

5 **test amperes (TA).** – The full load current (amperage) specified by the device manufacturer for testing and calibration  
6 adjustment. (Example: TA 30). [3.XX]

7 **thermal overload protector.** – A circuit breaker or fuse that automatically limits the maximum current in a circuit.  
8 [3.XX]

9 **U**

10 **unit price.** – The price at which the product is being sold and expressed in whole units of measurement. [1.10, 3.30,  
11 3.XX]  
12 (Added 1992)

13 **utility.** – A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution  
14 facilities for delivery of electric energy for use primarily by the public. Included are investor-owned electric utilities,  
15 municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few entities that are tariff  
16 based and corporately aligned with companies that own distribution facilities are also included.

17 A list of recognized utilities in the U.S. can be found at the U.S. Energy Information Administration (EIA) at:  
18 <https://www.eia.gov/electricity/data/eia861> [3.XX]

19 **V**

20 **volt.** – The practical unit of electromotive force. One volt will cause one ampere to flow when impressed across a  
21 resistance of one ohm. [3.XX]

22 **W**

23 **watt.** – The practical unit of electric power. In an alternating-current circuit (AC), the power in watts is volts times  
24 amperes multiplied by the circuit power factor. [3.XX]

25 **watthour (Wh).** – The practical unit of electric energy, which is expended in one hour when the average power  
26 consumed during the hour is one watt. [3.XX]

27 **meter – self-contained.** – A meter in which the terminals are arranged for connection to the circuit being measured  
28 without using external instrument transformers. [3.XX]

29 **watthour constant ( $K_h$ ).** – The expression of the relationship between the energy applied to the meter and the output  
30 indication, expressed as “watthours per revolution” or “watthours per output indication.” [3.XX]

31 **watthour test constant ( $K_t$ ).** – The expression of the relationship between the energy applied to the meter and the  
32 output indication, expressed as “watthours per output indication,” when the meter is in test mode [3.XX]

33 **Background/Discussion:**

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

**Electric Vehicle Refueling Subgroup:**

Ms. Tina Butcher, Chair  
NIST Office of Weights and Measures  
301-975-2196, [tina.butcher@nist.gov](mailto:tina.butcher@nist.gov)  
Or  
Ms. Juana Williams, Technical Advisor  
NIST Office of Weights and Measures  
301-975-2196, [juana.williams@nist.gov](mailto:juana.williams@nist.gov)

**Electric Watthour Meters Subgroup:**

Ms. Lisa Warfield, Chair  
NIST Office of Weights and Measures  
301-975-3308, [lisa.warfield@nist.gov](mailto:lisa.warfield@nist.gov)  
Or  
Ms. Tina Butcher, Technical Advisor  
NIST Office of Weights and Measures  
301-975-2196, [tina.butcher@nist.gov](mailto:tina.butcher@nist.gov)

This item was submitted as a Developing item to provide a venue to allow the USNWG to update the weights and measures community on continued work to develop test procedures and test equipment standards within its Electric Vehicle Refueling Subgroup. This item will also serve as a forum in which to report work on the development of a proposed tentative code for electric watthour meters in residential and business locations by the USNWG's Electric Watthour Meters Subgroup and a placeholder for its eventual submission for consideration by NCWM.

Ms. Tina Butcher (NIST OWM), Chairman of the USNWG on Electric Refueling & Submetering has continued to provide regular updates to the Committee on this work. See the Committee's 2016 through 2018 Final Reports for details.

**NCWM 2018 Interim Meeting:** No comments were heard on this item and the Committee agreed to maintain its "Developing" status. The Committee did not take comments during open hearings on Developing items at the 2018 NCWM Annual Meeting and agreed to allow only the submitter of a Developing item (or block of Developing items) to provide an update on the progress made to further develop the item(s) since the 2018 NCWM Interim Meeting. The Committee received an update on this item from Ms. Tina Butcher (NIST OWM), Chair of the USNWG on Electric Refueling & Submetering. See the Committee's 2018 Final Report for Details.

OWM personnel were unable to attend the 2019 NCWM Interim Meeting due to the Federal Government shutdown in early 2019 due to a lack of appropriations; however, OWM provided written comments to the Committee on this item in the advance of the meeting, including the following update on this item:

- The Electric Watthour Meter Subgroup (EWH SG) of the USNWG on Electric Vehicle Fueling & Submetering has held multiple in-person and web meetings since the 2017 NCWM Annual Meeting.
- The SG met in September 2017, November 2017, May 2018, and August 2018. All meetings included web-conferencing to allow those not able to attend in person to participate.
- The SG developed a proposed addition to NIST Handbook 130's Uniform Regulation for the Method of Sale (MOS) of Commodities (see Item MOS-8 on the L&R Committee's Agenda) to specify a method of sale for electrical energy sold through these systems and submitted the proposal to the four regional weights and measures association meetings in Fall 2018.
  - Three of the four regions recommend the MOS proposal on the L&R Agenda as a voting item, with the fourth abstaining due to lack of experience with these systems within the region.
- The SG continues work on a proposed code for EWH-type meters for NIST Handbook 44 and expects to have a draft ready for the 2020 NCWM cycle.
- OWM requests this item be maintained on the S&T Committee's agenda as a Developing Item while the SG finalizes its proposed HB 44 draft. OWM will continue to apprise the Committee of progress.
- At their Fall 2018 meetings, all four regional associations indicated support for maintaining this as a Developing item on the Committee's agenda.

- 1 • The SG will hold its next in-person meeting in February 2019 in Sacramento, CA. (*Technical Advisor's Note:*  
2 *This meeting was rescheduled to April 2019.*)

- 3 • Those interested in participating in this work are asked to contact SG Chair, Ms. Lisa Warfield, or Technical  
4 Advisor, Ms. Tina Butcher.

5 NCWM 2019 Interim Meeting: The Committee heard no comments on this item. At its work session, Committee  
6 members agreed with the submitter and the Regional Associations that this item should be assigned a Developing  
7 status.

8 NCWM 2019 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided the Committee with an update on the further  
9 development of this item. Ms. Butcher reported that the EWH SG will meet next in August 2019 to continue its work  
10 and requested this item remain on the S&T Committee agenda as a Developing item. During the committee's work  
11 session, the Committee agreed with the submitter to retain this item in a Developing status.

12 NCWM 2020 Interim Meeting: The Committee heard from Ms. Butcher who provided an update on developments in  
13 the Electric Watthour Meters Code which is also included in the NIST OWM analysis. Ms. Butcher requested that  
14 this item be given a developing status.

15 During the Committee work session, the committee agreed that this item should be given a Developing status.

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

19 NCWM 2021 Interim Meeting: The Committee heard from Ms. Tina Butcher who provided an update on the  
20 developments in the Electric Watthour Code which is include in the NIST OWM analysis and Ms. Butcher requested  
21 that this item be given a developing status. The Committee agreed that the item be given a Developing status.

22 NCWM 2021 Annual Meeting: Ms. Tina Butcher (NIST OWM) provided an update on the developments in the  
23 Electric Watthour Code which is included in the NIST OWM analysis. Ms. Butcher noted that the Electric Watthour  
24 Code is in Development and anticipates a Code by Fall 2021. There was discussion on definitions for electric master  
25 meters and possibly separating the definitions for gas and water master meters and Ms. Butcher requested that this  
26 item be given a developing status. The Committee agreed that the item be given a Developing status.

27 NCWM 2022 Interim Meeting: Matt Douglas (California – DMS) stated that California supports the development of  
28 this item but has concerns about identity marking requirements being on a separate document. Also that the devices  
29 should be easy to test before and after instillation. This device should allow for electronic data logger. Juana Williams  
30 (NIST) commented that the subgroup had provided a draft code that is on the website. Ms. Williams requested  
31 comments be submitted to Tina Butcher (NIST) or Lisa Warfield (NIST) by March 22, 2022. Ms. Williams stated  
32 these comments will be used to provide and updated draft for the 2022-2023 submission cycle and the item remain in  
33 developing status. The Committee agreed that the item be given a Developing status.

34 As discussed at the weighing sector meeting, multiple vehicle types are tested during the NTEP publication 14 test. If  
35 a specific vehicle type is failed or not tested, there needs to be a restriction on the vehicle types passed on the certificate.  
36 This restriction must also be marked on the device.

37 NCWM 2023 Interim Meeting: Ms. Tina Butcher (NIST) commented that the USNWG on Electric Watthour Meters  
38 Subgroup believes that the draft code is ready for consideration as a voting item. Ms. Butcher asked for continued  
39 feedback from the weights and measures community. During the committee work session, the committee agreed that  
40 the item is fully developed and has merit, and assigned the item a voting status.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: No comments were heard on this item. The WWMA S&T Committee recommends that this item should remain developing to allow the USNWG to continue development of the model code.

SWMA 2022 Annual Meeting: The following comments were received during the 2022 SWMA Annual Meeting:

Ms. Lisa Warfield, NIST, stated the workgroup planned to have an item in Pub 15 before the 2023 NCWM Interim Meeting.

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

NEWMA 2022 Interim Meeting: Ms. Lisa Warfield (NIST-OWM) commented that NIST is still working on this item. An update will be available for the NCWM Interim meeting.

The Committee is recommending that this item retain a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**BLOCK 1 ITEMS (B1) - MINIMUM DRAFT SIZE WHEN USING A FIELD STANDARD METER**

**Source:**

Endress+Hauser Flow USA, Inc.

**Purpose:**

Define the minimum test draft size when using a field standard meter.

**B1: LMD-23.1 V N.3.5. Wholesale Devices**

**Item Under Consideration:**

Amend Handbook 44, Liquid Measuring Devices Code to add a new paragraph under N.3.5. Wholesale Devices as follows:

**N.3.5. Wholesale Devices**

*N.3.5.X. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.*

*(Added 20XX)*

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

**B1: VTM-23.1 V N.3. Test Drafts**

**Item Under Consideration:**

Amend Handbook 44, Vehicle Tank Meters Code as follows:

**N.3. Test Drafts**

*N.3.X. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.*

*(Added 20XX)*

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

**B1: MLK-23.1 V N.3. Test Drafts**

**Item Under Consideration:**

Amend Handbook 44, Milk Meters Code as follows:

**N.3. Test Drafts**

**N.3.1. Test Drafts** - The delivered quantity ~~should~~ **shall** be equal to at least the amount delivered by the device in one minute at its maximum discharge rate, ~~and shall in no case be less than 400 L or 400 kg (100 gal or 1 000 lb).~~

*N.3.2. Field Standard Meter Test. – The minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.*

*(Added 20XX)*

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

**Previous Action:**

2023: New Items

**Original Justification:**

**The proposal describes the minimum quantity test draft size, using a field standard meter, when testing a Liquid-Measuring Device.**

This proposal to amend the 3.30 Liquid-Measuring Devices Code, 3.31 Vehicle Tank Meters Code, 3.35 Milk Meters Code, and provides a clear recommendation for the test draft size using a field standard meter which is significantly less than the draft size needed for fixed volume provers. The use of field standard meters offers accurate traceable commissioning and enforcement testing of metering systems in a fraction of the time needed when using fixed volume proving standards or scales.

**Test drafts recommendations using field standard meters (master meters) are presently described in code sections 3.34. Cryogenic Liquid-Measuring Devices, 3.38 Carbon Dioxide Liquid-Measuring Devices, and 3.39. Hydrogen Gas-Measuring Devices.**

There are similar proposals to amend Mass Flow Meter and Liquefied Petroleum Gas codes to include field standard meters and describe the necessary test draft size.

**The devices used as field standard meters are calibrated to traceable national standards and the process and equipment used for the calibration has been audited by nationally accredited organizations. Documentation supporting the calibration and validation is supplied with the devices.**

The American Petroleum Institute and the American Gas Association have standard documents describing the use of master meters.

**State Directors have stated that the addition of language for field standard meters (master meters) is useful for them to support adoption in their jurisdictions.**

There has been opposition to the proposed Mass Flow Meter and Liquid Petroleum Gas codes Test Draft amendments for field standard meters. Those cite that Appendix A gives the Director authority to choose testing standards. They have initiated several proposals to amend language in Appendix A. There is a proposal to add language to the General Code. They have remained silent regard to the description of test drafts and master meters in the other sections of Handbook 44 and the confusing references in Appendix D definitions.

NIST has not written a 105 Series standard for field standard meters (master meters). In 2018, NIST began conducting a long-term test program of master meters.

**Requested Status by Submitter:** Voting Item

**Comments in Favor:**

**Regulatory:**

- 

**Industry:**

- At the 2023 interim meeting, Mr. Michael Keilty (Endress+Hauser) spoke in favor of the item moving forward as the other items do as well.

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

-

**Item Development:**

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. At the 2023 Interim meeting the committee agreed with the comments regarding this item and assigned it a voting status.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Michael Keilty (Endress+Hauser) - Referred to previous comments regarding LPG-15.1 and MFM-15.1 items. He stated that the language is similar to the test draft language. The goal is to aid the States and this one is good. This applies to fuels and neck provers. Many systems are going unchecked due to the rarity of dedicated provers for milk for example. He recommended that Block 1 items be passed forward as a voting item.

Mr. Robert Murnane (Seraphin Test Measure Company) – He was opposed to this for the same reasons as stated in the discussion about LPG-15.1 and MFM-15.1 items. He did not think that we need a different code for a mass flow or LPG meter. He recommended changing N.3. to include test drafts “one minute at the flow rate being tested”.

During open hearings, the committee heard conflicting comments about these items. The committee takes the positions that the purpose of this item is better addressed in Block 8. WWMA S&T Committee recommends that this item be withdrawn with the recommendation that the submitter combine their efforts with the submitters of Block 8.

SWMA 2022 Annual Meeting: Mr. Keilty, Endress+Hauser, stated that this block contained the same changes as LPG 15.1, which has already been approved. He also stated that electronic devices have changed a lot since 1989, and they still comply with the Fundamental Considerations.

Mr. Searles, American Petroleum Institute, stated that he supported this item moving forward as developing, and that devices should not be pointed out separately.

Mr. Murnane, Seraphin, stated that he supported this moving forward as a developing item.

Mr. Nicholas Suemnick, Marathon Petroleum, stated that he supported this moving forward as developing.

Mr. Prince, Stated of Florida, stated that the membership needs to make a decision on how we want to handle this issue.

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

CWMA 2022 Interim Meeting: Michael Keilty – Endress+Hauser, These three items were initially submitted separately, but then blocked together. All submittals for each item have the same language, which is the same language from LPG-15.1 and MFM-15.1 that was approved by CWMA in May. Nebraska has been using a similar system for years and has positive feedback related to speed of testing. The same language was previously accepted by multiple regional associations. Provers for milk meters are getting harder to find and is affecting business owners. Move to voting status.

The CWMA S&T Committee believes this item is fully developed and recommends voting status. The Committee also believes that LPG-15.1 and MFM-15.1 should be added to Block 1.

NEWMA 2022 Interim Meeting: Mr. Michael Keilty (Endress Hauser) reported that the language in this item is similar to LPG-15.1 and MFM-15.1 Mr. Henry Opperman (Weights & Measures Consulting) has concerns that are related to the test notes that he believes have not been thought through. Will any meter that passes Fundamental Considerations be used? Mr. Opperman noted that a normal test of a LMD includes test of air eliminator and the test of a VTM includes a product depletion test, which would not be able to be performed. Any standard has to provide reproducible results under field conditions. Mr. Bob Murnane (Seraphin Test Measure) pointed out that some meters already meet 1/3 requirement and can already be used as a field standard. Ms. Diane Lee (NIST-OWM) noted that the members



have already withdrawn similar items that contain this same language. Ms. Tisha Arriaga (Marathon Petroleum) commented that she is not in favor of the proposal and doesn't want to keep creating a list of test devices. Would like to see them in one simple statement. Mr. Michael Keilty (Endress Hauser) commented that fixed volume provers are different than master meters and SVP, with separate benefits or disadvantages. Mr. Keilty stated that it is more important and beneficial to list different types of technologies and performance requirements. Mr. Lou Sakin (Holliston, MA) requested that the item be withdrawn. Mr. Prentiss Searles (API) commented that he is not in favor of the proposal. Mr. Jason Flint (NJ) noted the language in this proposal mirrored LPG-15.1 and MFM-15.1, which were already recommended for withdrawal by the body. Mr. Flint suggested that those items be merged into this Block or this Block be withdrawn as well.

After hearing comments from the floor, the Committee does not believe this item has merit. The Committee recognizes that the language in this item is the same as other items that have been previously recommended for withdrawal. The Committee recommends that this item be withdrawn.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **BLOCK 2 ITEMS (B2) - DEFINE TRUE VALUE FOR USE IN ERROR CALCULATIONS**

### **NOTES:**

1. At the 2020 NCWM Interim Meeting the committee agreed that GEN-20.1, SCL-20.1 and SCL-20.2 should be removed from Block 2 and given individual consideration. The items included in this block 2 are SCL-20.3, SCL-20.4, SCL-20.5, SCL-20.6, SCL-20.7 and SCL-20.8.
2. While this item was carried over from the 2020 Interim Meeting, it was not a voting item and therefore not discussed during the continuation of the 2020 Annual Meeting. Instead, it was placed on the 2021 Interim Meeting's agenda and was discussed during that meeting.

### **Source:**

Ross Andersen (Retired)

### **Purpose:**

This proposal has four parts:

1. Clarify the concepts in determining error in verification,
2. Correct Code references to ensure correct reference to either e or d, as appropriate,
3. Correct Code references regarding issues of scale suitability Table 8, and
4. Explain why e and d are not connected

## **B2: SCL-20.3      W    S.5.4. Relationship of Minimum Load Cell Verification Interval to the Scale Division**

### **Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

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

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

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

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

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

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

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

[Nonretroactive as of January 1, 1994]

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

## B2: SCL-20.4 W Table 3. Parameters of Accuracy Classes.

### Item Under Consideration:

Amend Handbook 44, Scales Code as follows:

Table 3. Parameters for Accuracy Classes			
Class	Value of the Verification Scale Division $e^1$ ( <del><math>d</math> or <math>e^1</math></del> )	Number of Scale <sup>4</sup> Divisions (n)	
		Minimum	Maximum
SI Units			
I	equal to or greater than 1 mg	50 000	--
II	1 to 50 mg, inclusive	100	100 000
	equal to or greater than 100 mg	5 000	100 000
III <sup>2,5</sup>	0.1 to 2 g, inclusive	100	10 000
	equal to or greater than 5 g	500	10 000
III L <sup>3</sup>	equal to or greater than 2 kg	2 000	10 000
III	equal to or greater than 5 g	100	1 200
U.S. Customary Units			
III <sup>5</sup>	0.0002 lb to 0.005 lb, inclusive	100	10 000
	0.005 oz to 0.125 oz, inclusive	100	10 000

**Table 3.**  
**Parameters for Accuracy Classes**

III L <sup>3</sup>	equal to or greater than 0.01 lb	500	10 000
	equal to or greater than 0.25 oz	500	10 000
	equal to or greater than 5 lb	2 000	10 000
III	greater than 0.01 lb	100	1 200
	greater than 0.25 oz	100	1 200

<sup>1</sup> ~~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 manufacturer may design a scale such that the verification scale division e does not be equal to the scale division d. To ensure the correct value for e is used, refer to marking requirements in footnotes 3 and 4 to Table S.6.3.a. and Table S.6.3.b.~~  
(Amended 20XX)

<sup>2</sup> 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)

<sup>3</sup> The value of ~~a~~ **the verification** scale division (**e**) for crane and hopper (other than grain hopper) scales shall be not be less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall not be less than 1000.  
(Amended 20XX)

<sup>4</sup> On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of 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)

<sup>5</sup> The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.)

[Nonretroactive as of January 1, 1986]

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

1 **B2: SCL-20.5 W Table S.6.3.a. Marking Requirements, Note 3.**

2 **Item Under Consideration:**

3 Amend Handbook 44, Scales Code as follows:

- 4 3. The device shall be marked with the nominal capacity. *The nominal capacity shall be shown together with the*  
5 *value of the scale division “**d**” (e.g.,  $15 \times 0.005$  kg,  $30 \times 0.01$  lb, or capacity = 15 kg,  $d = 0.005$  kg) in a clear*  
6 *and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless*  
7 *already apparent by the design of the device. Each scale division value ~~or weight unit with its associated~~*  
8 ***nominal capacity** shall be marked on multiple range or multi-interval scales. In the absence of a separate*  
9 *marking of the verification scale division “e” (see Note 4), the value of the verification scale division e shall*  
10 *be equal to the value of the scale division d.*

11 [Nonretroactive as of January 1, 1983]

12 (Amended 2005 and 20XX)

**B2: SCL-20.6 W T.N.1.2. Accuracy Classes and T.N.1.3. Scale Division.**

**Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

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 verification scale division ~~(d)~~ (e).

T.N.1.3. Scale Division. – **This Code contains references to two types of scale divisions, the verification scale division (e) and the scale division (d) (see definitions in Appendix D.).** The tolerance for a weighing device is **in the order of magnitude of 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.** **Other technical requirements may reference either the verification scale division (e) or scale division (d) as appropriate. The values of (e) and (d) are chosen by the manufacturer and are marked on the device pursuant to S.6.3., except that d is not used in reference to an analog device, such as an equal-arm balance, where the graduations do not correspond to units of weight.**

**B2: SCL-20.7 W Table 6. Maintenance Tolerances**

**Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

<b>Table 6.</b> <b>Maintenance Tolerances</b> <b>(All values in this table are in <u>verification</u> scale divisions)</b>				
Tolerance in <u>Verification</u> 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 +
III	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1 <del>d</del> <u>e</u> for each additional 500 <del>d</del> <u>e</u> or fraction thereof)	

**B2: SCL-20.8 W Table 8. Recommended Minimum Load**

**Item Under Consideration:**

Amend Handbook 44, Scales Code as follows:

Table 8. Recommended Minimum Load		
Class	Value of Scale Division (d or e*)*	Recommended Minimum Load (d or e*)*
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
	equal to or greater than 0.1 g	50
III	All**	20
III L	All	50
III	All	10
<p><del>*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 III L devices the value of “e” is specified by the manufacturer as marked on the device; “e” must be less than or equal to “d.” Scales manufacturers are permitted to design scales where the value a verification scale division e differs from the displayed scale division d. If the marked value of e is less than the value of d, use e in interpreting the Table. In all other cases use the value of d. Refer to marking requirements for d and e in footnotes 3 and 4 to Table S.6.3.a. and Table S.6.3.b.</del></p> <p><u>(Amended 20XX)</u></p> <p>**A minimum load of 10 <del>g</del> is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.</p>		

(Amended 1990) (Amended 20XX)

#### Previous Action:

2022: Assigned: Verification Scale Division (e) Task Group

#### Background/Discussion:

These items have been assigned to the newly formed Verification Scale Division (e) Task Group for further development. For more information or to provide comment, please contact the task group chair:

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Most scales under the Scales Code are designated by the manufacturer to have a value of e that equals d. Where e and d are not equal, there has been confusion in interpreting the Scales Code since the Code was adopted in 1984 (taking effect in 1986). This confusion came to the forefront with the needs arising from the cannabis trade. I believe that there were errors in translating OIML R76 (the basis of the current Scales Code) to HB44 format, there were key issues that were lost in translation, and finally there is misunderstanding of the HB44 Code that contributed to this confusion. This proposal will seek to identify the sources of confusion and offer revisions to make correction.

In this discussion I will be using the OIML term instrument when referencing a complete scale or weighing system. This eliminated the dual meaning of the term “device.” A device will only refer to functioning parts of an instrument. Finally, the term “scale” will not be a weighing instrument. Scale will refer only to the measurement scale, i.e., analog graduations or digital divisions.

**1. Determining Error in Verification**

**GEN-20.1.**

In 2017, item 3200-7, a proposal to revise the expression of tolerances in several codes, was considered and withdrawn by the S&T Committee. The proposal aimed to correct the missing reference in those codes to errors of over registration and under registration. It also included a change to the definition of over registration and under registration that was prompted in part to a lack of understanding of the process of verification. Many of the comments received indicated that it was better handled through training. Additionally, the NCWM is working on the issue of alternative test methods which directly impacts the subject of verification. In reviewing the 2017 proposal again, I believe the real problem is a misunderstanding of the process of verification itself, stemming from a missing definition for “True Value.”

The new definition and changes to the General Code correct deficiencies in the code. The “true value” has never been clearly defined in code although it may be inferred from the definitions. The concept of true value is essential to understanding verification process as it is used throughout the Handbook. It is also a legal issue establishing the basis for tolerance decisions with the uncertain test procedure clearly stated. Our decisions are based on the true value derived from a traceable standard and not based on the standard itself. Once established, the true value is considered to have no error for purposes of legal verification. In our tests, the uncertainties in the test procedure are unquantified. If you have to defend your test in court and are asked about the uncertainty in your test, what will you answer? With the addition of the True Value definition, you have a traceable test report for your standard and the text of G-T.3. regarding the legality of the specified test procedure. The verification process formally addresses the risks in two ways. First the risks are kept small by the standard and procedure specified. Second, the risks are shared equally between buyers and sellers. The enhancements explain clearly how errors are computed and how they are interpreted.

The addition of a % error definition in G-T.3. corrects a deficiency that was identified in testing LMD’s. The tolerances in the LMD codes are expressed using errors of over registration /underregistration (device indication – true value). Yet we in the US traditionally calculate those errors as errors of excess/deficiency (true value – device indication). When calculating % error in these calculations, it seemed appropriate to put the device indication in the denominator, but this is incorrect. All error calculations must be in terms of the true value, especially % calculations.

**SCL-20.1**

The addition of the Note addresses the issue of digital rounding. Parallel to R 76, the note requires errors to be determined to a resolution of at least 0.2 e. Remember that error = indication – true value, and the true value is normally the nominal value of the test weight. That means determining the indication to a resolution of 0.2 e or finer using error weights or other means when  $e \geq 2d$ , or by directly reading the indications when  $e \geq 5d$ . This means if  $e = 5d$  or  $e = 10d$ , the indication is resolved fine enough to reduce the rounding error. In R76, the requirement is to “eliminate” rounding error, but this is not possible. You can only reduce it to 0.5 of whatever division size you resolve the indication. Hence, the proposal uses the term “reduce” instead of “eliminate.” The waiver allows field inspectors to continue to use direct reading when  $e = d$ , with a resulting rounding error of 0.5 e. This accepts the additional risk of passing devices outside the tolerances. (See section 4 of the proposal)

The changes to the two Scales Code tolerance paragraphs create a specific reference to the type of error in G-T.3. In this case it formally states errors are errors of over registration/underregistration. The other change in T.1.1. addresses the missing part about applying tolerances to net values as well as gross values for unmarked scales. I believe this was just an oversight in 1984, as applying tolerances to either gross or net loads had been the established practice long before the 1984 changes to the Scales Code.

**2. Correct Code references to ensure correct reference to either e or d, as appropriate.**

**SCL-20.2**

Section S.1.2.2. is not dealing with the verification scale division e as the title implies. Instead, it is dealing with special requirements for instruments designed such that e does not equal d.

Section S.1.2.2.2. is not a specification issue directed to the manufacturer, but rather a question of suitability. It should have been put into the User Requirements section 1. Selection Requirements. For a discussion of the option to delete this refer to part 4 of the proposal.

#### SCL-20.3

The correct value for the table is e. The use of d in the formulas only works when  $e = d$ . That is addressed in the note \* below, which is not necessary when e is used in the formulas.

#### SCL-20.4

- The inclusion of references to d in the header to column 2 of the table is technically incorrect. The verification scale division must refer only to e.
- The change to Note 1 serves to eliminate the confusion about considering e to be the digit to the left of d, and ensures the e value comes from the markings on the device. It is the manufacturer who chooses e for classification purposes.
- The changes to note 3 correctly references the verification scale division e and not the scale division d, and they clean up some grammatical errors.

#### SCL-20.5

The change clarifies that the verification scale division is equal to the marked d when no separate marking of e is provided. Note that nothing in Note 3 prevents marking  $d = 1 \text{ g}$   $e = 1 \text{ g}$ , or capacity  $10000 \text{ g} \times 1 \text{ g}$   $e = 1 \text{ g}$ . The change to the last sentence cleans up a nonsensical term “weight unit.” The scale division must be in a unit of weight, e.g., g, kg, lb, etc. The intent was to have each range of a multi-range device include a capacity and division size n. Note R76 requires marking of Class, Max (capacity), and e, with a marking of d is only required when  $e < d$ .

#### SCL-20.6

The change to T.N.1.1.2. corrects the contradiction between the current code using d and the definition using e in determining accuracy class. The value of n in the definitions already correctly refers to e.

The change to T.N.1.1.3. is an attempt to clarify (e) and (d) similar to R 76 in Table 2. Note that when  $e=d$ , under S.6.3. only one marking is required. It is only when  $e \neq d$  that S.6.3. requires both to be marked. The addition of material for ungraduated analog devices is housekeeping since d has no meaning for these devices. The change also clarifies that some requirements are directed to d (functional requirements on the device) and some to e (relating to classification and tolerance values).

### **3. Discuss issues of suitability of scales when e and d are not equal.**

#### SCL-20.7

It is the value of e that is used in specifying tolerances according to the definition of e, and all values in this table must be expressed in terms of e. The table is currently written in terms of the scale division d, which is technically incorrect.

#### SCL-20.8

The parenthetical (d or e) in the headers to columns 2 and 3 is confusing when the two are not equal. Which one do you use? The note may address Class I and II devices, but it does not help with weight classifiers in Classes III and IIII, where you certainly don't want to use d.

It is vital to note that for instruments under R76 the manufacturer is required to mark a minimum load (Min). The manufacturer calculates Min using e. However, the minimum load is marked in mass units matching the instrument display in divisions of d. There is no confusion since it is marked on the instrument. In HB44 the inspector must determine the minimum load from Table 8 and the scale markings. Most users don't even know this requirement exists, unless told by the inspector.

Table 8 is addressing the large significance of rounding error at small loads. The table must be clear to ensure the correct scale division is used in enforcement. The table at right shows the relative errors resulting from roundoff to the nearest scale division  $d$  at various loads in the table. In principle, we are trying to ensure loads weighed are sufficient to reduce the relative errors to the levels shown, i.e. for Class I – 0.5%, for Class II – 1.0%, Class III – 1.0%, for Class III – 2.5%, and Class III – 5%. While these might seem large initially, there is a diminishing returns effect. A small percentage of a small number tends to be insignificant. Because the value of commodities goes up as the accuracy goes up, we have more stringent requirements on Classes I and II.

Load $d$	Relative Error
10	5.0%
20	2.5%
50	1.0%
100	0.5%

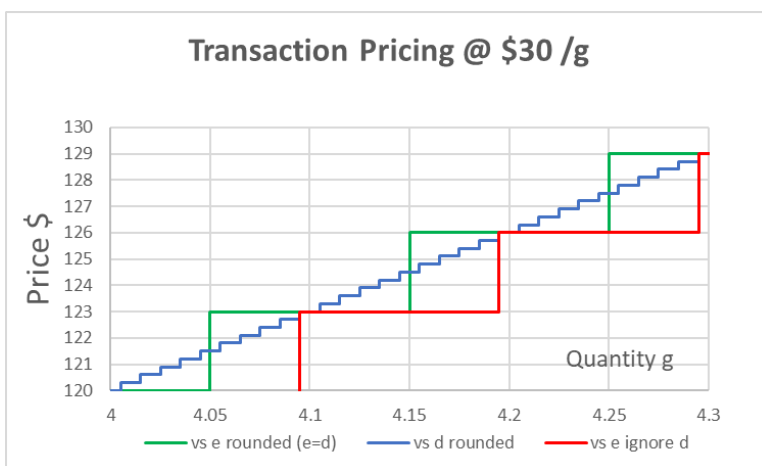
Scales fall into three categories, i.e. with  $e > d$ ,  $e = d$ , and  $e < d$ .

- If  $e < d$ , e.g. weight classifiers, it seems clear the appropriate choice is  $e$ . The table in the second note specifies  $d$ , which is technically incorrect. For example, a Class III weight classifier with  $d = 50$  g  $e = 1$  g, the relative accuracy of 5% is reached at 10  $e$ . At 10  $d$  or (500  $e$ ) the relative error due to rounding is 0.1%.
- If  $e = d$ , it doesn't matter.
- If  $e > d$ , on some Class I and II scales, you get the desired relative error when you use  $d$ . If you use  $e$ , the scale with  $e \neq d$  will result in much smaller rounding error since the rounding is internally applied to  $d$  and not to  $e$ . Examples: If  $e = 0.1$  g, then 50  $e$  is 5 g and the rounding error is  $0.5 e / 50 e = 1\%$ , i.e. the desired level for Class II. If  $e = 0.1$  g and  $d = 0.01$  g, then 50  $e$  is 5 g and the rounding is to 0.5  $d$  or 0.05  $e$ , thus the rounding error is  $0.05 e / 50 e = 0.1\%$ . This may be why the parenthetical ( $d$  or  $e$ ) is used in the current language. Perhaps it was intended that we use the smaller value of the two if  $e$  and  $d$  are different. The proposal states  $e$  is used in cases where  $e < d$  and  $d$  is used in all other cases. This eliminates any confusion. We may consider adding a marking of Min as per R76 as a future idea.

The change to the \* note performs a similar function to the change in Note 1 in Table 3, as it disconnects  $e$  from  $d$  and relies solely on the markings of  $d$  and  $e$ .

In 2017, the NCWM added S.1.2.2.2. to prohibit use of Class I and II scales with a differentiated scale division. One argument was that the differentiated digit would cause confusion. There were arguments in opposition to the proposal. I argued that the confusion rested mostly with the weights and measures community (see earlier discussion). Plus, the finer digit extended the usable range of the scale since you could reach the 1% limit to rounding error at 50  $d$ . For a Class II scale with  $e = 0.1$  g and  $d = 0.01$  g, that means weighing small loads down to 0.5 g loads which is something that users need in the cannabis trade.

One issue involves the rounding errors addressed in Table 8. A more critical issue in my view is the pricing increments. At \$30/g, 0.1 g  $e$  represents a pricing increment of \$3. By displaying 0.01 g  $d$ , that 0.01 g  $d$  reduces the price increment to \$0.30. This is displayed in the graph at right. The blue line shows the 30 cent steps if you use the differentiated  $d$ . If you use the digit to the left of the differentiated  $d$ , you see the counted divisions  $e$  discussed earlier. The gap between the blue and red lines show the losses to users if they are forced to round down. The green line shows pricing on a normally rounded scale





with 0.1 g e. The normal rounding shares the risk equally between buyer and seller.

If the user must have a scale with  $e = d$ , then it forces them to go to 0.01 g e to service loads at the 1 g level. For that scale 50 e is 0.5 g, and the 1 g loads weighed are near 100 e. Precision scales rarely use 2 or 5 divisions, so capacities get reduced by a factor of 10 to move down to the next smaller division size. Blocking the use of  $e=10d$  may force many users to purchase two scales where a single scale would have been suitable if using a scale with a differentiated d were not blocked.

#### **4. Discussion regarding disconnecting e from d**

Sections in the current Scales Code are being incorrectly interpreted to imply there is a direct connection between e and d. Essentially there is a belief when inspecting Class II scales when e does not equal d that we are somehow verifying the first digit to the left of d. Even when  $e = d$ , there is a belief that we are verifying d. That fails to follow the principles incorporated in G-T.3. We are not verifying the division; we are verifying the entire instrument indication at an applied load.

The scale division d is defined as the smallest division of the instrument under test (IUT). The scale division is referred to extensively in the code and we find that requirements written around d regulate the operating characteristics of the instrument, e.g. discrimination. When reading analog indications, we round to the nearest graduation (See Appendix A. Section 10). Under General Code G-S.5.2.2. (d), there is an important requirement that the smallest division of any digital device round off. Unless specifically designated the instruments in HB44 are in “normal rounding” class of instruments. Even with normal rounding, it is critical to understand that the digits to the left of the least significant digits are not rounded. They are counted. For example, as you count the rounded-off d's, when you increment from 9 to 0 in the least significant digit, the next digit increments 1 digit.

The break point between digits to left of the least significant digit always occurs at 9.5 d. If d is 1 g, then the tenth d is counted as 10 g and the 100<sup>th</sup> d is counted as 100 g, etc. Normal rounding of the tens place would normally occur at 5.0 d. If you attempt to apply tolerances to e and just ignore d, you are not rounding in conformance to G-S.5.2.2. (d). Instead, you are rounding down, which places the scale user at a disadvantage and disrupts equity.

UR.3.10. addresses dynamic monorail scales, which also have  $e \neq d$ , and requires that the commercial transaction using these devices shall be based on e, interpreted to mean the digit to the left of the differentiated d. These transactions therefore must be based on a counting scale (rounding down) instead of a half-up/half-down system as required in G-S.5.2.2. (d). When applied to a high-priced commodity at \$30 /g, the pricing errors add up because the scale user is forced to always round down. The table at right shows the impact, and this impact can be attributed to every transaction. At \$30/g, the average loss to the user per transaction is \$1.35. That is not equity!

Indication	\$ Using d	\$ Using e	\$ gain/loss
0.95	\$28.50	\$27.00	-\$1.50
0.96	\$28.80	\$27.00	-\$1.80
0.97	\$29.10	\$27.00	-\$2.10
0.98	\$29.40	\$27.00	-\$2.40
0.99	\$29.70	\$27.00	-\$2.70
1.00	\$30.00	\$30.00	\$0.00
1.01	\$30.30	\$30.00	-\$0.30
1.02	\$30.60	\$30.00	-\$0.60
1.03	\$30.90	\$30.00	-\$0.90
1.04	\$31.20	\$30.00	-\$1.20
1.05	\$31.50	\$30.00	-\$1.50

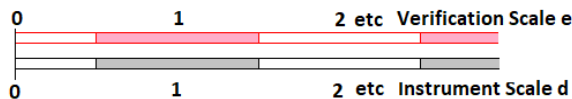
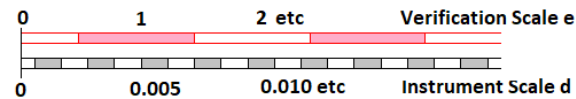
Verifying a scale division is virtually impossible. For a Class II device the accuracy requirement is approximately 0.01% of applied load. If the division is 0.1 g, then the required accuracy is  $\pm 0.00001$  g and we are trying to measure that with a resolution of 0.1 g. In addition, we don't have standards below 1 mg.

I contend that e is not the digit to the left of the differentiated d! Nor do we verify e. Careful reading of the definition of the verification scale division “e” in Appendix D will reveal no direct connection between e and the indications on the instrument being verified. The verification scale division is a mass (weight) value declared by the manufacturer in required markings that is used in classifying instruments and in specifying tolerances for the device. In the header to column 2 in Table 3., we find the expression “Verification Scale Divisions (d or e<sup>1</sup>). This is another chance to misunderstand the Code. The verification scale division must be e according to the definition. It can't be d, although

it can have the same value as d. Similarly, reading Note 1 in Table 3, you might conclude that e is the value of the digit immediately to the left of d. The critical distinction is that e is a value of that digit and not the actual division of the display. To avoid confusion, I propose amending Table 3. to simply direct you to the scale markings to find e and remove any reference to the digit in the display.

The e value is also used in classifying instruments in the Scales Code. Classes refer to relative error ranges. This comes from the ratio  $MTol / e$ . At the second step in the tolerance structure in Table 6. Under HB44 a Class III instrument is  $\sim 0.1\%$  accurate. This is 2 e tolerance for a load of 2,000 e. A Class II instrument is accurate to  $\sim 0.01\%$ , or 2 e error for a load of 20,000 e. However, the tolerances within a class are stepped, such that the % error varies through the operating range. For Class II the relative errors are 0.02% at 5,000 e, 0.01% at 20,000 e and 0.0033% at 100,000 e. The manufacturer decides what class and relative accuracy he needs to serve (based on capacity and n) and designs accordingly.

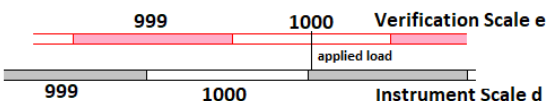
If e is not a division on the instrument, what is it? In R76, the basis of our current Scales Code, the term “scale” is not used to refer to a weighing instrument, but rather the graduations or divisions, i.e., the “scale” of indication. Thus, a scale division is not limited to weighing devices. A register on an LMD has a “scale division,” e.g., a RMFD typically indicates in 0.001 gal divisions of scale. It should be easy to see the 0.001 gal increments correspond to d in the Scales Code. When we verify the RMFD, we use a test measure with an independent scale, either  $1 \text{ in}^3$  for older measures and  $0.5 \text{ in}^3$  for newer measures. The “verification scale” for the RMFD is therefore the “scale” on the test measure used to determine the true value. The instrument scale and the verification scale connect at only one point, at ZERO! Error arises when the two scale diverge as you move along the measurement scale due to linearity errors, influence factors, random variations, etc., within the instrument. The Verification Scale is considered to have no error.

Classification when  $e = d$ Classification when  $e = 1 \text{ in}^3$   $d = 0.001 \text{ gal}$ 

Above at left, the graphic shows a case where  $e = d$ . Notice how the divisions d and e both begin at center zero and the divisions align perfectly because at this magnification it is impossible to see small differences. The test evaluates the sum of many divisions in order to see any deviation. Above at right, the graphic shows how the  $1 \text{ in}^3$  e for the RMFD verification aligns with the 0.001 gal d of the instrument. Now imagine what happens when a test is performed.

Classification is based on relative error. This allows the verification scale division to differ from the instrument scale division, sometimes larger and sometimes smaller. With the RMFD above right, d is significantly smaller than e. In fact, the 6 e maintenance tolerance is 25 d. The two scales are independent. Would anyone suggest that the d smaller than e is inappropriate for commercial use. We verify the RMFD to e just like the weighing instrument with  $e = 10 \text{ d}$ . The confusion comes from the requirement to differentiate d on these instruments.

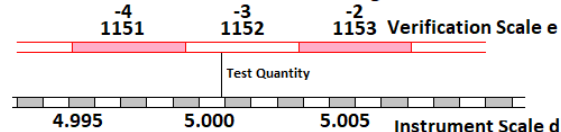
Why does the Code require d to be differentiated when d is smaller than e? That is the critical question. It is not because d is somehow inaccurate or unreliable. It is not because d is smaller than the e of the tolerances. I believe it is because the code wanted to ensure that the serviceperson or official did not use d for tolerance calculations. It had nothing to do with users or customers.

Verification when  $e = d$  under HB44

Error Indication = Indication - True Value

Error =  $1001 \text{ e} - 1000 \text{ e} = +1 \text{ e}$

Under R76 this scale is  $+0.6 \text{ e}$  after correcting for rounding

Verification when  $e = 1 \text{ in}^3$   $d = 0.001 \text{ gal}$ 

Error Delivery = True Value - Indication

Error =  $1152 \text{ in}^3 - 5.000 \text{ gal} (1155 \text{ in}^3) = -3 \text{ in}^3$

In the above graphics, the instrument scale diverges from the verification scale. They both started at the same zero reference. Notice that the RMFD at right calculates delivery error vs indication error at left. The key is to understand that the verification scale has no error and we are measuring the deviation of the instrument scale from the verification scale.

This pattern holds true for other verification tests, from tests of packaged goods with a reference scale to tests of taximeters on a road course. Circling back to the proposed definition of true value, in addition to its use in classifying scales, **the verification scale is that “scale” used to measure the true value. The division of that “true value” measurement scale is “e.”** With the new G-T.3, that true value is the legal basis of our tests and is known without uncertainty. A table of a variety of verifications and their d and e scales are provided below.

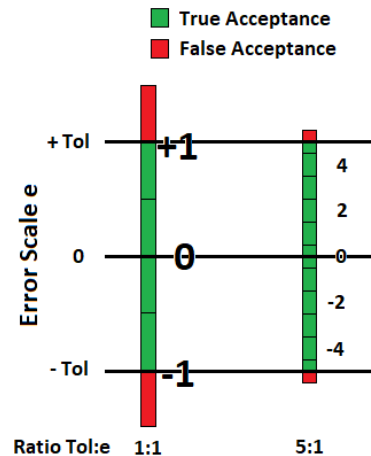
Instrument & quantity	Instrument scale division d	Verification scale division e	Maintenance Tolerance	Ratio MT/e
RMFD @ 5 gal	0.001 gal	1 in <sup>3</sup> 0.5 in <sup>3</sup>	6 in <sup>3</sup>	6 12
VTM @ 100 gal	0.1 gal	5 in <sup>3</sup>	~70 in <sup>3</sup>	14
Rack @ 1,000gal	1 gal	0.1 gal	3 gal	30
Mass Flow Class 0.3	<= 0.2% MMQ	<= 0.02%	0.3%	15
Taximeter @ 1 mi	0.2 mi	~0.001 mi (!5 ft)	+0.01/-0.04 mi	10/40
Package Checking @ 1 lb @ 4 oz	N/A N/A	<= 0.005 lb <= 0.002 lb	0.044 lb 0.016 lb	8.8 8
III scale e = d @ 200 d	1 d	1 e = 1 d	2 e	2
III scale e = d @ 2,000 d	1 d	1 e = 1 d	2 e	2
II scale e = d @ 20,000 d	1 d	1 e = 1 d	2 e	2
II scale e = 10 d @ 20,000 e	1 d	1 e = 10 d	2 e	2

The last column of the table is the real focus of verification. We want to have sufficient resolution in determining errors. Although the issue is a bit more complicated, this ratio is a measure of the effectiveness of the verification. Special notes:

- For the RMFD, VTM, and Rack instruments the ratio is limited by HB105-3 and the specified minimum division of the prover scale. This becomes part of the code when you specify the prover must meet that specification.
- For the mass flow instruments the Notes provide no guidance on the verification scale division. I submit the value of resolution in error should be in HB44 Notes for all Codes, similar to R76 for weighing instruments. This is something I hope the work group on alternative test methods addresses. The EPO does specify the reference scale division be no larger than 1/10 of the smallest tolerance applied. This means the Mass Flow code requires a minimum ratio of 15:1 for maintenance tolerance which I believe is overkill and very costly. Compare to 5:1 elsewhere.
- For scales the ratio is only 2:1 as currently written in Handbook 44. There is no mention of error weights in the Code. In R76, the ratio is specified in that it requires errors to be determined to at least 0.2 e. This produces a ratio of 5:1 in the first step, 10:1 in step two and 15:1 in step three. If you determine errors to 0.1 e, as we do normally with error weights, it allows you to double those ratios and provide 10:1 in the first step. Reading the errors in d when e = 5 d or e = 10d, allows you to meet the minimum without using error weights (or expanded resolution).

Why use maintenance tolerance in computing this ratio? In verification, there is a shift in emphasis relative to calibration. In verification, your primary concern is with the population. You want all the devices in the same commercial field to have performance that is similar enough to promote equity. Even if you are little sloppy in applying acceptance tolerance, the instrument is highly likely to perform within maintenance tolerances. In calibration, the focus is always on a single artifact or instrument.

Why is this resolution in determining errors important? The short answer is to reduce the incidence of false acceptance/rejection. The Range of False Acceptance (RFA) can be defined as the portion of the compliant measured error that reaches outside the tolerance limits due to rounding in the error calculation. Limiting the RFA is the objective in specifying the resolution of errors.



When we use direct reading in testing weighing instruments the ratio of Tol:e in the first tolerance step is 1:1 and we have an RFA of  $\frac{1}{2} e$  in proportion to the 1 e tolerance. The RFA is 50% of the tolerance, meaning we can accept instruments in error up to 1.5 times the tolerance. When we add the R76 requirement to measure errors to 0.2 e we increase the ratio of Tol:e to 5:1 and thereby reduce the RFA to 0.1 e in proportion to the 1 e maintenance tolerance (see graphic at right). This RFA is only 10% of the tolerance. Statistically, it can be shown that the RFA contributes to the population variability based on the Root Sum Square. At  $\frac{1}{2} e$  RFA when Tol:e is 1:1, the population variability gets increased by 22%. When we increase the Tol:e ratio to 5:1 the population variation is only increased by 1%, which is not considered significant.

A better way to express this in is terms of compliance rate. Imagine your test data shows compliance of a class of devices as 95% at 1 e tolerance, but you are testing using direct reading. Due to rounding in measuring the error that you are not addressing, 95 % of the instruments are actually within 1.22 e and not the 1.00 e indicated in the compliance data. By increasing the Tol:e ratio to 5:1, 95% of the instruments are accurate within 1.01 e.

2020 NCWM Interim Meeting: The Committee acknowledged written comments from the submitter and heard comments during the open hearing session on this item. Mr. Constantine Cotsoradis (Flint Hills Resources) and Mr. Russ Vires (SMA) representing interests from an industry perspective questioned the need for the changes being proposed in this block of items. Additional comments from regulatory officials indicated that the changes included in this proposal were not successful in clarifying HB44 requirements and possibly added to any confusion that exists. Mr. Steve Cook (CA, retired) pointed out that the changes ignored weighing devices that did not fall under Accuracy Class I or II and stated his willingness to work with the submitter to further develop the proposal.

Several other comments heard during open hearings indicated that it is questionable to include all of the individual items that are shown as part of Block 2. Comments from SMA, and some regulatory officials recommended that this Block of items be separated since not all items now grouped under Block 2 seem to be closely related. Mr. Kurt Floren (Los Angeles Co., CA) also pointed out that some of the proposed amended language is not clear and will add to confusion in interpretation of requirements and that there are some editorial corrections and proper formatting needed in this proposal as well.

NIST OWM commented that while most of the proposed changes seem to be fundamentally sound, the urgent need to implement some of those proposed changes is not clear. OWM also agreed with other comments that recommend separating the items under Block 2 into individual items or grouped together where items are more clearly related. OWM notes that item SCL-20.2 now included in Block 2 is clearly related to two other items individually listed on the S&T Committee's agenda: SCL-20.10 and SCL-20.11. Additionally, OWM believes that the determination if individual Scales Code requirements are meant to apply to either "e" or "d" should be carefully considered on a case-by-case basis. Also recommended was that additional input be solicited from stakeholders (industry officials and device manufacturers in particular) prior to adopting any changes based on this proposal.

During the Committee's work session, they agreed that some of the items combined under Block 2 should be separated. The Committee agreed that items GEN-20.1, SCL-20.1, and SCL-20.2 should be removed from Block 2 and given individual consideration. Considering items individually, the Committee agreed to the following:

- Item GEN-20.1: The Committee acknowledged the receipt of comments from some of the regional associations concerning the use of the term "True Value" in the formulas included in parts (a) & (b) and how it is defined in the proposal. The Committee agreed that there may be value in further defining the application of tolerance and that the item should be given a Developing status adding that consideration should be given to amending the use of the term "True Value."
- Item SCL-20.1: There were no direct comments regarding this item during open hearings. The Committee reviewed NIST OWM's analysis on this item and agreed it should be withdrawn noting this proposed change is unnecessary.
- Item SCL-20.2: During open hearings this item was discussed relative to items SCL-20.10 and SCL-20.11 which address the same issue. Most comments received were in favor of option 2 in this proposal which was effectively the same as SCL-20.10. The Committee agreed this item should also be withdrawn.
- Items SCL-20.3: The Committee agreed items SCL-20.4, SCL-20.5, SCL-20.6, SCL-20.7, and SCL-20.8 should be grouped together as Block 2 and given an Assigned status.

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

NCWM 2021 Interim Meeting: The Committee heard comments on this item during the open hearing session including the following.

Mr. John Barton (NIST OWM) stated that as a member of the Task Group assigned to this item, that group met on several occasions over the past 4 months to deliberate on the issues involved in this proposal. While the Task Group came to conclusions that are included in the final report, there had been other individuals and groups that came to different conclusions on those issues. Those other individuals and groups included subject matter experts, NTEP evaluators, scale manufacturers, and the NTEP Weighing Sector. Mr. Barton further stated that given the impact of changes proposed in this item, it may be wise to include additional sources of input prior to adopting the recommended changes.

It was also noted that the Committee set a date of November 15, 2023 for the Task Group to return its conclusions and that the Task Group finalized its work in a matter of 4 months rather than using the 3 years granted. It is also significant to note that the Task Group requested an Informational status for this item as opposed to a Voting status. This suggests that the Task Group is open to the notion that the proposal could be vetted further even when they have generated a "final" report on their work.

Mr. Henry Opperman (Weights and Measures Consulting) referred to the written comments he submitted to the Committee prior to this meeting and stated that all individual items in this Block should be withdrawn. Mr. Opperman stated that the proposals in this Block are based on false premises and therefore should not be adopted. Mr. Alan Walker (FL) agreed with Mr. Opperman and stated this proposal should be withdrawn also.

During the committee's work session, the Committee considered updating the charge to the TG to direct that group to specifically identify each change recommended in the final report to actual changes proposed as amendments in HB 44. The Committee also recommends this remains as an assigned item.

NCWM 2021 Annual Meeting: At the request of the Task Group Chair, the Committee elevated the status of this item from Assigned to the task group to Informational.

NCWM 2022 Interim Meeting: Rick Harshman (NIST) recommended that the Task Group provide the committee with its recommendations in the form of an updated item under consideration. NIST also provided the committee with written comments. Doug Musik (Task Group Chair) spoke to the changes the task group had made that were in Appendix A of the publication and recommended sending it back to the Task Group. Russ Vires (SMA) supports the development of the item and recommended the following changes;

**SCL-20.4: Table 3, footnote 1: note to discuss e not equal to d**

**SCL-20.6: “d” in parathesis () should be struck out**

**SCL-20.7: table 6 added SCL-20.8: scales may have verification internal e not equal to scale division “D”**

Matt Douglas (California, Division of Measurement Standards) recommended accepting the changes from SMA. Charlie Stutsman (KS) recommended sending the item back to the Task Group.

The Committee agreed the item should be assigned back to the Task Group and that the item be refined and submitted to the conference.

NCWM 2022 Annual Meeting: During open hearings, the Committee received an update from the Task Group Chair Doug Musick (KS). Mr. Musick indicated that the Task Group created a report in 2021 that had been added to Publication 15 and 16 as an Appendix. This report contains an analysis of the items under consideration, as well as recommendations for language changes to those items. Mr. Musick requested a joint meeting with the Task Group and the S&T and L&R Committees for coordinating moving the recommended changes to the items under consideration. The Committee recommends this remains Assigned and is requesting the Task Group facilitate joint meeting and work on moving the recommended changes from the report into the items under consideration.

NCWM 2023 Interim Meeting: During open hearings, the Task Group Chairman Mr. Doug Musick (KS) requested that this Block be withdrawn. He indicated that the Task Group has submitted a new proposal covering each of these items. The committee has agreed to withdraw this item.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Due to timing constraints, the committee did not take comments on assigned items. The committee did allow the source to provide updates on these items. No update was provided to the committee. The WWMA S&T Committee recommends that this item remain assigned and looks forward to a future update.

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

# **BLOCK 3 ITEMS (B3) - TOLERANCES FOR DISTANCE TESTING IN TAXIMETERS AND TRANSPORTATION NETWORK SYSTEMS**

## **Source:**

New York Department of Agriculture and Markets

## **Purpose:**

Provide the same distance-measurement tolerances for the Taximeters Code and Transportation Network Systems Code.

## **B3: TXI-20.1 W T. Tolerances**

### **Item Under Consideration:**

Amend Handbook 44, Taximeters Code as follows:

### **T. Tolerances**

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

**T.1.1. On Distance Tests.** – Maintenance and acceptance tolerances for taximeters shall be as follows:

(a) On Over registration: 1 % of the interval under test when the distance is 1.6 km (1 mile) or less. 2.5 % of the interval under test when the distance is greater than 1.6 km (1 mile).

## **B3: TNS-20.1 W T. Tolerances**

### **Item Under Consideration:**

Amend Handbook 44, Transportation Network Systems Code as follows:

### **T. Tolerances**

**T.1.1. Distance Tests.** – Maintenance and acceptance tolerances shall be as follows:

(a) On Over registration: ~~2.5%~~ 1 % of the interval under test when the distance is 1.6 km (1 mile) or less. 2.5 % of the interval under test when the distance is greater than 1.6 km (1 mile).

(b) On Underregistration: ~~2.5 %~~ 4 % of the interval under test.

### **Previous Action:**

2020: Developing

2021: Developing

2022: Developing

### **Comments in Favor:**

#### **Regulatory:**

- 2022 Interim: A regulator from New York presented current edits of the proposal at the time of his comments. These edits were not published in Publication 15 and when presented during open hearings, membership was unable to view the content due to the projected size on the screen and on online screens. The commenter stated that many taxis operate with a GPS based systems and are still

categorized as a taxi meter due to the nature of their business and this would provide the same tolerances for similar technology. Recommends revised version move forward as Voting status.

- 2023 Interim: The submitter of this item commented that this proposal is no longer needed and requested that it be withdrawn.

**Industry:**

- 

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- 2022 Interim: A regulator from Los Angeles County, CA commented this may set a dangerous precedence and noted the same requirements should apply to similar devices, regardless of design or technology used. Recommends withdraw. A regulator from California DMS commented there is no justification for increasing the tolerances for equipment already meeting the requirements. Recommends withdraw.

**Industry:**

- 

**Advisory:**

- 2022 Interim: An advisory member representing NIST OWM commented on the expansion of tolerances and noted that taximeters have a long-standing history showing these devices can meet these established tolerances. The commenter recommends the submitter work on the proposal and engage in efforts to merge the taximeter and TNMS codes with the USNWG. It was also stated the USNWG has this item on their agenda for further discussion. Recommends the proposal be further developed with the assistance of the USNWG.

**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

- 

**Advisory:**

- 

**Background/Discussion:**

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

Mr. Jim Willis  
New York Department of Agriculture and Markets  
518-485-8377, [james.willis@agriculture.ny.gov](mailto:james.willis@agriculture.ny.gov)

Taximeter manufacturers are submitting devices identical to the devices in the Transportation Network Measurement Systems code; however, they are faced with a tighter tolerance for over-registration. Both devices are typically computer pads or cell phones. Taximeter companies want to take advantage of some of the same technology used by TNMS companies, however, the tolerance for taximeters is much tighter than the tolerance for TNMS meters. During type evaluation, it is common to drive more than 1 mile to incorporate tunnels and valley effect. If the same tolerance was applied, taximeters would have the same chance of passing as TNMS meters.



Some jurisdictions that test taximeters may not want the tolerance for a 1-mile course to be raised given the good history of their test programs. This is the reason I am proposing maintaining the 1% tolerance at 1 mile or less.

Some TNMS companies may be concerned that their device will not pass a 1% tolerance, but we believe that on a straight, 1-mile course, devices operating properly should have no problem passing.

NCWM 2020 Interim Meeting: The Committee heard from NIST OWM explaining that the proposal is not technically correct by inserting language that refers to “intervals” in the tentative HB 44 TNMS Code. These types of systems do not calculate a charge for fare using intervals (i.e., segments) of the total travel in a trip as do taximeters. TNMS calculate fare charges based on the entire distance/time in a trip. Additionally, these two different systems (taximeters and TNMS) are becoming more similar and the differences that were used to distinguish them from one another are beginning to fade. OWM noted there is a need for the USNWG on Taximeters that developed the tentative TNMS Code to meet and discuss the potential of a merger of these two HB 44 Codes. Mr. Kurt Floren (Los Angeles Co., CA) pointed out that taximeters have been and still are meeting existing tolerances and therefore he questions the need to expand those tolerance values.

Mr. Stan Toy (Santa Clara Co., CA) expressed his belief that the tolerances for taximeters do not need to be expanded and that this item should be Withdrawn. Mr. Jim Willis (NY) pointed out that New York Weights and Measures has issued its own type approval for taximeters that use location services such as GPS to measure distance. Mr. Willis stated further that NY would support a Developing or Assigned status.

During the Committee’s work session, it was agreed to assign a Developing status with the understanding the USNWG on Taximeters has offered to assist the submitter in further development of the proposal.

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

NCWM 2021 Interim Meeting: Mr. John Barton (NIST OWM) stated that OWM noted issues of concern in this proposal during the 2020 NCWM Interim Meeting regarding how tolerances are applied to taximeters in contrast to how they are applied to TNMS. This proposal does not seem to recognize these differences. OWM also notes the many opposing comments made pertaining to the increase of tolerances for taximeters which have complied with existing tolerances for decades. The NIST USNWG on Taximeters has been conducting meetings with a goal of merging the HB 44 Taximeters and TNMS Codes. This work will include a number of modifications to both codes that will affect the specifications, test procedures, user requirements, and possibly the tolerances. The USNWG has offered to work with the submitter of this proposal.

Mr. Willis representing the submitter of this item stated a willingness to work the USNWG on Taximeters.

During the committee’s work session, the members noted the submitter’s willingness to work with the taximeter work group and agreed to maintain this item’s Developing status.

NCWM 2022 Interim Meeting: The Committee assigned a developing status for this item at the 2022 Interim Meeting. The committee recommends the submitter work with the USNWG on this proposal. As noted in open hearings this is an item on the USNWG agenda and there may be efforts on the way to address this issue by other means.

NCWM 2022 Annual Meeting: During open hearings, the Committee received an update from submitter Jim Willis, New York. Based on feedback, Mr. Willis has made language changes which will be updated for the fall meetings. Mr. Willis requested that the item retain its developing status.

NCWM 2023 Interim Meeting: Upon request of the submitter, the committee has agreed to withdraw this item.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Matt Douglas (State of California, Division of Measurement Standards) – Wanted to hear if this update addressed some of the concerns raised particularly by Mr. Floren. Did see the merit in how this was developed. Thought this is close to being ready if not already ready for a vote.

Mr. Kurt Floren (County of Los Angeles, California) - Was opposed to the original item and is against lowering the bar when there is technology out there that is meeting the tolerances. Didn't think that the verbiage of "physically connected to the vehicle" is sufficient. Thought the item needs to be developed to clarify that the drive is what is connected to the vehicle.

During open hearings, members in attendance were notified that the language in the agenda did not reflect the updated item under consideration. Membership was not fully aware of the new language at the time of open hearings. Concerns were heard that terms such as "physically connected" are not specific enough to enforce. The WWMA S&T Committee recommends that this item should remain developing to allow membership to review the updated proposal.

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

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

CWMA 2022 Interim Meeting: Craig VanBuren – Michigan

Trying to make two measurements of the same device category equal in tolerance values. i.e. GPS and taxis have the same tolerance. Concerns regarding errors in the customer's favor shouldn't be a problem. But on pages 284 - 285, depending on physical vehicle or GPS, there are different tolerances? Why is the tolerance conflicting within the same block? Haven't heard any input from transportation companies. Recommend withdrawal.

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

NEWMA 2022 Interim Meeting: Mr. Jim Willis (NY), submitter, requested that this item be withdrawn.

At the request of the submitter, the Committee recommends that this item be Withdrawn

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**BLOCK 4 ITEMS (B4) - ELECTRONICALLY CAPTURED TICKETS OR RECEIPTS**

*NOTE: The item under consideration reflects changes that were received by the committee from the submitter of the item and that the Committee agreed to during its 2021 Interim Meeting work session. The changes are highlighted.*

**Source:**

Kansas Department of Agriculture, Division of Weights and Measures

**Purpose:**

Allow recorded values to be captured electronically as an alternative to a printed ticket or receipt.

**B4: GEN-21.2 V G-S.5.6. Recorded Representations.**

**Item Under Consideration:**

Amend Handbook 44, General Code as follows:

**G-S.5.6. Recorded Representations.** – Insofar as they are appropriate, the requirements for indicating and recording elements shall also apply to recorded representations. All recorded values shall be ~~printed provided presented~~ digitally. In applications where recorded representations are required by a specific code, the customer may be given the option of not receiving the recorded representation. Unless otherwise specified, recorded representations referenced in specific codes shall be made available to the customer as a minimum in hard copy form. For systems equipped with the capability of issuing an electronic receipt, ticket, or other recorded representation, the customer may be given the option to receive any required information electronically (e.g., via cell phone, computer, etc.) in lieu of or in addition to a hard copy.

(Amended 1975, 2014 and **20XX**)

**B4: LMD-21.2 V S.1.6.5. Money Value Computations., UR.3. Use of a Device.****Item Under Consideration:**

Amend Handbook 44, Liquid Measuring Devices Code as follows:

**S.1.6.5. Money-Value Computations**

...

***S.1.6.5.6. Display of Quantity and Total Price, Aviation Refueling Applications.***

(a) *The quantity shall be displayed throughout the transaction.*

(b) *The total price shall also be displayed under one of the following conditions:*

(1) The total price can appear on the face of the dispenser or through a controller adjacent to the device.

(2) If a device is designed to continuously compute and display the total price, then the total price shall be computed and displayed throughout the transaction for the quantity delivered.

(c) *The total price and quantity shall be displayed for at least five minutes or until the next transaction is initiated by using controls on the device or other customer-activated controls.*

(d) A ~~printed~~ receipt shall be available and shall include, at a minimum, the total price, quantity, and unit price.

[Nonretroactive as of January 1, 2008]

(Added 2007) (**Amended 20XX**)

**S.1.6.7. Recorded Representations.** – Except for fleet sales and other price contract sales and for transactions where a post-delivery discount is provided, a ~~printed~~ receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:

(a) *the total volume of the delivery;\**

(b) *the unit price;\**

(c) *the total computed price;\**

(d) the product identity by name, symbol, abbreviation, or code number;\* and

(e) the dispenser designation by either an alphabetical or numerical description.\*\*

\*[Nonretroactive as of January 1, 1986] \*\*[Nonretroactive as of January 1, 2021]

(Added 1985) (Amended 1997, 2012, 2014, 2018 and 20XX)

**S.1.6.8. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided. –**

Except for fleet sales and other price contract sales, a **printed** receipt providing the following information shall be available through a built-in or separate recording element that is part of the system for transactions involving a post-delivery discount:

(a) the product identity by name, symbol, abbreviation, or code number;

(b) transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount(s), including the:

(1) total volume of the delivery;

(2) unit price; and

(3) total computed price of the fuel sale.

(c) an itemization of the post-delivery discounts to the unit price;

(d) the final total price of the fuel sale after all post-delivery discounts are applied; and

(e) the dispenser designation by either an alphabetical or numerical description.

[Nonretroactive as of January 1, 2021]

(Added 2012) (Amended 2014, ~~and~~ 2018, and 20XX)

...

**UR.3. Use of a Device**

...

**UR.3.3. Computing Device** – Any computing device used in an application where a product or grade is offered for sale at one or more unit prices shall be used only for sales for which the device computes and displays the sales price for the selected transaction.

(Became retroactive 1999)

(Added 1989) (Amended 1992)

The following exceptions apply:

(a) Fleet sales and other price contract sales are exempt from this requirement.

(b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement provided that:

(1) all purchases of fuel are accompanied by a **printed** receipt of the transaction containing the applicable price per gallon, the total gallons delivered, and the total price of the sale; and

(Added 1993)

- (2) unless a dispenser complies with S.1.6.4.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.

(Added 1993)

- (c) A dispenser used in an application where a price per unit discount is offered following the delivery is exempt from this requirement, provided the following conditions are satisfied:

- (1) the unit price posted on the dispenser and the unit price at which the dispenser is set to compute prior to the application of any discount shall be the highest unit price for any transaction;

(Amended 2014)

- (2) all purchases of fuel are accompanied by a receipt recorded by the system. The receipt shall contain:

- a. the product identity by name, symbol, abbreviation, or code number;
- b. transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount including the:
  - 1. total volume of the delivery;
  - 2. unit price; and
  - 3. total computed price of the fuel sale prior to post-delivery discounts being applied.
- c. an itemization of the post-delivery discounts to the unit price; and
- d. the final total price of the fuel sale.

(Added 2012) (Amended 2014)

(Added 1989) (Amended 1992, 1993, 2012, ~~and 2014~~, and 20XX)

**UR.3.4. ~~Printed Ticket, Recorded Representation.~~** – The total price; the total volume of the delivery; the price per liter or gallon; *and a corresponding alpha or numeric dispenser designation\** shall be ~~shown, either printed recorded~~ by the device ~~or in clear hand script~~, on any ~~printed ticket issued by a device and recorded representation~~ containing any one of these values and shall comply with G-S.5.6. Establishments where no product grades are repeated are exempt from the dispenser designation requirement.

*\*[Nonretroactive as of January 1, 2021]*

(Amended 2001, 2018, ~~and 2019~~, and 20XX)

#### **B4: VTM-21.1 V S.1.1. Primary Elements., UR.2. User Requirements**

##### **Item Under Consideration:**

Amend Handbook 44, Vehicle Tank Meter Code as follows:

##### **S.1.1. Primary Element**

**S.1.1.1. General.** – A meter shall be equipped with a primary indicating element. ~~and may also be equipped with a primary recording element.~~ Except for systems used solely for the sale of aviation fuel

into aircraft and for aircraft-related operations, a meter shall be equipped with a primary recording element.

(Amended 1993 and 20XX)

~~Note: Except for systems used solely for the sale of aviation fuel into aircraft and for aircraft related operations, vehicle tank meters shall be equipped with a primary recording element as required by paragraph UR.2.2. Ticket Printer; Customer Ticket. Recorded Representation~~

~~(Amended 1993 and 20XX)~~

...

**S.1.4.2. ~~Printed Ticket. Recorded Representation.~~** – If a computing-type device issues a ~~printed ticket~~ recorded representation which displays the total computed price, the ~~ticket recorded representation~~ shall ~~also have printed clearly thereon record~~ the total quantity of the delivery, the appropriate fraction of the quantity, and the price per unit of quantity.

(Amended 1989, and 20XX)

...

## UR.2. User Requirements.

...

**UR.2.2. ~~Ticket Printer, Customer Ticket Recording Element.~~** – Vehicle-Mounted metering systems shall be equipped with ~~a ticket printer which shall be used for~~ means to record all sales where product is delivered through the meter and shall comply with G-S.5.6. A copy of the ticket issued by the device shall be ~~left with~~ provided to the customer at the time of delivery or as otherwise specified by the customer.

(Added 1993) (Amended 1994, and 20XX)

## B4: LPG-21.1 V S.1.1. Primary Elements., UR.2. User Requirements

### Item Under Consideration:

Amend Handbook 44, LPG and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

### S.1.1. Primary Elements.

**S.1.1.1. General.** – A meter shall be equipped with a primary indicating element and may also be equipped with a primary recording element.

**Note:** Vehicle-mounted metering systems shall be equipped with a primary recording element as required by paragraph UR.2.6. ~~Ticket Printer; Customer Ticket. Recorded Representation~~

(Amended 20XX)

...

**S.1.1.6. ~~Printed Ticket. Recorded Representation~~** – Any ~~printed ticket issued~~ recorded representation created by a device of the computing type ~~on which there is printed~~ includes the total computed price, shall ~~have printed clearly also include~~ thereon the total volume of the delivery in terms of liters or gallons, and the appropriate decimal fraction of the liter or gallon, and the corresponding price per liter or gallon.

(Added 1979) (Amended 1987, and 20XX)

1 ...

2 **S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is**  
 3 **Provided.** – Except for fleet sales and other price contract sales, a ~~printed receipt~~ **recorded representation**  
 4 providing the following information shall be available through a built-in or separate recording element that  
 5 is part of the system for transactions involving a post-delivery discount:

- 6 (a) the product identity by name, symbol, abbreviation, or code number;
- 7 (b) transaction information as shown on the dispenser at the end of the delivery and prior to any post-  
 8 delivery discount(s), including the:
  - 9 (1) total volume of the delivery;
  - 10 (2) unit price; and
  - 11 (3) total computed price of the fuel sale.
- 12 (c) an itemization of the post-delivery discounts to the unit price; and
- 13 (d) the final total price of the fuel sale after all post-delivery discounts are applied.

14 (Added 2016) (**Amended 20XX**)

15 ...

## 16 **UR.2. User Requirements.**

17 ...

18 **UR.2.6. ~~Ticket Printer, Customer Ticket.~~ Recorded Representation**– Vehicle-Mounted metering  
 19 systems shall be equipped with ~~a ticket printer. The ticket printer shall be used for~~ **means to record** all sales;  
 20 **where product is delivered through the meter and shall comply with G-S.5.6.** ~~aA~~ copy of the ~~ticket-recorded~~  
 21 **representation** issued by the device shall be ~~left with~~ **provided to** the customer at the time of delivery or as  
 22 otherwise specified by the customer.

23 (Added 19932) (Amended 1994, **and 20XX**)

24 ...

25 **UR.2.7.2. Computing Device.** – Any computing device used in an application where a product or grade is  
 26 offered for sale at one or more unit prices shall be used only for sales for which the device computes and  
 27 displays the sales price for the selected transaction. The following exceptions apply:

- 28 (a) Fleet sales and other price contract sales are exempt from this requirement.
- 29 (b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement  
 30 provided that:
  - 31 (1) all purchases of fuel are accompanied by a ~~printed receipt~~ **recorded representation** of the  
 32 transaction containing the applicable price per unit of measure, the total quantity delivered, and  
 33 the total price of the sale; and

(2) unless a dispenser complies with S.1.5.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.

(c) A dispenser used in an application where a price per unit discount is offered following the delivery is exempt from this requirement, provided the following conditions are satisfied:

(1) the unit price posted on the dispenser and the unit price at which the dispenser is set to compute shall be the highest unit price for any transaction;

(2) all purchases of fuel are accompanied by a receipt recorded by the system for the transaction containing:

a. the product identity by name, symbol, abbreviation, or code number;

b. transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount including the:

1. total volume of the delivery;

2. unit price; and

3. total computed price of the fuel sale prior to post-delivery discounts being applied.

c. an itemization of the post-delivery discounts to the unit price; and

d. the final total price of the fuel sale after all post-delivery discounts are applied.

(Added 2016) (Amended 20XX)

**B4: CLM-21.1 V S.1.4.1. ~~Printed Ticket~~Recorded Representation., UR.2.6.3. ~~Printed Ticket~~Recorded Representation.**

**Item Under Consideration:**

Amend Handbook 44, Cryogenic Liquid-Measuring Devices Code as follows:

**S.1.4.1 ~~Printed Ticket~~ Recorded Representation** – Any ~~printed ticket~~ **recorded representation** issued by a device of the computing type ~~on which there is printed~~ **includes** the total computed price ~~shall have printed clearly thereon~~ **also include** the total quantity of the delivery, and the price per unit.

(Amended 20XX)

And

**UR.2.6.2. ~~Tickets or Invoices. Recorded representation~~** – Any ~~written invoice, or printed ticket, recorded representation~~ based on a reading of a device that is equipped with an automatic temperature or density compensator shall have shown thereon that the quantity delivered has been adjusted to the quantity at the NBP of the specific cryogenic product or the equivalent volume of gas at NTP.

(Amended 20XX)

**UR.2.6.3. ~~Printed Ticket. Recorded Representation.~~** – Any ~~printed ticket issued~~ **recorded representation provided** by a device of the computing type ~~on which there is printed~~ **includes** the total computed price, the



total quantity of the delivery, or the price per unit, shall also ~~show include~~ the other two values. ~~(either printed or in clear hand script).~~ and shall comply with G-S.5.6.

(Amended 20XX)

**B4: MLK-21.1 V S.1.4.2. Printed Ticket Recorded Representation., UR.2.6.3. Printed Ticket Recorded Representation.**

**Item Under Consideration:**

Amend Handbook 44, Milk Meter Code as follows:

**S.1.4.2. Printed Ticket Recorded Representation** – If a computing-type device issues a ~~printed ticket recorded representation~~ which ~~displays includes~~ the total computed price, the ~~ticket recorded representation~~ shall ~~also have printed clearly thereon include~~ the total quantity of the delivery, the appropriate fraction of the quantity, and the price per unit of quantity.

(Amended 1989 and 20XX)

**UR.2.2. Printed Ticket Recorded Representation.** – Any ~~printed ticket issued recorded representation created~~ by a device of the computing type on which ~~there is printed includes~~ the total computed price, the total quantity, or the price per unit of quantity, shall also ~~show include~~ the other two values ~~(either printed or in clear hand script).~~ and shall comply with G-S.5.6.

(Amended 1989 and 20XX)

**B4: MFM-21.2 V S.6. Printer Recorded Representations., UR.2.6. Ticket Printer, Customer Ticket, Recorded Representation., UR.3.4. Printed Ticket, Recorded Representation.**

**Item Under Consideration:**

Amend Handbook 44, Mass Flow Meter Code as follows:

**S.6. Printer, Recording Element** – When an assembly is equipped with means for ~~printing recording~~ the measured quantity, the following conditions apply:

(a) the scale interval shall be the same as that of the indicator;

(b) the value of the ~~printed recorded~~ quantity shall be the same value as the indicated quantity;

(c) ~~the printed recorded~~ quantity shall also include the mass value if the mass is not the indicated quantity;

*[Nonretroactive as of January 1, 2021]*

(d) a quantity for a delivery (other than an initial reference value) cannot be recorded until the measurement and delivery has been completed;

(e) the ~~printer recording element~~ is returned to zero when the resettable indicator is returned to zero; and

(f) the ~~printed recorded~~ values shall meet the requirements applicable to the indicated values.

(Amended 2016 and 20XX)

**S.6.1. Printed Receipt Recorded Representations.** – ~~Any~~ When a quantity is delivered, ~~printed quantity the recorded representation~~ shall include an identification number, the time and date, and the name of the seller. This information may be printed by the device or pre-printed on the ticket.

1           **(Amended 20XX)**

2       And

3           **UR.3.3 Ticket Printer, Customer Ticket, Recorded Representation.** – Vehicle-Mounted metering  
4       systems shall be equipped with ~~a ticket printer which shall be used for~~ **means to record** all sales where  
5       product is delivered through the meter ~~and shall comply with G-S.5.6.~~ A copy of the ~~ticket recorded~~  
6       **representation** issued by the device shall be ~~left with~~ **provided to** the customer at the time of delivery or as  
7       otherwise specified by the customer.

8       (Added 19934) **(Amended 20XX)**

9       ...

10          **UR.3.4. Printed Ticket, Recorded Representation.** – The total price, the total quantity of the delivery, and  
11       the price per unit shall be ~~printed~~ **provided** on any ~~ticket recorded representation~~ issued by a device of  
12       the computing type and containing any one of these values.

13       (Added 1993) **(Amended 20XX)**

14       **B4: CDL-21.1     V     S.1.4.1. Printed Ticket~~Recorded Representations., UR.2.4.2. Tickets or~~**  
15                               **Invoices. Recorded Representation.**

16       **Item Under Consideration:**

17       Amend Handbook 44, Carbon Dioxide Liquid-Measuring Devices Code as follows:

18           **S.1.4.1. Printed Ticket. Recorded Representation**– Any ~~printed ticket recorded representation~~ issued by a  
19       device of the computing type ~~on which there is printed~~ **includes** the total computed price shall ~~have printed~~  
20       ~~clearly thereon~~ also **include** the total quantity of the delivery and the price per unit.

21       **(Amended 20XX)**

22           **UR.2.4.2. Tickets or Invoices Recorded Representation.** – Any ~~written invoice or printed ticket recorded~~  
23       **representation** based on a reading of a device that is equipped with an automatic temperature or density  
24       compensator shall ~~have shown thereon~~ **include** that the quantity delivered has been temperature or density  
25       compensated.

26       **(Amended 20XX)**

27       **B4: HGM-21.1     V     S.2.6. Recorded Representations, Point of Sale Systems., S.6. Printer.**  
28                               **Recording Element., UR.3.2. Vehicle-mounted Measuring Systems Ticket**  
29                               **Printer Recording Element., UR.3.3. Printed Ticket. Recorded**  
30                               **Representation.**

31       **Item Under Consideration:**

32       Amend Handbook 44, Hydrogen Gas-Measuring Devices Code as follows:

33           **S.2.6. Recorded Representations, Point of Sale Systems.** – A ~~printed~~ receipt shall be available through  
34       a built-in or separate recording element for transactions conducted with point-of-sale systems or devices activated  
35       by debit cards, credit cards, and/or cash. The ~~printed~~ receipt shall contain the following information for products  
36       delivered by the dispenser:

37           (a) the total mass of the delivery;

38           (b) the unit price;

(c) the total computed price; and

(d) the product identity by name, symbol, abbreviation, or code number.

(Amended 20XX)

...

**S.6. ~~Printer.~~ Recording Element** – When an assembly is equipped with means for ~~printing~~ **recording** the measured quantity, the ~~printed~~ **recorded** information must agree with the indications on the dispenser for the transaction and the ~~printed~~ **recorded** values shall be clearly defined.

(Amended 20XX)

**S.6.1. ~~Printed Receipt.~~ Recorded Representation** – ~~Any~~ **When a quantity is** delivered, ~~printed quantity~~ **the recorded representation** shall include an identification number, the time and date, and the name of the seller. ~~This information may be printed by the device or pre-printed on the ticket.~~

(Amended 20XX)

And

**UR.3.2. Vehicle-mounted Measuring Systems ~~Ticket Printer~~ Recording Element.**

(Amended 20XX)

**UR.3.2.1. ~~Customer Ticket~~ Recording Element.** – Vehicle-Mounted metering systems shall be equipped with ~~a ticket printer which shall be used for~~ **means to record** all sales where product is delivered through the device ~~and shall comply with G-S.5.6.~~ A copy of the ~~ticket~~ **recorded representation** issued by the device shall be ~~left with~~ **provided to** the customer at the time of delivery or as otherwise specified by the customer.

(Amended 20XX)

...

**UR.3.3. ~~Printed Ticket.~~ Recorded Representation.** – The total price, the total quantity of the delivery, and the price per unit shall be ~~printed~~ **provided** on any ~~ticket~~ **recorded representation** issued by a device of the computing type and containing any one of these values.

~~(Added 1993)~~ (Amended 20XX)

**B4: OTH-21.2 V Appendix D - Definitions.: recorded representations, recording element.**

**Item Under Consideration:**

Amend Handbook 44, Appendix D - Definitions as follows:

**recorded representation.** – The printed, embossed, electronic, or other representation that is recorded as a quantity, unit price, total price, product identity or other information required by a weighing or measuring device. [1.10, 2.20, 2.21, 2.22, 2.24, 2.25, 3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 3.40, 5.54, 5.55, 5.56(a), 5.56(b), 5.57, 5.58, 5.60]

**recording element.** – An element incorporated in a weighing or measuring device by means of which ~~its~~ **the device's** performance relative to quantity or money value is permanently recorded ~~electronically or~~ on a tape, ticket, card, or the like, in the form of a printed, stamped, punched, or perforated representation **or recorded electronically in instances where that option is permitted by specific code.** [1.10, 2.20, 2.21, 2.22, 2.24, 2.25, 3.30, 3.31, 3.32, 3.33, 3.34, 3.35, 3.36, 3.37, 3.38, 3.39, 3.40, 5.54, 5.55, 5.56(a), 5.56(b), 5.57, 5.58, 5.60]

**Previous Action:**

- 2021: Developing
- 2022: Developing

**Original Justification:**

In 2014 G-S.5.6. was added to Handbook 44 to allow for the issuance of electronic receipts. At that time the use of the term “print”, and all variations on the word “print” was not fully addressed.

The Oxford Dictionary defines print as “a mechanical process involving the transfer of text, images, or designs to paper.”

The Oxford Dictionary defines record as: to “set down in writing or some other permanent form for later reference, especially officially.”

Values that are delivered via electronic means are recorded values and not necessarily printed vales. Printed indicates that a value has been transferred on to a hard document. While the intent of the 2014 amendment was to allow for the use of electronic receipts the terminology used is incorrect. In addition to receipts, there are instances where other information may be transmitted electronically.

When applying G-A.2. to weighing and measuring devices,

**G-A.2. Code Application.** – *This General Code shall apply to all classes of devices as covered in the specific codes. The specific code requirements supersede General Code requirements in all cases of conflict.*  
(Amended 1972)

Multiple conflicts arise in the implementation of the 2014 Amendment of G-S.5.6. This is to clarify the terminology in Handbook 44 and to recognize the changing technology in how transactions are recorded, and the information is disseminated.

**Comments in Favor:**

**Regulatory:**

- 2021 Interim: Mr. Charles Stutesman (KS), submitter of the item, agreed that the item should be developing and noted that updates to the item under consideration were provided to the S&T Committee based on reviews that he had with NIST, OWM.
- 2021 Annual: Mr. Charles Stutesman (KS) looks forward to maintaining developing status between now and Interim. When electronic receipt provision was put in GC, it works well but specific codes supersede. All the sections in this block have printer requirements. The goal was not to remove printers but to add the option for electronic receipts if customer wants it. He would appreciate comments on how to clean up the proposal.
- 2022 Interim: The submitter of the item commented the item needs editing and further work before voting. Recommends the item remain developing.
- 2022 Interim: A regulator from California DMS recommends the item remain developing.

**Industry:**

- 2021 Interim: Mr. Dmitri Karimov (MMA) commented that the proposed changes to recognize electronically captured tickets are needed, editorial corrections are needed to some parts of the proposal, and he agreed with a developing status for this item.
- 2022 Interim: A member of industry representing MMA commented general support with some edits to the language and supports further development.

- 2022 Interim: A member of industry representing SMA supports the item, as it recognizes the importance of providing flexible options for recorded representations to customers and sees value in the item as developing.
- 2023 Interim: A member representing the SMA supported GEN-21.1 and OTH-21.2 as voting. A member representing the MMA supported voting for the entire block.

**Advisory:**

- 2021 Interim: Ms. Diane Lee (NIST OWM) commented that there are two proposed changes to HB 44, Mass Flow Meter Code, Paragraph U.R.3.3 in the 2021 Interim Agenda. One proposal is Block 4 MFM-21.2 UR.3.3. (which was incorrectly number as UR.2.6 in the item under consideration in the 2021 Interim Meeting agenda) and the other is item MFM-21.1. UR.3.3. on the 2021 Interim Meeting agenda. The submitters should work together to provide one proposed change.
- 2022 Interim: An advisory member representing NIST OWM agrees with the need to address current language in the proposal and supports development.
- 2023 Interim: An advisory member representing NIST supported a developing status, but if no additional changes were voiced, would also support a voting status if the word “however” was struck from G-S.5.6.

**Comments Against:**

**Regulatory:**

- 2022 Interim: No comments heard.

**Industry:**

- 2022 Interim: No comments heard.

**Advisory:**

- 2022 Interim: No comments heard.

**Neutral Comments:**

**Regulatory:**

- 2022 Interim: No comments heard.

**Industry:**

- 2022 Interim: No comments heard.

**Advisory:**

- 2022 Interim: No comments heard.

**Item Development:**

NCWM 2022 Interim Meeting: The Committee assigned a developing status for this item at the 2022 Interim Meeting. The committee supports the work and recommends the continued work with all stakeholders. For more information or to provide comment, please contact:

Mr. Charles Stutesman  
 Kansas Department of Agriculture  
 785-564-6683 [charles.stutesman@ks.gov](mailto:charles.stutesman@ks.gov)

NOTE: The proposal as it appeared in the 2021 Interim Meeting agenda is available at <https://www.ncwm.com/interim-archive>.

NCWM 2022 Annual Meeting: During open hearings, the Committee received an update from submitter Charlie Stutesman, Kansas. Mr. Stutesman is working with NIST while continuing to develop the items. The submitter requests developing status as well as written feedback from interested parties while he works on the specific language of the items.

NCWM 2023 Interim Meeting: The committee updated GEN-21.2., removing the word “however” in G-S.5.6 and has assigned this item a voting status.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: No comments were heard on this item. The WWMA S&T Committee recommends that this item remain developing which would allow the submitter to ensure the edits are applicable for the identified sections. The Committee looks forward to an update on this Block.

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

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

CWMA 2022 Interim Meeting: No comments from the floor.

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

NEWMA 2022 Interim Meeting: Ms. Diane Lee (NIST-OWM) noted that NIST is working with the State of Kansas on this item. The item has been on agenda and recommends that it stays on as it is addressing all codes and tickets. Mr. John McGuire (NJ) is in favor of voting, but noted that the item conflicts with NJ law. Mr. Jim Willis (NY), Mr. Walt Remert (PA), and Ms. Cheryl Ayer (NH) recommend a voting status.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**BLOCK 5 ITEMS (B5) - TEST DRAFTS**

**Source:**

Murray Equipment, Inc./Total Control Systems.

**Purpose:**

Change the word “should” to “shall” to clarify the importance of using a calibrated container of adequate size to accept a “test draft of at least the amount delivered by the device in 1 minute at its maximum discharge rate” where it is referenced in Handbook 44 Vehicle-Tank Meters and the Liquid Measuring Devices codes.

**B5: LMD-23.2 V N.3.5. Wholesale Devices**

**Item Under Consideration:**

Amend Handbook 44, Liquid Measuring Devices Code as follows:

**N.3.5. Wholesale Devices.** - The delivered quantity ~~should~~shall be equal to at least the amount delivered by the device in one minute at its maximum discharge rate ~~and shall in no case be less than 200L (50 gal).~~

**B5: VTM-23.2 V N.3. Test Drafts**

**Item Under Consideration:**

Amend Handbook 44, Vehicle Tank Meters Code as follows:

**N.3. Test Drafts.** – Test drafts ~~should~~shall be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate ~~and shall in no case be less than 180 L (50 gal) or 225 kg (500 lb).~~

**Previous Action:**

2023: New Item

**Original Justification:**

In some locations, the largest available prover for fuel field testing is 100 gallons. In high flow situations over 100 gpm, the 100-gallon prover does not meet requirement of HB44. Inspectors are using what they have and doing the best they can. However, using a proving can smaller than what is recommended in HB44 can lead to errors in the field including failing an accurate metering system that would have been approved if the draft size was the correct size. In fact, we have experienced situations where mechanical registers are favored over electronic registers when smaller than recommended size test drafts are used due to inspectors visually estimating fractions of gallons on a mechanical register that reads out in whole gallons while only reading in whole gallons on electronic registers set to read in whole gallons.

In the following example, there is an aircraft refueler that normally operates at 300 GPM through a standard aircraft underwing fueling nozzle. The inspector is using the over-wing nozzle at 100 GPM in the available 100-gallon proving can to test the system. The customer wants the meter to display in whole gallons due to the high delivery speed and large volume of delivered fuel per transaction when fueling aircraft at 300 GPM.

Because the VTM code says the test draft “should” be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate, the inspector felt comfortable using the 100-gallon proving can rather than securing a 300-gallon or larger proving can.

Besides feeling empowered to use a proving can smaller than the recommended size, the inspector also interpreted the text from N.4.1 Normal Tests. – “...under the conditions of the installation” to mean that the meter display could not be changed to indicate decimal points, but rather must be left on whole gallons. Most likely the meter with electronic display would have passed this “non-normal” test if the display would have been set to tenths or hundredths of gallons for the test draft. The ½ gallon of potential rounding error caused by the whole gallon display introduced an additional system error of up to 0.5% on a 100-gallon prover, which make is nearly impossible to pass a test with +/- 0.2% of allowable error.

In the example above, the inspector set conditions that encouraged high variability in the system accuracy and precision. When questioned about the test draft conditions, the inspector referred to the Handbook 44 code, interpreting it to allow the undersized proving can and not allow meter display decimal changes. Changing Handbook 44 text from “should” to “shall” will prevent undersize test drafts. It is also important to clarify what “...under the conditions of the installation” specifically refers to; that is, the fluid path elements such as hose length, hose type, nozzle setting, system valve settings, etc. Metering systems with electronic digital displays should not be handicapped due to being set for whole gallons or tenths of gallons especially if the proving can used is smaller than what is required or recommended by Handbook 44.

One of the technological advancements of electronic registers over mechanical registers is the option of quickly and easily changing the number of decimal points shown on the display. Something that literally takes seconds to do on an electronic register is cumbersome, time consuming, and generally not recommended outside of a factory on mechanical registers. With very few exceptions, customers, distributors, and manufacturers favor electronic registers due to improved features, improved durability and accuracy. Mechanical registers, on the other hand, are becoming

obsolete and should not be given preference due to a misunderstanding of the meaning of the phrase "...under the conditions of the installation."

The submitter acknowledges the following arguments:

- 1) **Some locations don't have access to calibration containers large enough to hold the required test draft size.** In this case, the correct size calibration container should be borrowed or rented to meet HB44 requirements.
- 2) **Everything is fine with the current code text, don't change it.** The problem is that everything is NOT fine now. Due to the soft "should" language rather than the un-negotiable "shall" language, inspectors do from time to time use smaller than recommended proving cans that can lead to failing an accurate metering system or approving an inaccurate system.
- 3) **Inspectors know it is OK to change the decimal points for testing when using a calibration container that is smaller than is recommended.** In the example above, the inspector would NOT allow the decimal points to be changed for testing, so not all inspectors seem to agree.
- 4) **Inspectors may have to break the calibration seal to change the decimal point settings in some situations.** That is why the inspectors have calibration seals.

**Requested Status by Submitter:** Not Specified

**Comments in Favor:**

**Regulatory:**

- Jim Wills, (New York), supports the item.

**Industry:**

- John Hathaway, (Murray Equipment), supports using the word "shall" instead of "should".
- Michael Keilty, (Endress+Hauser), agreed with Mr. Hathaway.
- Prentiss Searles, (API), supports using language from LMD 23.4.

**Advisory:**

- 

**Comments Against:**

**Regulatory:**

- Scott Simmons, Colorado, not all jurisdictions have a 100 gal prover.

**Industry:**

- 

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

- 

**Industry:**

-



**Advisory:**

- Tina Butcher, (NIST), supports the word shall and pointed out if a jurisdiction did not have a particular size of prover they may use the general code to get the business to assist with that problem.

**Item Development:**

NCWM 2023 Interim Meeting: The committee combined this item and other related items for discussion purposes only. Based on comments, the committee struck “and shall in no case be less than 200L (50 gal)” from LMD-23.2, N.3.5. and “and shall in no case be less than 180 L (50 gal) or 225 kg (500 lb)” from VTM-23.2, N.3. With the modifications, the committee believes this item is fully developed and has assigned it a voting status.

**Regional Associations’ Comments:**

WWMA 2022 Annual Meeting: Mr. Brent Price (Gilbarco, Inc.) - Supported the item. The word “shall” expresses more importance.

Mr. Michael Keilty (Endress + Hauser Flow USA, Inc.) – Didn’t see why this is necessary to change from “should” to “shall” to fix one particular instance where there was a problem. Recommended withdrawal.

Mr. Jose Arriaga (Orange County, California) – “Shall” is becoming a bit antiquated. The modern legal interpretation would be to change “shall” to “must”.

The WWMA S&T Committee recommends that this item be assigned a developing status. The Committee also recommends that the submitter of this item take into consideration the testimony heard during open hearings and work together with the submitter of item LMD-23.4 to develop language that will support both of their purposes.

SWMA 2022 Annual Meeting: Mr. Keilty, Endress+Hauser, stated that this item represented the confusion over this issue, and is a misapplication. He recommends withdrawal.

Mr. Searles, API, stated that he has no issue with should to shall, and that he wasn’t sure if this correction would address the submitters problem.

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

CWMA 2022 Interim Meeting: Michael Keilty – Endress+Hauser; Conflicts with B1. Does not support.

Prentiss Searles – API; Withdraw.

Dmitri Karimov – Liquid Controls; Stems from field inspectors trying to test 100 gal flow rate with 50 gal provers. Conflicts with API proposal. Withdraw.

The CWMA S&T Committee recommends this item be withdrawn.

NEWMA 2022 Interim Meeting: Mr. John Hathaway (Total Control Systems/Murray Equipment) believes that this proposal would solve issues of inspectors using undersized provers for testing. Mr. Michael Keilty (Endress Hauser) believes that this proposal was drafted for a single instance where a meter under test was indicating in whole gallons, delivering at 300 gallons per minute and tested using a 100 gallon prover. This does not warrant a change to the whole code due to one instance. Mr. Prentiss Searles (API) commented that the change to the code would not bother API but agrees with Mr. Keilty’s point. Mr. Bob Murnane (Seraphin Test Measure) commented that he understands the reason for the proposal, but it doesn’t make sense commonsense wise. He hopes inspectors would use the correct equipment. Mr. Hathaway noted that changing “should” to “shall” is making it a non-debatable position. Mr. Jim Willis (NY) commented that empowering inspectors in the field, where it is appropriate, to test with a smaller prover is an advantage if that’s all they have at their disposal. Mr. Willis recommended withdrawal. Mr. James Cassidy (MA) concurred with Mr. Willis. Mr. Jason Flint (NJ) commented that NJ relies on “should” versus “shall” due to inspectors trying to use a 25 gallon prover to test 800 gal/min meter and recommended a developing status.

After hearing comments from the floor, the Committee believes the item has merit, but more discussion needs to be had. The Committee recommends this time be given a Developing status.

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

## **BLOCK 6 ITEMS (B6) - COMMERCIAL AND LAW ENFORCEMENT, AXLE AND AXLE GROUP WEIGHTS**

*Note: During the NCWM 2023 Interim Meeting, the committee agreed to remove these items from Block 6. SCL-22.1 and SCL-22.3 now appear separately in Scales section.*

## **BLOCK 7 ITEMS (B7) - TOLERANCES ON TESTS USING TRANSFER STANDARDS**

### **Source:**

Seraphin Test Measure Company, A Division of Pemberton Fabricators, Inc.

NOTE: The items below represent updated proposals by the developer following the fall 2023 regional association meetings. There is an explanation of the change for each item.

### **Purpose:**

The purpose of these proposals is to change the language in the tolerance paragraphs that already specify that larger tolerances when a transfer standard is used, but that the OIML R117 Reduced MPE formula shall be used. Unless the proposed changes to 2021 S&T Agenda Block 1 Item GEN-19.1. are accepted, these proposals should not proceed.

### **B7: CLM-22.1 V T.3. On Tests Using Type 2 Transfer Standards.**

#### **Item Under Consideration:**

Amend Handbook 44, Cryogenic Liquid-Measuring Devices Code as follows:

Explanation of change: The first sentence of this paragraph should be shown with strike out, since the first sentence is to be deleted and replaced with what is in bold and underlined.

~~T.3. On Tests Using Type 2 Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard. When commercial meters are tested using a Type 2 transfer standard, the tolerance applied to the meter under test shall be calculated using the formula specified in the General Code Tolerance section.~~

(Amended 202X)

### **B7: CDL-22.1 V T.3. On Tests Using Type 2 Transfer Standards.**

Explanation of change: The first sentence of this paragraph should be shown with strike out, since the first sentence is to be deleted and replaced with what is in bold and underlined.

~~T.3. On Tests Using Type 2 Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard. When commercial meters are tested using a Type 2 transfer standard, the tolerance applied to the meter under test shall be calculated using the formula specified in the General Code Tolerance section.~~

(Amended 202X)

**B7: HGM-22.1 V T.4. Tolerance Application on Tests Using Type 2 Transfer Standard Test Method.**

Explanation of change: The first sentence of this paragraph should be shown with strike out, since the first sentence is to be deleted and replaced with what is in bold and underlined. Additionally, add the words “Type 2” to the title of T.4. below to correct the oversight.

**T.4. Tolerance Application on Tests Using Type 2 Transfer Standard Test Method.** – ~~To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.~~ **When commercial meters are tested using a Type 2 transfer standard, the tolerance applied to the meter under test shall be calculated using the formula specified in the General Code Tolerance section.**  
**(Amended 202X)**

**Previous Action:**

2022: Developing

**Original Justification:**

In the codes mentioned above, when transfer standards are used, the basic tolerances to be applied to the devices under test are to be increased by the uncertainty of the transfer standard (i.e., two times the standard deviation of the transfer standard). The proposed changes incorporate the OIML R117 formula to state how the tolerance is to be increased when transfer standards are used. The formula effectively places an upper limit on how large the uncertainty associated with the transfer standard can be.

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

Mr. Bob Murnane  
Seraphin Test Measure Co.  
609-267-922, [rmurnane@pemfab.com](mailto:rmurnane@pemfab.com)

The current paragraphs already state that, when transfer standards are used, the tolerances are to be increased by two standard deviations for the repeatability of the transfer standard. One can argue that effect of the proposed changes is small and not necessary. The proposed changes are intended to provide consistency with the changes proposed in the amended proposals of 2021 S&T Agenda Block 1 Item GEN-19.1.

The submitter requested that this be a Voting Item in 2022.

**Comments in Favor:**

**Regulatory:**

- At the 2023 interim meeting, Tim Chesser (Arkansas) was in favor of making it a voting item.
- At the 2023 interim meeting, Kevin Schnepp (California) was in favor of the item.

**Industry:**

- Bob Murnane (Seraphin) explained the addition of “Type 2” term.
- At the 2023 interim meeting, Dmitri Karimov (Liquid Controls) commented that Block 7 and Block 8 should move forward together and have several benefits.
- At the 2023 interim meeting, Bob Murnane (Seraphin) stated Block 7 and Block 8 were ready for a vote.

- At the 2023 interim meeting, Michael Keilty, (Endress+Hauser) agreed that Block 7 and 8 were ready for a vote.
- At the 2023 interim meeting, Brent Price (Gilbarco) was in favor of the item suggested maybe adding “state” in front of “director”.

**Advisory:**

- At the 2023 interim meeting, Tina Butcher (NIST) stated that the item revises tolerances and guidance in identifying transfer standards.

**Comments Against:**

**Regulatory:**

- 

**Industry:**

- A revised version by Seraphin (submitter) was presented and made available on the NCWM website to properly align with GEN 19.1. The submitter requests that Block 7, Gen 19.1 and related item OTH 21.1 follow the same path moving forward.
- Dmitri Karimov (Liquid Controls) commented that the Block is linked to GEN 19.1 due to definition of Type 1 and 2 transfer standards. Mr. Karimov said it seems odd to single out Type 2. He explained T.1-3 restates what’s in GEN 19.1 and recommends the Block to be withdrawn and GEN 19.1 move forward.

**Advisory:**

- 

**Neutral Comments:**

**Regulatory:**

- Matt Douglas (California) recommends this Block and the associated items be given developing status.

**Industry:**

- Dmitri Karimov representing the Meter Manufacturers Association (MMA) stated that there was no consensus within the MMA.

**Advisory:**

- Diane Lee (NIST, OWM) who provided a brief overview of the written NIST analysis, which can be found on the NCWM website. This item is related to GEN 19.1 and OTH 22.1.

**Item Development:**

NCWM 2022 Interim Meeting: The committee recommended that this item be given a developing status to allow the submitter to work on it. Since the 2022 interim meeting, the submitter has made additional changes to the items under consideration which are currently reflected in Block 7 above. These changes reference using the specific formula in the general code tolerance section, rather than a formula specified here.

NCWM 2022 Annual Meeting: Seraphin was not present but submitted comments in writing to update the Items under Consideration.

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. The committee agreed with the comments from the floor and assigned the item a voting status.

**Background and Discussion:**

Seraphin and NIST OWM are working together in a joint effort to address changes to Block 7 items which are impacted by changes being made to GEN-19.1. Seraphin made changes to the Block 7 items that appear in the 2022 Interim Meeting Agenda to make it clear that the tolerances apply to Type 2 transfers standards as stated in the definitions included in the combined proposal GEN-19.1 and OTH-22.1. Additionally, the tolerances in the specific codes refer to the NIST HB 44 General Code Tolerance section rather than providing the equation in each Tolerance section in the Liquid Measuring Devices Code, Carbon Dioxide Liquid-Measuring Devices, and Hydrogen Gas-Measuring Devices Code. Although changes will be needed to the Taximeter and Transportation Network Measuring Systems Code, Block 7 is limited to measuring devices and if these changes are accepted, other industry sectors will be involved in making similar changes as they apply to their specific Handbook 44 codes.

If the S&T Committee presents the combined item GEN-19.1 and OTH-22.1 for a vote in 2022, then this item may also go forward for a vote in 2022.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Robert Murnane (Seraphin Test Measure Company) - Wanted everyone to look at the version that was posted to the WWMA website, the most current version. Addressed multiple changes present in the updated language. Asked that this item be a voting item, only if Block 8 passes.

Mr. Michael Keilty (Endress + Hauser Flow USA, Inc.) – Didn't see where there is a formula to be calculated, in the HB44 general code. Also affirmed that Block 7 is dependent on Block 8.

Mr. Robert Murnane (Seraphin Test Measure Company) – Clarified that the formula is in Block 8, that is why Block 7 should only move forward if Block 8 is passed.

During open hearings, members in attendance were notified that the language in the agenda did not reflect the updated item under consideration. Membership was not fully aware of the new language at the time of open hearings. The WWMA S&T Committee recommends that this item should remain developing to allow membership to review the updated proposal. The Committee further recommends that this item be blocked with Block 8 as the items in Block 7 are contingent on Block 8 items.

SWMA 2022 Annual Meeting: Mr. Keilty, Endress+Hauser, stated that Block 7 is dependent on Block 8, and both blocks should receive the same status. He had no recommendation on it. This is an example where meters are being added into three codes.

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

CWMA 2022 Interim Meeting: Bob Murnane – Seraphin; Block 7 cannot stand alone without Block 8 moving forward.

The CWMA S&T Committee believes this item is fully developed and recommends voting status.

NEWMA 2022 Interim Meeting: Mr. Bob Murnane (Seraphin Test Measure) commented that the item that appears in the agenda is not what has been proposed as there are many typos. A true version of the item was submitted to the NEWMA S&T Chairman and shared with the body. Mr. Murnane asks that the same status be given to Block 7 and Block 8 as they are directly linked. Mr. Michael Keilty (Endress Hauser) indicated that he drafted LPG-15.1 and MFM-15.1 based on these codes. The standards are meters but they have 2x the deviation, which do not meet 1/3 requirement recommended in the Fundamental Considerations. Mr. Keilty recommended a developing status. (Mr. Keilty was experiencing internet connection problems during his comments and the Committee may not have been able to hear his entire testimony).

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

**BLOCK 8 ITEMS (B8) - TOLERANCES ON TESTS USING TRANSFER STANDARDS, APPENDIX A - TOLERANCES FOR STANDARDS, AND APPENDIX D – FIELD STANDARDS AND TRANSFER STANDARDS**

*Note: These proposals are a combined modification of the 2021 S&T Agenda Block 1 Items GEN-19.1 and OTH-22.1. Since the S&T Committee has changed item GEN-19.1 from “assigned” to “developing,” the submitter has worked with NIST OWM to revise and combine the original proposals of GEN-19.1 and OTH-22.1 to address discussions within the NCWM Field Standards Task Group and other comments received at the regional weights and measures meetings on the proposals. These items are related, so they are presented together. These OWM and Seraphin proposals were submitted to the S&T Committee just before the 2022 Interim Meeting.*

**Development Updates November 2022:** As part of the development process for these items, several changes have been made to respond to comments that were received since July 2022.

**Changes to Respond to Comment 1:** The first comment pointed out that corrections may be used with transfer standards in the same manner as corrections are made with field standards.

**Changes to Respond to Comment 2:** In an email to the NCWM S&T Committee and several other interested parties, the Meter Manufacturers Association suggested that Section 3.2. of the Fundamental Considerations apply to all commercial weighing and measuring devices. The developers of the Block 8 proposals (NIST OWM and Seraphin) agree.

**Changes to Respond to Comment 3:** Michael Keilty, Endress + Hauser Flowtec AG, has several proposals on the S&T agenda to include references to meters as field standards. To make clear that meters (and any other types of weighing and measuring devices) may be used as field standards if they meet the Fundamental Consideration requirements for field standards, the developers have added examples of devices that may be used as field standards to the definitions for field standards and transfer standards. Specifically, the words “such as scales, meters, etc.” are added to the definitions. The code references in the definitions have been changed to “[1.10]” so that the definitions apply to all codes as explained at the beginning of Appendix D.

**Changes to Respond to Comment 4:** Michael Keilty, Endress + Hauser Flowtec AG, objected to the references to “metal volumetric field standards” in Section 3.3. The developers agreed to delete the references to metal volumetric field standards.

The updated text for of the proposals is shown below.

**Source:**

Seraphin Test Measure Company (GEN-19.1) and NIST, Office of Weights and Measures (OTH-22.1)

**Purpose:**

- (a) Add a tolerance statement to the General Code that applies whenever a Type 2 transfer standard is used;
- (b) Clarify in the Fundamental Considerations (Appendix A of Handbook 44) that the authority to approve field test standards rests with the regulatory official and that specific types of field test standards need not be identified in the body of a Handbook 44 Code in order to be approved by the weights and measures director;

- (c) Add text to Section 3.2. Tolerances for Standards of the Fundamental Considerations (Appendix A of Handbook 44) to recognize the wide range of transfer standards already recognized in Handbook 44, explain the critical differences between field standards and transfer standards, and to specify the formula to be used to calculate the device tolerance when the uncertainty of the transfer standard exceeds the one-third requirement; and
- (d) Add definitions to Appendix D of Handbook 44 for field standard and Type 1 and Type 2 transfer standards that identify the critical characteristics for field and transfer standards.

**B8: GEN-19.1 V G-T.5. Tolerances on Tests When Transfer Standards are Used., Appendix A, Section 3.2. Tolerances for Standards., and Appendix D – Definitions: standards, field., ~~transfer standard.~~ and ~~standard, transfer.~~**

**Item Under Consideration:**

Amend Handbook 44, General Code as follows:

**G-T.5. Tolerances on Tests When Type 2 Transfer Standards Are Used. – When Type 2 transfer standards are used, the following formula shall be used to compute the tolerance applicable to the device under test:**

$$\text{Increased MPE} = (2/3 \times \text{MPE} + U)$$

**with an upper limit of  $U_{\text{MAX}} = 2/3 \text{ MPE}$**

**Where MPE is the basic tolerance that applies when using a basic reference standard; and**

**U = uncertainty associated with the Type 2 transfer standard.**

**The increase in the applied tolerance when using a Type 2 transfer standard applies only to the basic tolerances for devices as defined in Handbook 44; that is acceptance, maintenance and minimum tolerances. Note that the repeatability tolerance and the special test tolerances are NOT increased.**

**Codes 5.56.(a) Grain Moisture Meters, 5.56.(b) Grain Moisture Meters, and 5.57. Near-Infrared Grain Analyzers are exempt from this requirement because NIST Handbook 159 has requirements for monitoring and retesting grain samples to ensure adequate stability and the tolerances for the devices under test already incorporate the uncertainty associated with the use of grain samples as transfer standards. The code 2.21. Belt-Conveyor Scale Systems Code is also exempt because relative and absolute tolerances are included in the code.**

Amend Handbook 44 Appendix D – Definitions as follows.

**Standard, Field. – A physical artifact, static or dynamic measurement devices, such as scales, meters, etc., or a reference material that (a) meets the requirements of the Fundamental Considerations, Section 3.2., (b) is stable (accurate and repeatable) over a designated period of time of use (as determined by the Director), (c) is valid (with corrections that may be applied) over the range of environmental and operational parameters in which the commercial measuring devices to be tested can be reasonably anticipated to be used, and (d) is traceable to the reference or working standards through comparisons, using acceptable laboratory procedures. [1.10] (Added 202X)**

**~~transfer standard. – A measurement system designed for use in proving and testing cryogenic liquid measuring devices. [3.38]~~**

**Standard, Transfer, Type 1 and Type 2. – A physical artifact, static or dynamic measurement devices, such as scales, meters, etc., or a reference material that is demonstrated to be stable (accurate and repeatable) under**

the limited environmental and operational conditions and time during which the transfer standard is used. A Type 1 transfer standard is a transfer standard that meets the one-third accuracy requirement over a limited range of environmental conditions and/or a limited range of operating conditions and time in which it is used. A Type 2 transfer standard is one that does not meet the one-third requirement and may not be stable or valid over an extended time period or over wide ranges of environmental or operating conditions. [1.10]  
(Added 202X)

## **B8: OTH-22.1 V Appendix A: Fundamental Considerations, 3. Testing Apparatus**

### **Item Under Consideration:**

Amend Handbook 44, Appendix A: Fundamental Considerations as shown below. Delete Footnote 2 referenced in Section 3. Testing Apparatus of NIST Handbook 44 Appendix A, Fundamental Considerations, moving portions of the footnote into Section 3.1 as part of the proposed changes to Section 3.1 shown above. Note that no changes are proposed to Footnote 1.

~~<sup>2</sup> Recommendations regarding the specifications and tolerances for suitable field standards may be obtained from the Office of Weights and Measures of the National Institute of Standards and Technology. Standards will meet the specifications of the National Institute of Standards and Technology Handbook 105-Series standards (or other suitable and designated standards). This section shall not preclude the use of additional field standards and/or equipment, as approved by the Director, for uniform evaluation of device performance.~~

**3.1. Adequacy.**<sup>2</sup> – Tests can be made properly only if, among other things, adequate testing apparatus is available. Testing apparatus may be considered adequate only when it is properly designed for its intended use, when it is so constructed that it will retain its characteristics for a reasonable period under conditions of normal use, when it is available in denominations appropriate for a proper determination of the value or performance of the commercial equipment under test, and when it is accurately calibrated.

**3.1.1. Essential Elements of Traceability.** To ensure that field test standards and test methods provide for measurements that are traceable to the International System of Units (SI), through NIST or other National Metrology Institutes, they must satisfy the “Essential Elements of Traceability.” As explained in NIST IR6969 GMP-13 Good Measurement Practice for Ensuring Metrological Traceability, these elements include the following.

- Realization of SI Units
- Unbroken Chain of Comparisons
- Documented Calibration Program
- Documented Measurement Uncertainty
- Documented Measurement Procedure
- Accredited Technical Competence
- Measurement Assurance

**3.1.2. Specifications for Standards.** Standards shall meet the specifications of the National Institute of Standards and Technology Handbook 105-Series standards or other appropriate designated documentary standards (e.g., ASTM, ASME, etc.). Recommendations regarding the specifications and tolerances for suitable field standards may be obtained from the Office of Weights and Measures of the National Institute of Standards and Technology.

**3.1.3. Authority for Approving Field Test Standards and/or Equipment.** This section shall not preclude the use of additional field standards and/or equipment, as approved by the Director, for uniform evaluation of device performance. Specific types of field test standards are not required to be identified in a NIST Handbook 44 code in order to be considered suitable. Provided the standards



meet the “Essential Elements of Traceability” (described in Section 3.1.1. above) that help ensure the standards are suitable and capable of supporting measurements traceable to the International System of Units (SI) through NIST or other National Metrology Institutes, they need only be approved by the Director.

**3.2. Tolerances for Standards.** – Except for work of relatively high precision, it is recommended that the accuracy of standards used in testing commercial weighing and measuring equipment be established and maintained so that the use of corrections is not necessary. When the standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable device tolerance.

Device testing is complicated to some degree when corrections to standards are applied. When using a correction for a **field standard or a transfer standard**, the uncertainty associated with the corrected value must be less than one-third of the applicable device tolerance. The reason for this requirement is to give the device being tested as nearly as practicable the full benefit of its own tolerance.

Whenever possible and practical, field standards should be used to test commercial weighing and measuring devices. However, where it is impractical or unduly cumbersome to use field standards, transfer standards may be used. There are two categories of transfer standards. The critical criteria that distinguish between these standards are: (1) the accuracy and uncertainty of the standard; (2) the stability as a standard over a designated period of time (as determined by the Director); and (3) demonstrated validity or performance of the standard over the range of environmental and operational conditions in which the standard can be reasonably anticipated to be used.

A “field standard” is one that meets the one-third requirement mentioned earlier in this section. Additionally, the field standard maintains its validity or stability as a standard over an designated period of time (defined based on data of the standard’s stability by an authorized metrology lab or as specified by the Director) and can be demonstrated to maintain its value as a standard over the range of environmental conditions and the range of operating conditions in which the standard can be reasonably anticipated to be used to test commercial weighing and measuring devices.

Transfer standards do not meet one or more of these critical criteria. One category of transfer standards, which is referred to here as a “Type 1 transfer standard,” is a transfer standard that meets the one-third accuracy requirement for a limited time of use, under a limited range of environmental conditions and/or a limited range of operating conditions. The accuracy of a Type 1 transfer standard may have to be verified through testing each time it is used to verify that the desired accuracy and performance can be achieved when the Type 1 transfer standard is used under the limited environmental and operating conditions. When a Type 1 transfer standard is used, the basic tolerances specified for the commercial weighing and measuring devices are applied as specified in the applicable codes.

The second category of transfer standard, which is referred to here as a “Type 2 transfer standard,” is one that does not meet the one-third requirement. The Type 2 transfer standard must be stable and valid under the environmental or operating conditions in which it can be reasonably anticipated to be used. The performance characteristics must be confirmed with sufficient data to properly characterize the uncertainty associated with the Type 2 transfer standard. When a Type 2 transfer standard is used, the tolerances applicable to the commercial weighing and measuring device must be increased to recognize the large uncertainty associated with the Type 2 transfer standard.

When commercial weighing and measuring devices are tested using a Type 2 transfer standard, the tolerance applied to the commercial weighing and measuring devices ~~meter~~ under test shall be determined as specified in the General Code.

(Added 202X)

**3.3. Accuracy of Field Standards.** – Prior to the official use of testing apparatus, its accuracy should invariably be verified. Field standards should be calibrated as often as circumstances require. ~~By their nature, metal~~

~~volumetric field standards are more susceptible to damage in handling than are standards of some other types. A field standard should be calibrated whenever damage is known or suspected to have occurred or significant repairs have been made. In addition, field standards, particularly volumetric standards, should be calibrated with sufficient frequency to affirm their continued accuracy, so that the official may always be in an unassailable position with respect to the accuracy of his testing apparatus. Secondary field standards, such as special fabric testing tapes, should be verified much more frequently than such basic standards as steel tapes or volumetric provers to demonstrate their constancy of value or performance.~~

Accurate and dependable results cannot be obtained with faulty or inadequate field standards. If either the service person or official is poorly equipped, their results cannot be expected to check consistently. Disagreements can be avoided and the servicing of commercial equipment can be expedited and improved if service persons and officials give equal attention to the adequacy and maintenance of their testing apparatus.

#### Previous Action:

2022: Developing

2023: The committee agreed with to the changes submitted by Mr. Floren and assigned the item a voting status.

#### Background and Discussion:

NCWM 2023 Interim Meeting: The S&T Committee combined this item and other related items for discussion purposes only. The committee was provided written comments provided by Kurt Floren (Los Angeles County) and recommended the item have a voting status with these changes. Dimitri Karimov (Liquid Controls) stated the item has significant benefits with test methods for regulators and supported the item. Bob Murnane (Seraphin) was in favor of Mr. Floren's changes and recommended voting. Michael Keilty (Endress+Hauser) was supported the item. Hal Prince (Florida) states this might be a problem for him as he does not adopt Appendixes to the Handbook. Tim Chesser (Arkansas) and Kevin Schnepf (California) supported the item as voting with Mr. Floren's changes. Brent Price (Gilbarco) asked if the word "state" should proceed the word "director" in the item.

NCWM 2022 Interim Meeting: Item GEN-19.1 was assigned to the original submitter, Seraphin, for further development. As noted at the beginning of this item Seraphin has worked with NIST OWM to revise and combine the original proposals of GEN-19.1 and OTH-22.1. Consequently, NIST OWM has asked that OTH-22.1 be combined with GEN-19.1. For more information or to provide comment, please contact:

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2022 NCWM Annual Meeting: The committee heard from Tina Butcher NIST, the submitter of the item. She stated that they had addressed items heard at the fall regional meeting and the 2022 interim NCWM meeting. She stated they felt the item as is ready to move forward in tandem with Block 7. The intent is to clarify that it isn't necessary to identify what type of standard is to be used, i.e.: provers aren't referenced in section 3.30. OWM also provided written comments on this item.

The submitter of the original GEN 19.1 provided the following:

Over the last several years, there have been, and still are, proposals to recognize some types of meters as either transfer standards or as field standards. Handbook 44 already recognizes the use of many different types of master meters,

other reference materials, or devices as transfer standards. This proposal is based upon the existing recognition and permitted use of transfer standards that are already in Handbook 44.

However, there is no common understanding among industry and weights and measures officials as to what distinguishes a field standard from a transfer standard. Consequently, changes are proposed to the Fundamental Considerations Section 3.2. and definitions are proposed for field standards and transfer standards to highlight the critical differences between these two types of standards. Any artifact, reference material or measuring device that meets the requirements of accuracy and repeatability as specified in Section 3.2. of the Handbook 44 Fundamental Considerations qualifies as a field standard. However, what has not been clearly understood is that **the field standard must meet Section 3.2. over the environmental and operational parameters in which the commercial measuring devices under test are used.** The ranges for these environmental and operational parameters may be very large and include:

- The range of flow rates at which the commercial meters under test operate (from the minimum to maximum flow rates for the meters);
- The range of air temperatures over which meters are used (perhaps 10° F to 105° F);
- The range of product temperatures over which meters are used (perhaps 10° F to 105° F, especially applicable for above ground storage tanks);
- The range of temperature differences that may exist between the product, the standard and the air over which meters are used (perhaps up to 50° F, especially for cold fuel in underground tanks and hot air temperatures);
- The range of pressures at which the pumping systems operate at different times and locations;
- The different products measured by similar meters; and
- Tests of multiple “standards” of the same type when used in different test system configurations (and “standards” of different sizes) to verify that the results agree and are consistent.

A range of environmental and operational parameters over which a transfer standard must meet the accuracy and repeatability requirements are more limited, that is, a transfer standard need only be accurate and repeatable over the conditions that exist for the “short” time that the transfer standard is used. Transfer standards may be tested before and after use to verify a commercial measuring device, so the range of conditions in which accuracy and repeatability may be relatively small. The transfer standard is only required to be accurate and repeatable during the time it is in use, which might be to test only one commercial device. For example:

- The range of flow rates at which the meters under test operate **at the time of the test**;
- The range of air temperatures that exist **at the time of the test**;
- The range of product temperatures that exist **at the time of the test**;
- The range of temperature differences that may exist between the product, the standard and the air **at the time of the test**;
- The range of pressures at which the pumping systems operate **at the time of the test**; and
- The product being measured by the meter **at the time of the test**.

A critical issue that has not been adequately addressed and defined is, “How long must a field standard remain valid (i.e., accurate and repeatable)?” Common sense dictates that the field standard must remain valid over an extended period of time. Transfer standards need only remain valid during their “short” period of use. Because (1) there are some many different types of field standards used to test commercial measuring devices, (2) there are so many transfer standards recognized in Handbook 44, and (3) the applications vary greatly, it isn’t clear that a common minimum time period for field standards or for transfer standards can be established. Nevertheless, field standards must be valid and stable over long time periods and wide ranges of environmental and operational parameters as compared to transfer standards.

Additionally, transfer standards do not have to meet the one-third requirement for the uncertainty associated with its performance. Consequently, Handbook 44 typically specifies that the basic tolerances to be applied to the device under test be increased by two times the standard deviation of the transfer standard. This presumes that the transfer standard has been adjusted to have “zero error” or corrections are used to address any significant systematic errors in the transfer

standard. This also applies when field standards are used. “The reason for this requirement is to give the device being tested as nearly as practicable the full benefit of its own tolerance.”<sup>17</sup>

The submitter also provided the following possible opposing arguments:

- I. There are several proposals before the S&T Committee to recognize some meters as field standards and field standard reference meters. These proposals have not specified how the proposed field standards are to be tested to demonstrate compliance with the Fundamental Considerations requirements of Section. 3.2. It is possible that some companies will push for the recognition of meters as field standards without submitting data to support their claims of performance as field standards.
- II. It is very difficult, time consuming and expensive to test meters that are proposed for use as field standards, especially to test using different fuels over the range of temperatures that exist for commercial applications and for temperature differences between the fuel and the air. It is possible that some will object to having to prove meter performance over the range of environmental and operational parameters.
- III. It is possible that some companies will want to use performance data collected under laboratory conditions as being indicative of the expected performance of the meters under field conditions.
- IV. Laboratory calibration procedures may not reflect the performance of the proposed field standard under field conditions.
- V. Some companies may object to the cost of collecting data for transfer standards (meters) of different sizes and with different flow rate ranges to prove that the results for the different sized transfer standards (metering systems) will produce consistent test results on the same commercial meters.
- VI. Establishing a reasonably good estimate of the standard deviation associated with a transfer standard (to be added to the basic tolerances for the devices under test) may require significant time, effort and cost.
- VII. Some companies may want to modify the device under test to be able to test the commercial measuring device, rather than testing the device as used.

The submitter states that these items are fully developed and requested that this be a Voting Item in 2022.

**Background and Discussion for Item OTH-22.1 originally submitted by NIST Office of Weights and Measures.**

**Source:**

NIST, Office of Weights and Measures

**Previous Action:**

New

**Original Justification:**

Footnote 2 of Handbook 44, Appendix A, Fundamental Considerations, Section 3. Testing Apparatus was added to:

- (1) specify recommendations for suitable field test standards;
- (2) require that field test standards meet specifications in Handbook 105 Series or other appropriate documentary standards; and

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<sup>17</sup> Handbook 44, Fundamental Considerations, Section 3.2.

- (3) note that guidance may be obtained from NIST OWM regarding appropriate specifications, tolerances, and other criteria for assessing the suitability of a field test standard for use in inspecting and testing commercial weighing and measuring equipment.

Footnote 2 also recognizes that the Director has the authority to approve additional field test standards and/or equipment beyond those recommended by NIST or specified in a Handbook 105 or other documentary standard. NIST OWM periodically receives inquiries regarding the use of various types of test equipment and test methods. OWM has worked with state weights and measures programs and industry to develop standards and procedures and recommendations on the use of such equipment/methods and, in some cases this has resulted in a specific recommendation or Handbook 105. However, as recognized, in Footnote 2, this does not preclude the Director from approving equipment for which a specific Handbook 105 or other documentary standard does not exist.

In order to be considered suitable for use in official testing of a commercial weighing or measuring device, field test standards and procedures need to meet a list of what is often referred to as the “Essential Elements of Traceability.” This list includes elements outlined in NIST IR6969 GMP-13 Good Measurement Practice for Ensuring Metrological Traceability shown above in the proposed Section 3.1.1. Essential Elements of Traceability. Provided steps are taken to ensure that a given field test standard has been demonstrated to meet the requirements in these elements, it is appropriate for that field test standard to be used in the official inspection and testing of a commercial weighing or measuring device or for use by a service company in testing and placing a device back into service after service work.

While Footnote 2 already provides a statement regarding the authority of the Director to approve such equipment, OWM believes including additional information regarding the essential elements of traceability and a reference to specific measurement practices would be helpful to both emphasize that authority and provide guidance to Directors and industry regarding the selection of appropriate field test standards.

NIST OWM recommends the guidance originally included in Footnote 2 along with the additional references to the “Essential Elements” described above are best included in the body of Section 3 for clarity and ease of use. Consequently, OWM recommends deleting the existing Footnote 2 and incorporating its contents into the body of Section 3.

OWM also believes that some may erroneously believe that field test standards must be specifically listed within a NIST Handbook 44 code in order to be used in the inspection and testing of devices covered by that code. Providing a clear statement that this is not the case along with a reference to the required criteria may help alleviate this misunderstanding.

The submitter acknowledges that Footnote 2 already provides a clear statement that the Director has authority to approve standards which are not addressed by a NIST Handbook 105 Series handbook. Some might argue that the proposed inclusion of additional information and guidance is not necessary.

The submitter states that these items are fully developed and requested that this be a Voting Item in 2022.

#### **Additional Justification for the Formula in the Proposed G-T.5.**

##### **Assessment of the 2/3 Formula and the OIML “Reduced MPE” Formula**

The 2/3 Formula: Increased MPE =  $(2/3 \times \text{MPE} + U)$  with an upper limit of  $U_{\text{MAX}} = 2/3 \text{ MPE}$

OIML Formula: Reduced MPE =  $(4/3 \times \text{MPE} - U)$

*Note: The general term “standard” is used in this paper to address both field standards and transfer standards. The specific terms “field standard” and “Type 2 transfer standard” (T2TS) distinguish between these two types of standards according to the proposed definitions submitted to the NCWM by Seraphin. Type 1 transfer standards (TITS) are not addressed in this paper.*

Based on the results of a discussion between one of the submitters (Seraphin) and Marc Buttler, Emerson - Micro Motion, the submitters agreed to recommend the  $2/3$  formula for use rather than the OIML formula. However, it is essential that an upper limit be established on the uncertainty associated with a Type 2 transfer standard (abbreviated as T2TS). The submitters agreed to recommend this upper limit not exceed  $2/3$  of the MPE of the commercial device under test. The same limit should be used if the OIML formula is used.

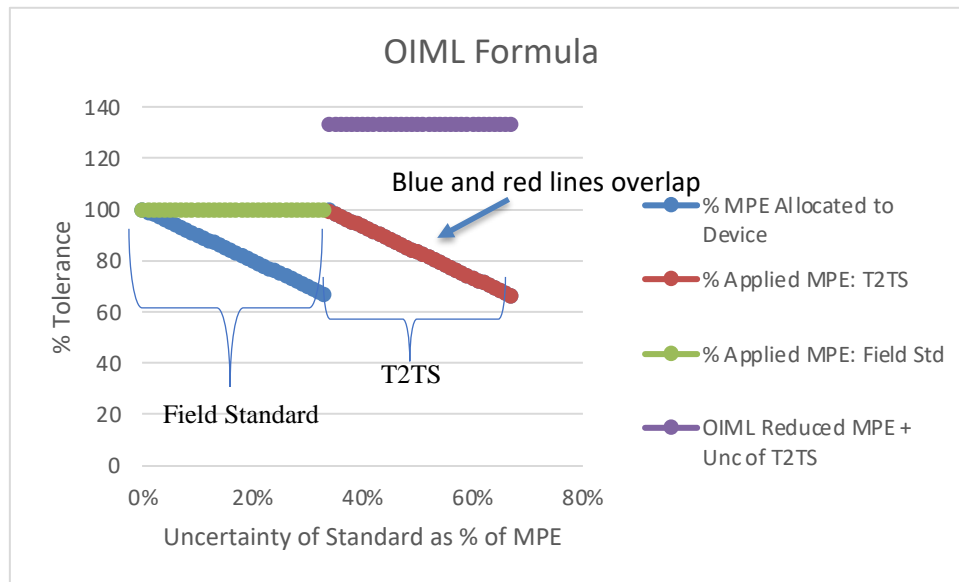
The OIML formula and the  $2/3$  formula are similar, but they take different approaches to establish the tolerances for the device under test. The  $2/3$  formula is more logical, more technically consistent with the Handbook 44 concept of Type 2 transfer standards, and it is easier to understand. The  $2/3$  formula combines the tolerance that remains to be used by the commercial device with the growing uncertainty of the T2TS into one total tolerance value, whereas the OIML Reduced MPE calculates only the tolerance applied to test of the commercial meter under test. When Type 2 transfer standards are used in the field, the uncertainties associated with the T2TS should be recorded on the report form or a copy of the calibration certificate should be left with the test report, so the uncertainty values are available on site and can be used in an analysis should the tests with another T2TS generate different results.

The most accurate reference standard that is available should always be used for any field test. However, when the only practical option for a field test that is available is a Type 2 transfer standard, the  $2/3$  formula will err in favor of the commercial device to avoid failing a device that should have passed. Conversely, the OIML Reduced MPE might result in failing a commercial device that would have passed had a more accurate (e.g., Type 1 transfer or field) reference standard been available to use for the test.

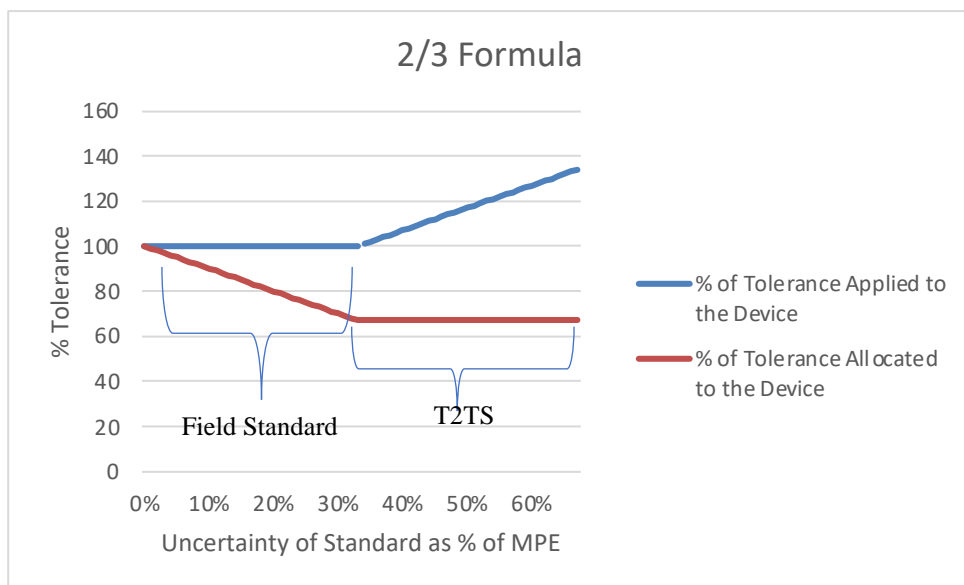
## Conclusion

Field standards are intended to have an error and uncertainty less than or equal to  $1/3$  of the tolerance applied to the commercial device under test. When a Type 2 transfer standard has an uncertainty slightly greater than  $1/3$  of the tolerance, then, using the  $2/3$  formula, the total tolerance applied to the device under test increases above the H44 tolerance by the amount that the uncertainty associated with the Type 2 transfer standard exceeds the  $1/3$  limit, thereby establishing a total tolerance slightly greater than the H44 tolerances specified in the applicable codes and keeping the portion of the tolerance that remains allocated to the device under test at a constant level equal to  $2/3$  of the H44 tolerance. When the uncertainty for the Type 2 transfer standard exceeds  $1/3$  of the MPE, the OIML formula resets the “Reduced MPE” (applied tolerance) to 100% of the MPE. As the uncertainty of the Type 2 transfer standard gets larger and larger, the tolerance allocated to the device under test (e.g., a meter since OIML R117 applies to meters) gets smaller and smaller, to the extent that it is not realistic to use a T2TS to test a commercial meter, because the uncertainty of the T2TS uses up most of the device tolerance. The  $2/3$  formula is consistent with (but actually smaller than) the usual H44 tolerances that state that the basic tolerances are to be increased by two standard deviations when using a T2TS. Note that with a  $U_{MAX}$  of  $2/3$  MPE for the maximum uncertainty of the T2TS, the applied tolerance associated with the field test result using the  $2/3$  formula never exceeds 1.33 of the original H44 tolerance for the device under test. The submitters note that, while these principles and associated formula were established to apply to metering systems, the concepts can apply equally to other types of commercial weighing and measuring equipment.

The  $2/3$  formula specifies the total uncertainty as the device tolerance when a T2TS is used. The OIML formula generates only the tolerance applied to the meter under test when a T2TS is used. The OIML formula is designed to keep the **combined** Reduced MPE value plus the uncertainty associated with the T2TS equal to 1.33 MPE. The OIML formula should also have an upper limit for the uncertainty of the T2TS as well, which should be  $U_{MAX}$  of  $2/3$  MPE. Note that when there is an upper limit of  $2/3$  the MPE, then the OIML formula always has a tolerance (applied MPE or the Reduced MPE) that is greater than or equal to  $2/3$  of the original MPE. The OIML Reduced MPE is the tolerance applied to the reading of the meter under test compared to the reading of the T2TS. Consequently, the use of the Reduced MPE with a T2TS is a meter-to-meter or device-to-device tolerance.



1



2

3 The error in the device under test is determined as the difference between the indication of the device under test  
 4 compared with the value represented or measured by the standard (usually presumed to have zero error or corrections  
 5 are used for any errors in the standard).

6 The increase in the applied tolerance when using a Type 2 transfer standard applies only to the basic tolerances for  
 7 devices as defined in Handbook 44, i.e., acceptance, maintenance and minimum tolerances.<sup>18</sup> Note that the

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<sup>18</sup> **basic tolerances.** – Tolerances on underregistration and on overregistration, or in excess and in deficiency, that are established by a particular code for a particular device under all normal tests, whether maintenance or

1 repeatability tolerance and the special test tolerances are NOT increased. [Note that the definition should apply to all  
2 codes, not just those listed with the definition, which do not include all codes that refer to basic tolerances.]

### 3 ***Explanation and Assessment***

#### 4 *Field Standards: Uncertainty is Part of the Tolerance*

5 Under the Fundamental Considerations, the correction and uncertainty of field standards are not to exceed 1/3 of the  
6 tolerance for the device under test. Under this condition, field standards are considered to be known values and the  
7 H44 tolerance is applied to the device under test without any consideration for the uncertainty associated with the field  
8 standard. The uncertainty associated with field standards may vary from nearly zero relative to the tolerance for the  
9 device under test up to 1/3 of the tolerance for the device under test. Even though the field standard may have an  
10 uncertainty as large as 1/3 of the tolerance applied to the device under test, the tolerance specified in H44 for the  
11 device is applied without consideration for the uncertainty associated with the field standard. The objective of this  
12 limit on the uncertainty associated with field standards "...is to give the device being tested as nearly as practicable  
13 the full benefit of its own tolerance."<sup>19</sup> Once the uncertainty associated with a "standard" exceeds the 1/3 limit, the  
14 "standard" no longer qualifies as a field standard, but is a Type 2 transfer standard under Seraphin's proposed  
15 definitions.

#### 16 *Type 2 Transfer Standards: Uncertainty is Added to the Tolerance*

17 When the uncertainty associated with a T2TS exceeds 1/3 of the tolerance applied to the device under test, the  
18 uncertainty of the T2TS is recognized in the field test result by increasing the tolerance that is applied to the device  
19 under test. The OIML formula and the 2/3 formula take different approaches to increasing the tolerance for the device  
20 under test.

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acceptance. Basic tolerances include minimum tolerance values when these are specified. Special tolerances,  
identified as such and pertaining to special tests, are not basic tolerances. [2.20, 2.22., 3.34, 3.38, 4.42, 5.54]

<sup>19</sup> Handbook 44, Fundamental Considerations, Section 3.2



	Field Standard	Field Standard	OIML Formula	OIML Formula	2/3 Formula	2/3 Formula
Uncertainty of Standard (as % of Tolerance)	% of MPE (Tolerance) Applied to the Device	% MPE (Tolerance) Allocated to Device	% of MPE Applied to the Difference in the Test Results Using a T2TS	OIML Reduced MPE and Uncertainty of T2TS (%)	% of Combined Tolerance and Uncertainty Applied to the Device	% of Combined Tolerance and Uncertainty Allocated to the Device
0%	100	100				
10%	100	90				
20%	100	80				
30%	100	70				
33%	100	67				
34%			99	133	101	67
40%			93	133	107	67
50%			83	133	117	67
60%			73	133	127	67
67%			67	133	133	67
70%			63	133	137	67
80%			53	133	147	67
90%			43	133	157	67
100%			33	133	167	67

The OIML formula increases the tolerance applied to the device under test by 1/3 minus the uncertainty of the T2TS as soon as the uncertainty of the Type 2 transfer standard exceeds the 1/3 limit. This increase recognizes the uncertainty that is up to 1/3 of the tolerance for field standards. Hence, the tolerance applied to the device under test plus the uncertainty of the T2TS is 1.33 times the original MPE when the uncertainty of the Type 2 transfer standard exceeds 1/3 of the MPE. As the uncertainty of the Type 2 transfer standard increases, the portion of the MPE allocated to the meter under test for the field test result decreases. If the uncertainty of the Type 2 transfer standard becomes very large, the poor accuracy and/or poor repeatability of Type 2 transfer standard makes its use ineffective.

In the 2/3 approach, the formula starts with 2/3 of the device tolerance (i.e., the MPE) apportioned to the device under test, which is the situation when the uncertainty of a field standard is exactly equal to 1/3 of the device tolerance. Next, the uncertainty associated with the T2TS is added to the 2/3 of the original MPE. Consequently, the tolerance (i.e., the MPE) applied to the field test gradually increases by the same amount as the uncertainty for the Type 2 transfer standard increases above the 1/3 level of the original MPE. An upper limit for the uncertainty of the T2TS is proposed to be 2/3 of the MPE, so that the uncertainty does not increase without limit and become meaningless. Hence, the tolerance applied to the device under test, when a T2TS has an uncertainty at the upper limit of 2/3 the MPE, the total tolerance plus the uncertainty will be 1.33 times the original MPE, which is equal to the maximum allowed by the OIML formula for the Reduced MPE plus the uncertainty of the T2TS when the uncertainty of the T2TS just exceeds the 1/3 limit.

#### *The Impact of Large Uncertainties for Field and Transfer Standards*

When different standards are used to test the same commercial devices, there is the possibility that the results will not agree exactly. As the uncertainties associated with the field or Type 2 transfer standards increase, then the probability increases that the field test results will not agree or even agree within tolerance. The concern is that some commercial devices could be tested with one standard and pass (or fail) the field tests, but, when tested with a different standard,

some commercial devices would fail (or pass) the field tests. Consequently, it is important to keep the uncertainties associated with the standards used to test commercial devices as small as reasonably possible, so that the probabilities of getting different field test results when using different standards are reduced.

**Regional Associations' Comments:**

WWMA 2022 Annual Meeting: Mr. Robert Murnane (Seraphin Test Measure Company) – It was verified the updated language was posted on the WWMA website for membership. Mr. Murnane commented the September 1, 2022, version is no different than the original, this version has the changes highlighted for ease of reference. He noted a correction in section 3.2. Tolerance for Standards, first paragraph. In the statement where it notes “accuracy of standards”, the corrected language should be " accuracy of field standards". He further noted the change on S&T agenda page 309, line 42, stating a correction to "field standard or transfer standard". Mr. Murnane’s final comment was a reference to the discretion of the State Director for allowance of these transfer standards is already in the handbook.

Mr. Matt Douglas (State of California, Division of Measurement Standards on behalf of S&T Committee)- Mr. Douglas sought clarification on the equation, noting it appeared that the error of the transfer standard is less than 1/3 the applicable tolerance, and it would end up with a lower tolerance for the device. Though it looks like the intention would be to give an extended tolerance.

Mr. Robert Murnane (Seraphin Test Measure Company) – Mr. Murnane provided clarification to the question on the equation. He noted the equation gives the benefit to the meter and referred to the submitted documentation for clarification.

Mr. Michael Keilty (Endress+Hauser) – Mr. Keilty commented the addition of "Weighing and Measuring" is beneficial. He noted, if you were testing a Type 1 device then you don't use the formula. When you have a Type 2 device then you would use the formula to calculate the corrections allowed. Mr. Keilty recommended a developing status.

Mr. Kurt Floren (County of Los Angeles, CA) – Mr. Floren commented he did not want to impede the progress of this item and technology, although is struggling to understand the language and its implications. Mr. Floren made reference to the language which references "field conditions" and “extended time” in a Metrology lab. He noted the language is unclear to what conditions need to be met and how to document these for enforcement purposes. Jurisdictions are not equipped to test all “field conditions”, and questions what an extended time and what a short time is with regards to how long a device remains accurate.

Mr. Brent Price (Gilbarco) – Mr. Price referred to S&T agenda, page 310, line 8. He was questioning the need for the last sentence.

Mr. Michael Keilty (Endress+Hauser) – Mr. Keilty commented on the definition and meaning of what long-term versus short-term mean. Mr. Keilty recommended the item continue to be developing and answers to Mr. Floren's questions be answered.

Mr. Robert Murnane (Seraphin Test Measure Company) – Mr. Murnane commented this represent a current attempt at this issue. He commented there needs to be definitions established. Mr. Murnane asked the question, what are jurisdiction doing to defend themselves with no established definition (referencing transfer standard versus field standard). The commentator mentioned he is looking for input but hasn’t received much. Mr. Murnane recommends the item be voting.

Mr. Kurt Floren (County of Los Angeles, CA) – Mr. Floren commented that the term “field standard” encompasses everything imaginable. It was suggested that as written, jurisdictions would require evidence that every mass standard would have been tested and proven to be stable under every possible scenario. Mr. Floren commented there is a need to be very specific about what qualifies as a transfer standard.

During open hearings, Mr. Robert Murnane representing Seraphin Test Measure provided testimony with changes to the proposed language which is now posted on the WWMA website. The WWMA S&T Committee recommends this item remain developing, and the submitter provide the updated language to NCWM to allow membership to review the updated proposal. The Committee further recommends that this item be blocked with Block 7 as the items in Block 7 are contingent on Block 8 items.

SWMA 2022 Annual Meeting: Mr. Murnane, Seraphin, stated that you can't always define every environmental issue, and we must be able to use judgment.

Mr. Keilty, Endress+Hauser, stated that Block 8 adds a definition for Type 1 and 2 Transfer Standards into the code, and he recommends this item move forward as developing.

The SWMA S&T Committee questioned why the submitter wants to move some of these items into code when they have been traditionally covered by the Fundamental Considerations. Additionally, the Committee questioned the open-ended nature of the timeframe component in defining the type of standard, and section 3.1.1. Essential Elements of Traceability potentially restricting the Directors authority in allowing certain standards to be used. The committee also requests documentation of specific standards in use and which type of standard they would be based on these definitions.

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

CWMA 2022 Interim Meeting: Bob Murnane – Seraphin, Nomenclature has been cleaned up since previous version. Intent not changed, simply clarifications. Former contended point was referring to only measuring devices instead of weighing and measuring devices. Wants this change, which was provided to the committee in writing, to be included and moved forward with this item.

The CWMA S&T Committee believes this item is fully developed and recommend voting status with the following changes which were provided by the submitter:

**Whenever possible and practical, field standards should be used to test commercial weighing and measuring devices. However, where it is impractical or unduly cumbersome to use field standards, transfer standards may be used. There are two categories of transfer standards. The critical criteria that distinguish between these standards are: (1) the accuracy and uncertainty of the standard; (2) the stability as a standard over an extended period; and (3) proven validity or performance of the standard over the range of environmental and operational conditions in which the standard may be used.**

**A “field standard” is one that meets the one-third requirement mentioned earlier in this section. Additionally, the field standard maintains its validity or stability as a standard over an extended period (defined based on data of the standard’s stability by an authorized metrology lab or as specified by the Director) and is known to maintain its value as a standard over the full range of environmental conditions and the range of operating conditions in which the standard may be used to test commercial weighing and measuring devices. Corrections, as documented by an authorized metrology laboratory, may be used.**

**Transfer standards do not meet one or more of these critical criteria. One category of transfer standards, which is referred to here as a “Type 1 transfer standard,” is a transfer standard that meets the one-third accuracy requirement for a short time, under a limited range of environmental conditions and/or a limited range of operating conditions. The accuracy of a Type 1 transfer standard may have to be verified through testing each time it is used to verify that the desired accuracy and performance can be achieved when the Type 1 transfer standard is used under the limited environmental and operating conditions. When a Type 1 transfer standard is used, the basic tolerances specified for the commercial weighing and measuring devices are applied as specified in the applicable codes.**

**The second category of transfer standard, which is referred to here as a “Type 2 transfer standard,” is one that does not meet the one-third requirement. The Type 2 transfer standard must be stable and valid under the environmental or operating conditions in which it is used. The performance characteristics must be confirmed with sufficient data to properly characterize the uncertainty associated with the Type 2 transfer standard. When a Type 2 transfer standard is used, the tolerances applicable to the commercial weighing and measuring devices must be increased to recognize the large uncertainty or corrections associated with the Type 2 transfer standard. When commercial ~~meters~~ weighing and measuring devices are tested using a Type 2 transfer standard, the tolerance applied to the commercial weighing and measuring devices ~~meter~~ under test shall be determined as specified in the General Code.**  
**(Added 202X)**

**3.2. Tolerances for Standards.** – Except for work of relatively high precision, it is recommended that the accuracy of ~~field~~ standards used in testing commercial weighing and measuring equipment be established and maintained so that the use of corrections is not necessary. When the ~~field~~ standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable device tolerance.

Device testing is complicated to some degree when corrections to standards are applied. When using a correction for a ~~field~~ standard **or a transfer standard**, the uncertainty associated with the corrected value must be less than one-third of the applicable device tolerance. The reason for this requirement is to give the device being tested as nearly as practicable the full benefit of its own tolerance.

NEWMA 2022 Interim Meeting: Mr. Bob Murnane (Seraphin Test Measure) commented that the item that appears in the agenda is not what has been proposed as there are many typos. A true version of the item was submitted to the NEWMA S&T Chairman and shared with the body. Mr. Murnane asks that the same status be given to Block 7 and Block 8 as they are directly linked. Mr. Murnane indicated that this proposal draws from the Fundamental Considerations and clarifies that State Directors have the authority to use any standards. Mr. Michael Keilty (Endress Hauser) questions Section 3.2 that was shaded, regarding corrections by a metrology lab and clarification was given by Mr. Murnane. Mr. Keilty stated that he understands what is being done to introduce type 1 and type 2 transfer standards, but transfer standards are not always stable and type 2 standards do not meet 1/3 requirement in the Fundamental Consideration and has questions about “time” and “environmental conditions”.

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

Additional letters, presentation and data may have been submitted for consideration with this item. Please refer to [www.ncwm.com/publication-15](http://www.ncwm.com/publication-15) to review these documents.

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Mr. Jason Glass, Kentucky | Committee Chair  
Mr. Nick Owens, Stark County, Ohio | Vice-Chair  
Mr. Jason Flint, New Jersey | Member  
Mr. David Aguayo, San Luis Obispo County, California | Member  
Mr. James Willis, New York | Member  
Mr. Éric Turcotte, Measurement Canada | Canadian Technical Advisor  
Mr. Richard Harshman, NIST OWM | NIST Technical Advisor  
Ms. G. Diane Lee, NIST, OWM | NIST Technical Advisor  
Mr. Allen Katalinic, NCWM | NTEP Technical Advisor  
Mr. Jeff Gibson, NCWM | NCWM Technical Advisor  
Mr. Greg Gholston, Mississippi | Committee Coordinator

#### **Specifications and Tolerances Committee**

## **APPENDIX A**

### **Item Block 2 – Final Report of the Verification Scale Division Task Group**

**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.

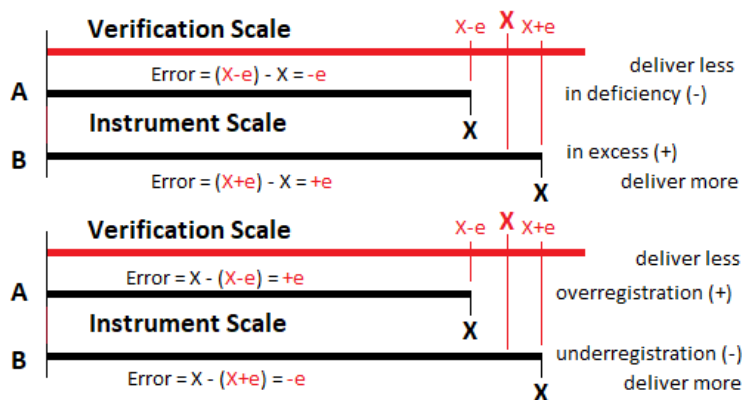
Instrument Scale	Scale div d	Verification “True Value” Scale	Scale div e	Relation e to d
Rule	1/16 in	Standard Rule or Tape	1/16 in	e = d
Taximeter	1/10 mi	Road Course	2 ft	e << d
LMD’s	0.1 gal	Prover indication	5 cu in	e > d
Mass Flow Meter	1 lb	Reference Scale	0.01 lb	e < d
Weighing Devices	0.01 lb	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.

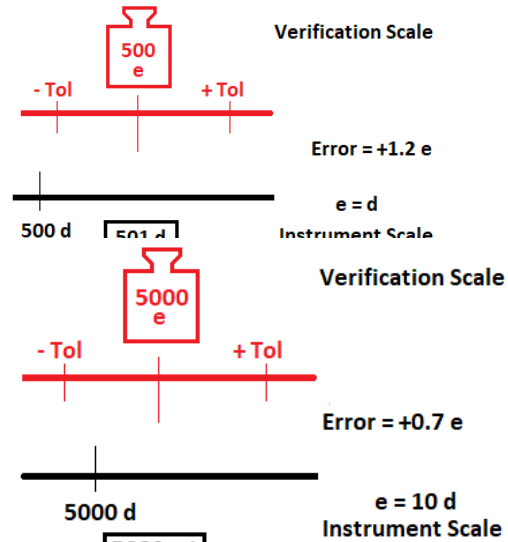
Error of delivery =  
verification scale – instrument scale  
+ in excess  
– in deficiency

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).

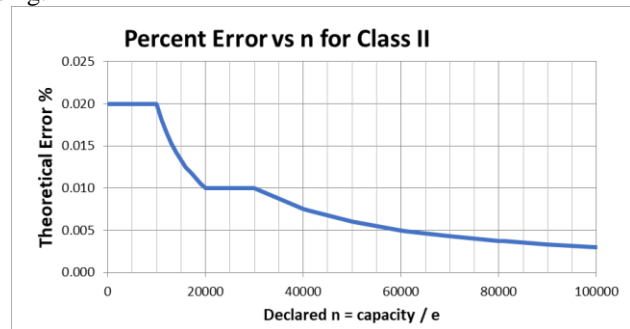
**T.N.1.3. Scale Division.** – The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.

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 ~~(d)~~ (e).

(Amended 20XX)



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

(Amended 20XX)

These changes bring the principles in the T.N. section in agreement with the definitions. Classification is exclusively based on e.

Table 3. Parameters for Accuracy Classes			
Class	Value of the Verification Scale Division ( <del>d or</del> e <sup>1</sup> )	Number of <u>Verification</u> Scale <sup>4</sup> Divisions (n)	
		Minimum	Maximum
SI Units			
I	equal to or greater than 1 mg	50 000	--
II	1 to 50 mg, inclusive	100	100 000
III <sup>2,5</sup>	equal to or greater than 100 mg	5 000	100 000
	0.1 to 2 g, inclusive	100	10 000
	equal to or greater than 5 g	500	10 000
III L <sup>3</sup>	equal to or greater than 2 kg	2 000	10 000
III	equal to or greater than 5 g	100	1 200

<sup>1</sup> ~~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.).~~

<sup>2</sup> 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)

<sup>3</sup> 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.

<sup>4</sup> 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)

<sup>5</sup> 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  $n = \text{capacity} / e$ .

<b>Table S.6.3.a. Marking Requirements</b>					
<b>To Be Marked With ↓</b>	<b>Weighing Equipment</b>				
	<b>Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC<sup>1</sup></b>	<b>Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC</b>	<b>Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC</b>	<b>Load Cell with CC (11)</b>	<b>Other Equipment or Device (10)</b>
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” ( <del>3</del> 4)	X	X			
Value of <u>Verification Scale Division</u> , “e” (4 <del>3</del> )	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 7<sup>th</sup> and 8<sup>th</sup> 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).

<p style="text-align: center;"><b>Table S.6.3.b.</b> <b>Notes for Table S.6.3.a. Marking Requirements</b></p>	
1.	<p>Manufacturer's identification and model designation and <i>model designation prefix</i>.*</p> <p><i>[*Nonretroactive as of January 1, 2003]</i></p> <p>(Also see G-S.1. Identification.) <i>[Prefix lettering may be initial capitals, all capitals or all lower case]</i></p> <p>(Amended 2000)</p>
2.	<p><i>Serial number [Nonretroactive as of January 1, 1968] and prefix [Nonretroactive as of January 1, 1986].</i> (Also see G-S.1. Identification.)</p>
3.	<p>The device shall be marked with the nominal capacity. <i>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, <del>d</del> 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 <del>or weight unit</del> 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."</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" "e." This does not apply to an ungraduated device (equal arm scale) where the graduations do not refer to a fixed weight value.</i></p> <p><i>[Nonretroactive as of January 1, 1986]</i></p> <p><u>(Amended 20XX)</u></p>

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.

<b>Table S.1.2.2.</b> <b>Relative Magnitude of e to d</b>	
<u>Type of device (see Note)</u>	<u>Relative magnitude of e to d</u>
<u>Graduated, without an auxiliary indicating device</u>	$e = d$
<u>Graduated, with an auxiliary indicating device</u>	$e > d$ and e is chosen by the manufacturer according to Table 3. and S.1.2.2.1.
<u>Graduated, and marked for use in special applications (weight classifier)</u>	$e \leq d$ and e is chosen by the manufacturer according to Table 3. and S.1.2.2.4.

*Note: Ungraduated devices, e.g. equal arm balances where the scale graduations do not represent a fixed weight quantity, are not included in this table since they have no scale divisions (d) to permit comparison with (e).*

**S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales.** – If  $e \neq d$ , 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 IIIL Scales.** On Class IIIL scales the value of “e” shall equal the value of “d.”  
(Added 20XX)

(Add new definition)

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

(Added 20XX)

Section S.1.2.2. is a key part of understanding application of e and d. The first change was to make references uniform to verification scale “division” as used in all other parts of the code. This section currently uses the term verification scale “interval”. Several additions of the term “scale” were also added to S.1.2.2.1. for clarity. Of note, R76 exempts Class I from the e not greater than 10 d requirement when e = 1 mg or less.

A major addition is the new text and table in T.1.2.2. This would create a parallel section in HB44 to R76 section 3.1.2 and Table 2. This section describes four types of instruments:

1. Graduated without an auxiliary indicating device – most instruments e = d
2. Graduated with an auxiliary indicating device – Class I and II with high resolution e > d
3. Graduated & marked for special applications – weight classifiers (round down instruments) e < d
4. Ungraduated – equal arm balances where graduations don’t refer to fixed weight quantities. No d

These four types also impact application of minimum load in Table 8.

The current S.5.3. was moved to this section as S.1.2.2.5. to keep these paragraphs dealing with the magnitude of e and d together. A new paragraph S.1.2.2.6. was added to address Class IIIL where e should always equal d. Now all classes (I, II, III, IIIL, and IIIL) 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,  $d$ , for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent<sup>1</sup> 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)  $v_{min} \leq \frac{d * e}{\sqrt{N} \times (\text{scale multiple})}$  for scales with lever systems.

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

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

- the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;
- the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and
- the complete weighing/load-receiving element or scale is equipped with an automatic

*zero-tracking mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.*

*[Nonretroactive as of January 1, 1994]*

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

The renumbering resulted from the move of S.5.3. to the S.1.2.2. section as S.1.2.2.5. The other changes correctly reference e instead of d in this section. Technically,  $v_{min}$  for load cells corresponds to verification scale division e for weighing instruments. They are accuracy ratings declared by the manufacturer. There is no significant change for the inspector in properly referring to e since for scales where e = d the issue is moot and when e ≠ d the section already directed the use of e. With the change the inspector will always use e.

### **Group 3. Changes to clarify appropriate application of tolerances (Marked Scales)**

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

The proper reference in this section has always been e, and this is how it has always been interpreted. The current language says “scale divisions” which technically refers to d. This means we weren’t following the Code. The removal of “in Scale Divisions” after Tolerances in the second row was made to provide parallel construction with the header for Test Load. The parenthetical at the top should be sufficient to cover both sections of the table.

The change for Class IIIL was made since e should be used to specify tolerances and we added S.1.2.2.6. requiring that d = e for this class.

**T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales.** – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class IIIL, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 ~~e~~ 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~~) 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)**

<b>Table 8.</b> <b>Recommended Minimum Load</b>		
<b>Class</b>	<b>Value of <u>Verification Scale Division “e”</u> (<del>d or e*</del>)</b>	<b>Recommended Minimum Load <u>in</u> <u>scale divisions “d” (See notes) (<del>d or</del></u> <u>e*)</u></b>
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
III	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 III 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~~ **\*\*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 weighment of 0.05 g. That's 4.8% relative error in the weighment ( $0.05 \text{ g} / 1.05 \text{ g}$ ) 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 weighment ( $0.005 / 1.005$ ). That is 10 times smaller at the same 20 e load.

Returning to the four types of instruments from revised S.1.2.2. and applying revised Table 8.:

- |  |                   |
|--|-------------------|
| 1. Graduated without an auxiliary indicating device:         | minimum load in d |
| 2. Graduated with an auxiliary indicating device:            | minimum load in d |
| 3. Graduated and marked for special use (weight classifier): | minimum load 5 e  |
| 4. Ungraduated (equal arm scales):                           | minimum load in e |

#### **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 ~~( $\pm$ )~~ (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.

<b>Code Section</b>	<b>Applies to</b>	<b>Justification</b>
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  $\frac{1}{4}$  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 gross – tare = net be in mathematical agreement due to rounding issues. Note that in most transactions, the customer only gets one or two of the gross, tare or net values. Rounding issues do not arise for this reason. This may impact a current issue before NCWM dealing with printing tare on POS transaction receipts. Consider a POS transaction where the customer saw 1.02 lb on the weight display and sees 1.00 lb net and 0.03 lb tare. These are all accurate weights (and correct per R76) but the numbers don't add up. The customer will claim they were overcharged by 0.01 lb since  $1.02 \text{ lb} - 0.03 \text{ lb} = 0.99 \text{ lb}$ .

**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.

