NIST Office of Weights and Measures (OWM) Analysis
Specifications and Tolerances (S&T)
2023 NCWM Annual Meeting Agenda

The NIST OWM Analysis is submitted to assist the Weights and Measures community as it deliberates on items before the Conference. OWM offers these comments and recommendations based on information and input available as of the date of this report. This does not address information received after this date.

Language shown in boldface print by striking out information to be deleted and underlining information to be added. Requirements that are proposed to be nonretroactive are printed in boldface italics.

Assessment of items contained within this report is as of July 10, 2023 and does not address information received after this date.

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Subject Series List for the Specifications and Tolerances Committee

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Details of All Items
(In order by Reference Key)

GEN – General Code

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

Source: Seraphin Test Measure Company

Submitter's Purpose and Justification:

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. 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 HB44 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.

The submitter requests that this be a retroactive section and request a Voting status for this item.

NIST OWM Executive Summary for GEN-23.1 – G-N.3. Test Methods

NIST OWM Recommendation: We recognize that GEN-23.1 could be used as a roadmap to what is being proposed in Block 8 to support those States needing a specific requirement in the handbook that address the use of Standards within a Jurisdiction. NIST OWM supports this as a Voting item along with the changes where it ensures continuity in terms, as described in the detailed technical analysis section.

- Some States have argued the need for specific requirements in NIST HB44 for specific standards that can be used for testing commercial devices and this new proposal would address that concern.
- Item GEN-23.1 provides requirements in NIST HB 44 General Code reinforcing that jurisdictions have the authority to use standards that meet the criteria specified in NIST HB 44 Appendix A. Fundamental Considerations, Section 3. Testing Apparatus.
- Block 8 is a proposal to add tolerances to NIST HB 44 General Code applicable to devices tested with Type 2 Transfer Standards, add definitions to NIST HB 44 Appendix D for Type 1 & 2 Transfer Standards and supplement and clarify NIST HB 44 Appendix A. Fundamental Considerations, Section 3. Testing Apparatus.
- With both GEN-23.1 and the Block 8 Items, weights and measures Jurisdictions will have the necessary tools to determine the appropriate Standards for use when testing commercial devices.
- With respect to item WIM 23.1, the community may want to consider amending this item further to include the words "and law enforcement" after the word "commercial" per the NIST OWM Detailed Technical Analysis below.

Table 2. Summary of Recommendations
GEN-23.1 – G-N.3. Test Methods

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		Recommendation-Annual 2022
NEWMA	Voting		
SWMA	Developing		Recommendation-Annual 2022
CWMA	Voting		
NCWM	Voting		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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.

NIST OWM Detailed Technical Analysis:

S&T Agenda item LPG-15.1 and MFM-15.1 are proposed changes to the test draft paragraphs in NIST HB 44, LPG Code, and MFM Code with the purpose statement to accept meters for use as standards. Many comments were heard expressing technical concerns with the proposed changes and comments that acceptance of a standard used to test commercial devices within a jurisdiction is the responsibility of the Director within a weights and measures jurisdiction, which is specified in NIST HB 44 Fundamental Considerations.

This proposal would add a paragraph to NIST HB 44 General Code to support those regulators that need to site a specific requirement in NIST HB 44, other than those in Appendix A. This proposal also eliminates the need to place a paragraph in each section of NIST HB 44 that address specific standards for use in testing commercial and law enforcement devices. NIST is also in support of the changes to the Item Under Consideration that were proposed by Robert Murnane at the CWMA meeting which replaces "State Director" with "Director" and removes "of weights and measures" to match other language in the NIST HBs and is a more general title.

The Director's responsibilities are further clarified in S&T Agenda Item Block 8. As was pointed out by the submitter of this item, some regulators may argue that if NIST HB 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 a NIST HB 44 code and the Handbook must be changed every time a new standard is to be recognized.

With the addition to NIST HB 44 of both GEN-23.1 and the Block 8 Items, weights and measures Jurisdictions will have the necessary tools to determine the appropriate Standards for use when testing commercial devices.

We would suggest that the community consider amending the item further to include the words "and law enforcement" after the word "commercial" to GEN-23.1. The item would then appear as follows on the addendum at the 2023 NCWM Annual Meeting:

G-N.3. Test Methods. – Permissible test methods for verifying compliance of commercial and law enforcement 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.

G-A.1. Commercial and Law-Enforcement Equipment. (2) states the General Code applies to "…weighing and measuring equipment in official use for the enforcement of law or the collection of statistical information by government agencies." Radar guns, Breathalyzers, and Roll-a-Tape are a few

examples of law enforcement devices that may be checked for accuracy by W&M officials to establish traceability. If WIM-23.1 is eventually adopted having only the term "commercial" may lead to the interpretation that transfer standards are not appropriate for use when evaluating law enforcement equipment.

Summary of Discussions and Actions:

Some states have expressed the concern that the information contained in Appendix A - Fundamental Considerations, Section 3. Testing Apparatus isn't sufficient to allow the use of reference standards or transfer standards when there are no specific requirements in the applicable device codes. Some states also indicated that they don't adopt Appendix A and can't reference it to support the decision to use reference standards or transfer standards. GEN-23.1 along with items in block 8 provide the requirements for use of various test standards to test commercial devices.

At the 2023 NCWM Interim Meeting the changes suggested at the CWMA 2022 Interim Meeting were addressed as follows:

The NIST OWM opposes the addition of the word "commercial" to proceed the terms "**weighing and measuring systems..**" to the item under consideration. The OWM believes this may limit the scope of this item since NIST HB 44 does apply to " To weighing and measuring equipment in official use for the enforcement of law or the collection of statistical information by government agencies.".

It was also suggested to strike the following terms as shown "…~~**State** Directors **for Weights and Measures…**~~" and we concur with this change and note that Handbook 130 Uniform Weights and Measures Law, Section 1, Definitions 1.4 gives a State the latitude to define the position of Director within an agency.

As such, NIST OWM suggests the Item Under Consideration be updated to appear as follows:

G-N.3. Test Methods. – Permissible test methods for verifying compliance of 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.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received: Robert Murnane (Seraphin Test Measure Company) provided the reason for this addition and stated that rather than adding paragraphs for each code regarding use of testing equipment (it resides in Appendix A; puts it out there for everyone) putting it in the general code will keep us from having to go back to it. He recommended this as a Voting item.

Michael Keilty (Endress+Hauser) opposed this item. He noted that Robert Murnane also submitted the item under Block 8 and stated that everything in this proposal is repeated in Block 8 by the fundamental considerations; it is redundant. Michael Keilty recommended the item be withdrawn.

During Open Hearings there was testimony heard about redundancy between this item and Block 8.

The WWMA S&T Committee recommended 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 and reduce redundancies.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Matt Curran (Florida) commented that he was not 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.

Robert Murnane 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.

Tim Chesser (Arkansas) echoed Matt 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.

Michael Keilty 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.

Hal Prince (Florida) stated that he didn't see a need for this proposal. Ken Ramsburg (Maryland) echoed Hal 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.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Robert Murnane 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. Michael Keilty 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. 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 be provide for 2023 NCWM Interim. Robert Murnane responded to Michael Keilty's 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. Lou Sakin (Holliston, Massachusetts) recommended this item have a Voting status. Jim Willis (New York) indicated that this item will have a Voting status.

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

At the 2023 NEWMA Annual Meeting, Robert Murnane spoke in support of this item. He indicated by putting this in the General Code, rather than just in the fundamental considerations, it references all devices covered in the handbook.

Michael Keilty supported this item and he stated in the past that it was redundant but now feels it is a pointer item to the Appendix and believes it is an important change to make.

Loren Minnich (NIST OWM) supported this item.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Robert Murnane recommended adding "commercial" to line 12 between the words "of" and "weighing".

The CWMA S&T Committee believes this item is fully developed and recommended 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.**

At the 2023 CWMA Annual Meeting, Robert Murnane provided the following comments:

This item was introduced after Block 7 and 8 after many jurisdictions said Appendixes aren't enforceable. So, this item moved to the General Code so that it may be enforceable. He supports this as a voting item.

Loren Minnich stated that OWM supports this item as a Voting item. It gives more enforcement power if in the General Code vs. Appendix.

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

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 and make it a stand-alone item.)

Source: NIST, Office of Weights and Measures

Submitter's Purpose and Justification:

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.

NIST OWM Executive Summary for SCL-22.1 – Recorded Representation of Axle or Axle Group Weights

NIST OWM Recommendation:

- The S&T Committee agreed to update this item during the 2023 NCWM Interim Meeting to reflect some changes proposed by NIST OWM that had earlier been recommended by the SMA and supported by OWM. OWM believes this item is fully developed and should be presented for vote during the upcoming 2023 NCWM Annual Meeting

- The changes proposed by this item require 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, to be identified as to which independent platform performed the weighing.

  Note: These scale systems <u>are not</u> required to be equipped with a ticket printer and the changes proposed by this item would not require one. Consequently, the changes proposed by this item only apply to those systems that provide recorded representations of the weight values determined from the scale system.

- OWM believes most (perhaps all) existing multi-independent platform vehicle scale systems used commercially or for law-enforcement purposes are equipped with a ticket printer. OWM also believes most (perhaps all) of these systems already identify, on the printed ticket generated from the scale system, the particular independent platform associated with each axle and axle group load of a vehicle weighed.

- It is important to identify the particular platform associated with each weight value that gets recorded on a ticket by these systems because there are typically four different values that get recorded, i.e., one for each independent platform and a summed total of all three platforms. Failure to provide this information on the ticket would cause confusion and could possibly facilitate the perpetration of fraud.

Table 2. Summary of Recommendations
SCL-22.1 – Recorded Representation of Axle or Axle Group Weights

	Status Recommendation	Note*	Comments
Submitter			This item was submitted by
OWM	Voting		
WWMA	Developing		SCL-22.1 and SCL-22.3 were blocked together at the time of WWMA's 2022 Annual Meeting, i.e., Block 6. The status recommendation provided was for both items in the block.
NEWMA	Voting		
SWMA	Developing		SCL-22.1 and SCL-22.3 were blocked together at the time of SWMA's 2022 Annual Meeting. The status recommendation provided was for both items in the block.
CWMA	Voting		
NCWM			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend NIST Handbook 44, Scales Code as follows:

S.1.15. Recorded Representations, Multi-Independent Platform[1] 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[2], 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.

[1]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.

[2]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]

NIST OWM Detailed Technical Analysis:

OWM developed the two proposals in SCL-22.1 and SCL-22.3 to address perceived gaps in NIST HB 44 Scales Code requirements pertaining to the design and use of multi-independent platform vehicle scale systems commercially used to charge a fee for the service of providing axle- and axle-group weights, as well as total vehicle weight to those needing them (typically commercial truck drivers). These systems are most often used commercially to verify compliance with federal and state vehicle load limits but at times may also be used to establish the net loads of products that are bought and sold by weight, establish transportation charges, and for other commercial purposes.

These proposals were developed as the result of an OWM inquiry from a state questioning the permissible use of a multi-independent platform vehicle scale system (each platform having its own A/D conversion circuitry and weight indicator) that printed total vehicle weight from summing the axle- and axle-group loads of vehicles weighed when not all parts of those vehicles were able to fit onto a live portion of the scale and be weighed simultaneously. That is, the scale was being used on occasion to "split weigh" in two different drafts the different axle and axle groups of "over-sized" coupled-vehicle combinations because not all axle and axle groups would fit onto a live portion of the scale at the same time, which thus necessitated weighing those particular vehicles in multiple drafts. Even though the printed ticket for those weight determinations provided clear indication that the total vehicle weight value recorded was "non certifiable," it is questionable whether or not a scale system is permitted to record this weight since NIST HB 44 Scales Code paragraph UR.3.3. Single-Draft Vehicle Weighing currently requires a vehicle or coupled-vehicle combination to be commercially weighed on a vehicle scale only as a single draft. Note: The manufacturer of this particular scale system advised us that most vehicles and coupled-vehicle combinations that are weighed on the scale can be weighed as a single draft. That is, all axle and axle groups can be positioned onto a live portion of the scale to be weighed simultaneously. It is only the occasional oversized vehicle or coupled-vehicle combination that exceeds the length of the scale that must therefore be split weighed.

We purposely chose to simplify these proposals to only address multi-independent platform vehicle scale systems. These systems have been installed at truck stops (and perhaps other locations) throughout the

US for many years and are used primarily to determine axle loads, axle-group loads, and total vehicle weight of vehicles and coupled-vehicle combinations for a fee. Although we recognize that single-platform vehicle scales may also sometimes be used for this same purpose, we don't view them as being suitable for the application. This is because the approach requirements for vehicle scales and axle-load scales in NIST HB44 are very different and few vehicle scales in commercial service have approaches that comply with the approach requirements for axle-load scales. Axle-load scales are required to have a straight paved approach in the same plane as the platform on each end of the platform. The approaches must be the same width as the platform and of sufficient length to ensure the level positioning of vehicles during weight determinations. If vehicles aren't level when the different axle and axle groups are weighed, a portion of the force of the load transfers to other axle and axle groups that aren't positioned on the scale resulting in false weight. It is important to recognize that not all multi-independent platform vehicle scale systems may be installed with approach requirements meeting the HB 44 approach requirements for an axle-load scale. Many do, but we are unable to confirm that all do. We view this somewhat of an important concern given that these proposals, if adopted, would make it permissible to split weigh vehicles and coupled-vehicle combinations for a fee providing the only use of the weighing results from doing so is to verify whether or not the different axle-, axle-group loads, and total vehicle weight are compliant with highway weight limits.

Another reason we elected to limit these proposals to only address multi-independent platform vehicle scale systems is that we do not believe it to be a very common practice to use single-platform vehicle scales to determine axle loads and axle-group loads of vehicles and coupled-vehicle combinations to verify compliance with federal and state vehicle load limits. Those that are using them for this purpose usually don't charge a fee, i.e., the weighing is usually done as a complimentary service.

NIST HB 44 does not currently require a multi-independent platform vehicle scale system to be equipped with a ticket printer and whether or not one should be required, is something to be considered. We have not proposed it, but perhaps others will conclude this would be an important HB 44 addition. We believe most (perhaps all) of the multi-independent platform vehicle scale systems currently in commercial service have been equipped with a ticket printer and this is likely because the few scale manufacturers of these systems recognize the need for the multiple indications displayed by these systems to be made available in printed form to the operator and customer. We also believe most of the systems currently in service comply with both newly proposed sub-paragraphs of S.1.15. We developed these two new sub-paragraphs (S.1.15.1. and S.1.15.2.) because it is important for scale operators, customers, and enforcement officials to be able to clearly identify from a weigh ticket the different scale platforms utilized at the time a vehicle was weighed and their corresponding scale indications so that the accuracy of those values (including the summed total) can be verified. It is also important to clearly specify on a weigh ticket generated from one of these scale systems that any recorded total vehicle weight value determined from summing the different axle- and axle-group loads of a vehicle or coupled-vehicle combination weighed in multiple drafts (i.e., split weighed) is "Not-Legal-For-Trade."

Paragraph UR.3.3. needs to be amended to address the current use of multi-independent vehicle scale systems to split weigh oversized vehicles for a fee. The current paragraph does not take into consideration both the past and present use of these scales to provide a total vehicle weight that's most often only used to verify compliance with maximum legal load limits and safe distribution of the load. These systems have been in existence at truck stops for many years and their primary commercial use is to provide axle weights, axle group weights, and total vehicle weight to commercial haulers for a fee so that those haulers are able to determine whether or not their loads are distributed safely and within legal load limits. Years ago, (prior to the existence of multi-independent platform vehicle scale systems) axle-load scales served this same purpose at truck stops throughout the US and summing of the different axle

and axle groups to determine total vehicle weight undoubtedly occurred to ensure total vehicle weight didn't exceed maximum legal load limits when using those scales. It is also important to recognize that the weight values corresponding to the different axle- and axle-group loads of vehicles weighed on a multi-independent platform vehicle scale system are not constant; but rather fluctuate/change depending on the position of those axles and axle groups on the different platforms of the system when the vehicle is weighed. That is, a change of the scale indication of one platform is offset by a change in the opposite direction of the indication from one or both of the other platforms if the position of a vehicle being weighed is changed slightly forward or backwards from its initial position. It is only the summed total of all indications that is constant; although it too changes minimally since not all sections of all platforms are typically adjusted the same. For these reasons, OWM has provided the Committee an updated proposal to amend Scales Code paragraph UR.3.3., which would make it permissible to weigh in multiple drafts (i.e., split weigh) a vehicle or coupled-vehicle combination and charge a fee for the service of providing weights of the different axle- and axle-group loads when the only use of those values is to determine compliance with highway legal load limits.

Summary of Discussions and Actions:

During open hearings at the 2022 NCWM Annual Meeting, Richard Harshman (NIST OWM) provided the Committee a high-level summary of its analysis of the two remaining items in Block 6, which included much of background information that had led OWM to submit the two proposals in Block 6 as well as the GEN-22.1 G.A.1. Commercial and Law-Enforcement Equipment item, which the Committee had previously removed from Block 6. Richard Harshman reported that OWM had recently provided the Committee an updated version of the proposal in SCL-22.1 and requested the Committee replace the version of SCL-22.1 in its current agenda with the updated version recently received. Richard Harshman also reported that OWM planned to revise the proposal in SCL-22.3 and would later (sometime following the 2022 NCWM Interim Meeting) submit the revised version to the Committee in hopes it could be reviewed by one or more of the regional weights and measures associations meeting in the Spring and/or Fall of 2022. Richard Harshman recommended both items remain in a developing status to allow stakeholders time to review and recommend any changes they felt necessary.

Russ Vires (Mettler Toledo LLC) speaking on behalf of the SMA reported that the SMA recommends Block 6 be broken apart into three individual items (i.e., GEN-22.1 Commercial and Law-Enforcement Equipment, SCL-22.1 Recorded Representation of Axle or Axle Group Weights, and SCL-22.3 UR.3.3. Single-Draft Vehicle Weighing and UR.3.4. Axle and Axle Group Weight Values). Russ Vires then provided the SMA's position and rationale for each of these items speaking verbatim from the SMA's November 2, 2021 report titled "SMA Positions on the NCWM Specification and Tolerances Committee Report (For the NCWM Interim Meeting, January 2022, Developed November 2, 2021). *NIST Technical Advisors note: Refer to the subheading shown below titled, "Scale Manufacturers Association (SMA-Fall 2021 Meeting)" to view the different positions and rationales provided by Russ Vires on behalf of the SMA for the items in Block 6.* Russ Vires also reported that the SMA had had the opportunity during its Fall 2021 meeting to review the updated version of the proposal in SCL-22.1 that OWM had provided the Committee for replacement of the one in its current agenda and that the SMA supported the changes OWM had made.

These were several officials who spoke in support of further development of the two items in Block 6.

Lou Straub (Fairbanks Scale) reported that Fairbanks Scale had been manufacturing the multi-platform "CAT" vehicle scale system for over forty years and the systems had been installed in approximately 2,000 locations. He also reported that he fully supported the GEN-22.1 item that the Committee had

earlier removed from Block 6. Referencing the proposal in SCL-22.1, Lou Straub stated he agreed that the recorded representation of weights from individual axle or axle groups need to be clearly identified as "not-legal-for- trade" on the printed ticket unless the entire vehicle is positioned on live elements of the vehicle scale system and all axles/axle groups are weighed simultaneously. He voiced disagreement with the second sentence proposed in paragraph S.1.14. noting that when one considers a truck with six to eight axle groups that cannot fit onto the different independent platform and be weighed simultaneously, identifying which platform weighed each of these axle and axle groups becomes unnecessary.

The Committee, in consideration of the comments received during open hearings, agreed to replace the Block 6 SCL-22.1 proposal in its 2022 NCWM Interim Meeting Agenda with the updated version provided by OWM just prior to the 2022 NCWM Interim Meeting and maintain a developing status on the two remaining items in Block 6. The following proposal represents the Block 6 SCL-22.1 item appearing in the 2022 version of NCWM Publication 15 that the Committee agreed to replace with the Item under Consideration now shown in SCL-22.1:

Item under Consideration:

Amend Handbook 44, Scales Code as follows:

S.1.14. Recorded Representation of Axle or Axle Group Weights. – The recorded representation of weights from individual axle or axle group weights shall clearly be identified as "not legal for trade" or "non-commercial" weight values unless the entire vehicle is positioned on live elements of a multiple-platform vehicle scale and where all axles/axle groups are weighed simultaneously. All recorded weights of axles/axle groups shall be identified as representing only a portion of the vehicle's total gross weight (e.g., by axle groupings such as: "axle group 1," "axle group 2," "axle group 3," or by individual axle description such as: "steering axle," "drive axles," "trailer axles").

Any total gross weight of the vehicle included in the recorded representations determined by summing axle weights shall be clearly identified as "not-legal-for trade" or "non-commercial" unless those axle weights were recorded when all parts of the vehicle rested simultaneously on live portions of the scale, or the individual components were uncoupled, positioned completely on the live elements, and weighed separately on the scale.

[subsequent requirements to be renumbered as appropriate]

On May 19, 2022, OWM provided S&T Committee Chair Bradford Bachelder an electronic file containing the following revised version of the B6: SCL-22.3 proposal as replacement for the current proposal in 2022 NCWM Publication 16. OWM requested he share it with the Committee to be considered as replacement for the current proposal in the Committee's agenda.

OWM's Revised Replacement Proposal for B6: SCL-22.3 UR.3.3. Single-Draft Vehicle Weighing, and UR.3.4. Axle and Axle Group Weight Values.

Amend NIST 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)

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~~s~~ 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.

During the 2023 NCWM Interim Meeting, the Committee agreed to remove SCL-22.1 from Block 6 and make it a voting item for the upcoming 2023 NCWM Annual Meeting after receiving comments indicating support for the item from the SMA, OWM, and an industry representative. With respect to SCL-22.3, (i.e., the other item in Block 6) the committee renumbered paragraphs S.1.14.x to S.1.15.x. and also amended S.1.15.1. by adding the words "when" and "in a single draft" as recommended by the SMA's updated proposal that was received on October 16, 2022. Refer to SCL-22.3 to view the actions taken by the Committee on this particular item, which the Committee also agreed to remove from Block 6 and make a stand-a-lone item since there were only two items remaining in the block.

Regional Association Reporting:

Central Weights and Measures Association

During the 2023 CWMA Annual Meeting, Loren Minnich (NIST OWM) supported this item as a voting item.

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

Western Weights and Measures Association

At the 2022 WWMA Annual Meeting, the following comments were received during on SCL-22.1 and SCL-22.3, which at the time, were together in a Block (i.e., Block 6):

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.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, the following comments were received on SCL-22.1 and SCL-22.3, which at the time, were together in a Block (i.e., Block 6):

Robert Huff (Delaware) questioned whether this would allow law enforcement officials to split weigh.

The SWMA S&T Committee asked how legal split weighing would be initiated? How would it 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 a Developing Item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Annual Meeting, Loren Minnich stated that this item is fully developed and ready for adoption. Doug Bowland (SMA) supported this item.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Scale Manufacturers Association

At the SMA Spring 2023 Meeting they supported this as a Voting item.

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

Source: NCWM Cannabis Task Group

Submitter's Purpose and Justification:

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

NIST OWM Executive Summary for SCL-22.2 – UR.1. Selection Requirements, UR.1.X. Cannabis

[1]**NIST OWM Recommendation:** Additional consideration to possibly withdraw or further develop this item by the Cannabis Task Group and/or its Scales Focus Subgroup is needed. For this reason, OWM recommends this item remain assigned to the Task Group until a decision is made by its members on how best to proceed.

No longer are maximum scale division values proposed for the weighing of cannabis products as was the case with the original proposal. Consequently, no longer do the comments and recommendations that OWM developed previously for this item apply.

The following represents OWM's executive summary for the current proposal and provides justification for the "Assigned" status recommendation:

- Although OWM doesn't believe it was the intent of the CTG Scales Focus Group, adding the terminology, "and weighing of all Cannabis products," to each of the three accuracy class classifications in Table 7a (i.e., Class I, Class II, and Class III) leads one to believe that a scale of any one of those three accuracy classes would be permissible for use to weigh all cannabis products.

- It is OWM's understanding that some participants of the CTG believe NIST HB 44 requirements cannot be applied to scales used commercially to weigh cannabis products unless Table 7a explicitly indicates such use. We do not share this opinion and note that the description in Table 7a for Class III scales specifies "All commercial weighing not otherwise specified…," which would include scales used to weigh cannabis products. That is, the description of "Weighing Application or Scale Type" in NIST HB 44 Scales Code Table 7a for Class III scales adequately captures scales used to weigh cannabis products.

- There are several commercial uses of scales excluded from Table 7a in which jurisdictions continually regulate those scales without concern. For example, scales used in a grocery store to weigh bakery items, meat products, delicatessen products, and produce are not explicitly identified in the existing table; yet these scales are regularly regulated by weights and measures officials throughout the US. The different uses of these scales are encompassed in the terminology, "All commercial weighing not otherwise specified…" as would be the case for scales used to weigh cannabis products.

- We take no position, however, on adding an additional example device type to HB 44 Scales Code Table 7a if others believe it is essential, since the title of the table specifies that the different device types listed are only "typical." Yet, because the "Note" included at the bottom of Table 7a specifies a scale with a higher accuracy class than that specified as "typical" may be used, it is unnecessary to add the additional device type to more than one accuracy class

NIST OWM Executive Summary for SCL-22.2 – UR.1. Selection Requirements, UR.1.X. Cannabis

classification in the table. Adding it to the Class III description alone would suffice given that Class I and Class II scales are of higher accuracy class. Additionally, we believe adding the additional device type description to the Accuracy Class I and Class II classifications would cause unnecessary confusion due to the Note explaining that a higher accuracy class may be used.

- OWM currently participates on the Scales Focus Subgroup of the NCWM Cannabis Task Group. Most recently, several members of the subgroup have voiced support for the development of a scale suitability guidance document that could not only be used by the Cannabis industry, but other industries as well. We too would be in favor of developing such a document and believe it would be helpful in selecting a suitable scale.

[1] In contrast to hemp, marijuana remains a Schedule I substance under the Controlled Substances Act. NIST does not have a policy role related to the production, sale, distribution, or use of cannabis (including hemp and marijuana). NIST participates in the National Conference of Weights and Measures (NCWM) as part of NIST's statutory mission to promote uniformity in state laws, regulations, and testing procedures.

Table 2. Summary of Recommendations
SCL-22.2 – UR.1. Selection Requirements, UR.1.X. Cannabis

	Status Recommendation	Note*	Comments
Submitter			
OWM	Assigned		
WWMA	Assigned		
NEWMA	Assigned		
SWMA	Assigned		
CWMA	Assigned		
NCWM	Assigned		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

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

Notes:
A scale with a higher accuracy class than that specified as "typical" may be used.

The use of italicized text in the references to "*Cannabis*" in this table is only to denote its proper taxonomic term; the italicized font does not designate a "nonretroactive" status as is the convention used throughout NIST Handbook 44.

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

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)

NIST OWM Detailed Technical Analysis:

No longer are maximum scale division values proposed for the weighing of cannabis products as was the case with the original proposal. Consequently, no longer do the comments and recommendations that OWM developed previously for this item apply.

The following represents OWM's executive summary for the current proposal and provides justification for the "Assigned" status recommendation:

- Although OWM doesn't believe it was the intent of the CTG Scales Focus Group, adding the terminology, "and weighing of all Cannabis products," to each of the three accuracy class classifications in Table 7a (i.e., Class I, Class II, and Class III) leads one to believe that a scale of any one of those three accuracy classes would be permissible for use to weigh all cannabis products.

- It is OWM's understanding that some participants of the CTG believe NIST HB 44 requirements cannot be applied to scales used commercially to weigh cannabis products unless Table 7a explicitly indicates such use. We do not share this opinion and note that the description in Table 7a for Class III scales specifies "All commercial weighing not otherwise specified…," which would include scales used to weigh cannabis products. That is, the description of "Weighing Application or Scale Type" in HB 44 Scales Code Table 7a for Class III scales adequately captures scales used to weigh cannabis products.

- There are several commercial uses of scales excluded from Table 7a in which jurisdictions continually regulate those scales without concern. For example, scales used in a grocery store to weigh bakery items, meat products, delicatessen products, and produce are not explicitly identified in the existing table; yet these scales are regularly regulated by weights and measures officials throughout the US. The different uses of these scales are encompassed in the terminology, "All commercial weighing not otherwise specified…" as would be the case for scales used to weigh cannabis products.

- We take no position, however, on adding an additional example device type to HB 44 Scales Code Table 7a if others believe it is essential, since the title of the table specifies that the different device types listed are only "typical." Yet, because the "Note" included at the bottom of Table 7a specifies a scale with a higher accuracy class than that specified as "typical" may be used, it is unnecessary to add the additional device type to more than one accuracy class classification in the table. Adding it to the Class III description alone would suffice given that Class I and Class II scales are of higher accuracy class. Additionally, we believe adding the additional device type description to the Accuracy Class I and Class II classifications would cause unnecessary confusion due to the Note explaining that a higher accuracy class may be used.

- OWM currently participates on the Scales Focus Subgroup of the NCWM Cannabis Task group. Most recently, several members of the subgroup have voiced support for the development of a scale suitability guidance document that could not only be used by the Cannabis industry, but other industries as well. We too would be in favor of developing such a document and believe it would be helpful in selecting a suitable scale.

Summary of Discussions and Actions:

During the 2022 NCWM Interim meeting, the Committee received somewhat a wide range of comments during open hearings. Most who commented supported further development of the item, although there were also several questions raised concerning the need for the proposed changes.

Doug Musick (Kansas) acknowledged that he agreed with the concept of the proposal while noting too that the NCWM had failed to adopt strong standards in that NISI Handbook 44 Scales Code Table 8 specifies "recommended" minimum loads, making them difficult to enforce. He also noted that HB 44 already addresses scale suitability, and that any proposal should address more than just a single commodity; but rather, all products of high cost.

Evan Foisy (A&D Engineering) read the position statement provided by A&D Engineering to the Committee in advance of the 2022 NCWM Interim Meeting as follows:

A&D opposes this item completely and recommends that it be withdrawn. The addition of such specific user requirements for a commodity is unprecedented for HB 44. We fail to see the rationale for including readability requirements for Cannabis when such requirements have never been required for gold or other precious metals with a higher dollar per gram value.

If the Committee decides that such specifications are warranted, A&D proposes that the requirements be changed to 0.01 g for net weighments up to 100 g capacity. The technology exists and is already in use to not limit the readability to 0.1 g for capacities from 10 g up to 100 g. Having different accuracy requirements for Cannabis consumers who purchase less than 10 g vs. those who purchase more than 10 g is not promoting fairness and equity in the market. The maximum that any state allows for a single user purchase is 2.5 oz (approximately 71 g). By offering 100 g x 0.01 g, the entire range of consumer purchases will be covered equally and consistently.

> **Example:** Deli scales allow the same increment size whether you're getting 1 slice or 10. Cannabis should be no different.

The SMA supported continue development of the item with the recommendation that NIST Handbook 44 Scales Code Table 8 titled "Recommended Minimum Load" be considered in its further development.

NIST OWM provided the Committee a high-level summary of its analysis of the item, many of the points of which questioned not only the need for the proposed change, but also the effect the change (if adopted) would have for setting a precedent for producers of other commodities to use in support of making similar changes to HB 44 intended to address products they produce. OWM, in its comments to the Committee, emphasized that HB 44 already provides the necessary tools (in the way of General Code and Scales Code requirements) for officials to be able to enforce scale suitability. It also provides officials the needed discretion to decide (at time of inspection), based on the many important factors needing to be considered, whether or not a scale is or is not suitable for its given application. OWM recommended, as an alternative to the proposal, the development of a scale suitability guide, which should include all important factors (and not just scale division value) that need to be considered when determining scale suitability.

Several who commented before the Committee also questioned use of the term "scale division" in the proposal and whether any maximum increments proposed should, instead, be based on "scale verification division."

The Cannabis Scale Focus Group modified the proposal in the fall of 2022 as represented below.

The Cannabis Scales Focus Group 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 Cannabis Scales Focus Group 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.)

In considering the comments received during open hearings, the Committee agreed to maintain the Assigned status of the item.

The NIST OWM Technical Advisors assigned to the S&T Committee opted to participate virtually in the 2022 NCWM Annual Meeting due to COVID-19. During S&T open hearings, there was an audio problem with the virtual platform being used by the NCWM that prevented those participating virtually to hear much of the open hearing testimony. With regard to this particular item, no testimony could be heard by those attending virtually. A member of the national S&T Committee, who had attended the 2022 NCWM Annual Meeting in person reported that the Committee was given an update from Charles Rutherford (NCWM Cannabis Task Group Co-Chair). In his update, Co-Chair Rutherford requested that this item remain Assigned to the Task Group for further discussion. The Scales Focus Group will be regrouping, with Lou Sakin (Towns of Holliston, Hopkinton, Northbridge, Massachusetts) as the Chair, for further development of the item. The Committee agreed that this item will retain an Assigned status.

During the 2023 NCWM Annual Meeting, the Committee received a request for assigned status of the item from the co-Chair of the NCWM's Cannabis Task Group (TG). The SMA noted in comments it provided that user requirements do not typically apply to a particular commodity. The SMA supported further development of the item and the additions to Table 7A. The Committee updated the item to include proposed new paragraph UR.3.1.2., as recommended by NEWMA and shown in the item under consideration of this report. The Committee also agreed to assign the item to the TG per recommendations from the submitters.

Regional Association Reporting:

Western Weights and Measures Association

During the 2021 Annual Meeting Open Hearings, Josh Nelson (Ex-Officio NCWM S&T Committee) put forward to address some issues for cannabis, recommend developing - still needs work and continue to work forward.

Matt Douglas (California Division of Measurement Standards) remarked that California supports further development, add non retroactive date - subsection A states up to capacity… lists suitability requirements based on California, however, this info is not a standard.

Eric Golden (Cardinal Scales) remarked that in Section A, B, and C be better to say 0.1 g for net weighments up to 10 grams, then B 10 to 100 grams, then C say over 100, etc.

Kurt Floren (Los Angeles County, California) remarked that Eric Golden stated perfectly what is lacking. There has to be ranges put in as to where the graduations are appropriate.

Erin Sullivan (Colorado Department of Agriculture) asked if this pertain to cannabis in any form or concentration?

Josh Nelson asked if this is what is going into NIST HB44 - each jurisdiction has to define their own. For Oregon, medical is much different than retail. Retail has to abide by this and medical does not. Verbiage in A, B, and C does need additions.

Erin Sullivan is this grows vs. dispensaries? Different products in processing facilities are weighed with many containers on the scales. Do states determine the regulation?

Josh Nelson asked if it is up to the states to determine how to apply tares and increments in which product is weighed.

Kurt Floren (Los Angeles County, California): cannabis products: later we'll see proposed def. of cannabis and cannabis products, are we anticipating the adoption of the proposed language?

Josh Nelson remarked it is not limited to flowers or bud. Mentions dabs. Is there a packaging requirement for the label? Oregon does. There must be a legal for trade scale that can prove they are meeting net contents. They must ensure that their process is being executed correctly. He thinks this is not limited to flower/bud.

Kurt Floren this raises the point that further consideration needs to be put into terms. Brownies, cannabis infused pizza… and other items sold by weight. Are we setting the terms for pure cannabis product or are the scales being used for any cannabis containing product?

Josh Nelson welcomes written input for this topic from anyone. Don Onwiler was a big proponent in this; Josh Nelson will continue to develop this.

Eric Golden asked for clarification on Josh Nelson: geared towards net sales, packaging for the customer. Is this part of the track and trace program for growers or just for retail?

Josh Nelson remarked this needs to be expanded upon, in Oregon. Even the growers have to do track and trace. Any scale weight that is used for the cannabis tracking system needs to be Weights and Measures compliant. Maybe has to address even a class III scale. They will look more into it.

Joe Moreo (Agriculture Commissioner/Sealer) stated over time we are going to need one level for concentrates, one for food, one for flower, one size fits all will not work.

Josh Nelson agrees that one size does not fit all. This will start to give limitations as to what a particular weight will be. Not trying to pigeonhole any device into one category, just trying to figure out what works, that's the intent.

The WWMA S&T Committee recommended the item be assigned a Developmental status so that the submitter could continue to work on this as they commented during open hearings.

During the WWMA's 2022 Annual Meeting, Cannabis Co-Chair Rutherford remarked that everything in this book isn't updated. They have added "and cannabis" to Table 7. cannabis talks about cannabis and hemp. They expect to finish soon. What is in the book is old and doesn't apply any more.

Due to timing constraints during Open Hearings, the Committee did not take comments on Assigned Items. The Committee did allow the source to provide updates on these items. An update from the Co-Chair Rutherford was provided. The WWMA S&T Committee recommends that this item remain Assigned.

During the WWMA 2022 Annual Meeting, Co-Chair Rutherford stated that everything in this book isn't updated. They have added "and Cannabis" to Table 7. He also clarified that cannabis talks about cannabis and hemp. The Task Group expects to finish soon. He said that what is in the book is old and no longer applies.

During open hearings, 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. An update from the Co-Chair Rutherford was provided. The WWMA S&T Committee recommends that this item remain assigned.

Southern Weights and Measures Association

At the 2021 SWMA Annual Meeting, Russ Vires (SMA) stated that they have no position on this item at this time.

Matt Curran (Florida) stated that he supports this as a Voting item. He also provided comments in support of this item from Eric Golden. Cardinal offered some changes as well. The suggested changes are as follows:

UR.1.X. Cannabis. – The scale division for scales weighing Cannabis shall not exceed:

(a) 0.01 g for net weighments ~~**up to capacity**~~ up to 10g,

(b) 0.1 g for net weighments greater than 10g, up to 100g~~**, capacity, and**~~

(c) 1 g for net weighments greater than 100g, up to capacity.
(Added 20XX)

Charlie Rutherford stated that he supports this item moving forward as a Voting item with the changes suggested by Cardinal Scale and Matt Curran.

This Committee recommended that this item be moved forward as a Voting item if the changes suggested above are made.

During the 2022 SWMA's Annual Meeting, Charlie Rutherford stated that Table 1A has been updated in the item. The SWMA S&T Committee recommended this item remain as an Assigned Item.

Northeastern Weights and Measures Association

During the 2021 NEWMA Interim Meeting Open Hearings, Eric Golden made suggestions to change the language in this item to the following:

UR.1.X. ***Cannabis***

(a) 0.01g for net weighments up to 10 g

(b) 0.1g for net weighments greater that 10g , up to 100 g, and

(c) 1 g for net weighments greater than 100g , up to capacity

Lou Sakin (Hopkinton/Northbridge, Massachusetts) commented that he agrees with changes above.

Discussions were heard regarding the agreement with Table 8. in the scales code as this requirement is more restrictive than Table 8 parameters.

Eric Golden commented that national uniformity would be good and many states have informational publications that outline requirements in their state for Cannabis scale requirements. Jimmy Cassidy (Massachusetts) recommended Voting status with the changes above. Matt Curran (Florida) commented that harmonization with table 8 would be a good idea if possible. Lou Sakin questioned if Cannabis should be in *italics.* The Committee suggests making the change to italics for *Cannabis*.

The NEWMA S&T Committee recommended that this item be given Voting status with suggested edits.

During the 2022 NEWMA Annual Meeting, James Cassidy (Massachusetts) commented as the Co-Chair of the NCWM Cannabis Task Group. He supported the Assigned status so the Task Group can continue to develop the item from comments received at the 2022 Interim. Russ Vires (SMA) supported continued development and indicated that a user requirement typically does not pertain to a specific commodity. Russ Vires suggested the words "retail cannabis" should be added to the "Class II" section of Table 7a and the words "bulk cannabis processing and sales" should be added to the "Class III" section of Table 7a.

Tina Butcher (NIST OWM) read the following statement: "As a non-regulatory metrology institute, NIST defers to federal agencies with regulatory authority under the Controlled Substances Act (CSA) for the scheduling of drugs or other substances. NIST does not have a policy role related to the production, sale, distribution, or use of cannabis (including hemp and marijuana). While the 2018 Farm Bill removed hemp from the list of controlled substances under Schedule 1 of the CSA, marijuana remains on that list. NIST must respect that distinction even as it exercises its statutory authority to develop and disseminate national weights and measures standards for the production, distribution, and sale of products in the commercial marketplace. NIST remains committed to providing technical assistance to the weights and measures community. OWM has provided key technical points for the community to consider in its deliberations of cannabis-related proposals, and OWM would be happy to provide any necessary clarification. OWM comments are intended to encourage technically sound application of legal metrology laws, regulations, and practices to the measurement and sale of these products."

After hearing comments from the floor, the Committee recognized the need for further development of the item and recommended that the item retain an Assigned status. The Committee recommends the NCWM Cannabis Task Group work with the SMA and other stakeholders to further develop this item.

During the 2022 NEWMA Interim Meeting, the Committee recognized comments received the from Cannabis Task Group from the Chair Sakin (Cannabis TG Scales). Cannabis TG Co-Chair Rutherford commented that the Cannabis Scales Focus Group is under new leadership lead by Lou Sakin. Co-Chair Rutherford pointed out that the Item Under Consideration is not current and current language was sent to the NEWMA. Co-Chair Rutherford requested a Voting status for this item. Lou Sakin indicated that the new language was submitted to SWMA and NEWMA. The TG chose to modify tables instead of changing the entire code. He believes that the item is fully developed and ready for a Voting status.

James Cassidy requested that this item move forward as Voting with changes as proposed in the submitted documentation.

After hearing comments from the floor, the Committee agreed that the item has merit. The Committee agreed 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.

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

Notes:

A scale with a higher accuracy class than that specified as "typical" may be used.

The use of italicized text in the references to "Cannabis" in this table is only to denote its proper taxonomic term; the italicized font does not designate a "nonretroactive" status as is the convention used throughout NIST Handbook 44.

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

At NEWMA's 2023 Annual Meeting, Charlie Rutherford (CPR Squared) spoke as the Cannabis Task Group Co-Chair. He stated the team is sorting out d and e, which will inform group as how to move forward. Lou Sakin explained that the language in the handbook charts say "may" and gives an option of d or e. Hopes d and e task group would come up with more precise language. The Cannabis Task Group Scales Focus Group received input from other participants in NCWM with concern of adding language in the tolerance chart that specifies the tolerances will apply to cannabis. The purpose was to follow form with precious metals and other items of high dollar value. Language in Table 8 says 'may' but may add language that says "shall" to apply to cannabis due to dollar value of the product in the marketplace. Doug Bowland (SMA) indicated support of development. Suggested that in Table 7a Class 3, replace wording with" non-retail cannabis" and refer to table 8 for cannabis selection. The exact SMA language changes were submitted in writing. Lou Sakin stated that as a field inspector, when scales are tested in a

recreational facility, that is retail and should fall under the jurisdiction of this particular section. Some states require NTEP from seed to sale, which covers entire family of devices.

After hearing comments from the floor, the Committee recommended to the body that this item maintain an Assigned status, and the body concurred.

Central Weights and Measures Association

During the 2021 CWMA Interim Meeting Open Hearing, the Committee heard comments from the floor. Loren Minnich (Kansas) stated he's not sure of the intent and that it needs more developing. Eric Golden agreed with is it "e" or "d", will send notes to Committee. Ivan Hankins (Iowa) would support item with Eric Golden's language. Eric Golden continued by recommending the following change to which will add clarity to the listed weight ranges in SCL22.2 (in red):

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

UR.1.X. Cannabis. – The ~~scale division~~ verification scale interval, e, for scales weighing Cannabis shall not exceed:

(a) 0.01g for net weighments ~~up to capacity~~ up to 10g,

(b) 0.1g for net weighments greater than 10g, up to 100g, **~~capacity, and~~**

(c) 1g for net weighments greater than 100g, up to capacity.
(Added 20XX)

CWMA S&T Committee recommended as Voting Item with the proposed changes from Cardinal Scales.

During the 2022 CWMA Annual Meeting Open Hearings, Doug Musick (Kansas) welcomed the attempt to define suitability; recommended the following:

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

UR.1.X. Cannabis. – A retail Cannabis scale shall not be used to weigh net loads smaller than 100 displayed scale divisions "d",

(a) 0.01g for net weighments 10g or less,

(b) 0.1g for net weighments greater than 10g and up to 100g, and

(c) 1g for net weighments greater than 100g.
(Added 20XX)

Russ Vires (SMA) stated the addition of a User Requirement is not the best approach in this situation; User Requirements do not typically apply to a specific commodity. Supported continuing as Developing and the following proposed changes should be considered instead:

– The words "retail cannabis" should be added to the "Class II" section of Table 7a.

– The words “bulk cannabis processing and sales” should be added to the “Class III” section of Table 7a.

Charlie Stutesman (Kansas) questioned why only metric units are referenced and not also include inch-pound units. The CWMA S&T Committee recommended this item remain with the NCWM Cannabis Task Group and that the suggested changes are considered.

During the 2022 CWMA Interim Meeting Open Hearings, Charlie Rutherford (ASTM International) remarked the old version is still listed in today’s agenda. Pushing the suitable scales discussion to a later date. The submitter provided updates to Table 7a. which add Cannabis verbiage to the weighing application column for Classes I, II, and III.

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

At the CWMA’s 2022 Annual Meeting, Co-Chair Rutherford stated this will be better developed once e vs. d is finalized. Hopefully the Task Group gets work done to submit updated language by Aug 15, 2023. Mr. Thomas (SMA) stated the SMA supported this item.

The CWMA S&T Committee recommends this item remain as Assigned to the Task Group.

Scale Manufacturers Association (SMA)

During the 2021 SMA Fall and 2022 SMA Spring Meetings, the SMA supported the continued development of this item.

Rationale: The addition of a User Requirement is not the best approach in this situation; User Requirements do not typically apply to a specific commodity. The following proposed changes should be considered instead:

- The words “retail cannabis” should be added to the “Class II” section of Table 7a.
- The words “bulk cannabis processing and sales” should be added to the “Class III” section of Table 7a.

During the 2022 Fall SMA meeting, they supported the continued development of this item.

Rationale: The addition of a User Requirement is not the best approach in this situation; User Requirements do not typically apply to a specific commodity. The following proposed changes should be considered instead:

- The words “retail cannabis” should be added to the “Class II” section of Table 7a.
- The words “bulk cannabis processing and sales” should be added to the “Class III” section of Table 7a.

During the SMA 2022 Spring Meeting, they supported the continued development of this item. The following was suggested:

- In Table 7a Class III, replace the word “All Cannabis” with “non-retail Cannabis”.

- Add in notes section in Table 7a; "Refer to tale 8 for guidance on scale selection for Cannabis".

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

Submitter's Purpose and Justification:

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.

NIST OWM Executive Summary for SCL-22.3 Single-Draft Vehicle Weighing., and UR.3.4. Axle and Axle Group Weight Values.

NIST OWM Recommendation:

- SCL-22.3 proposes amending the text in the "Note" of existing HB-44 Scales Code paragraph UR.3.3. Single-Draft Vehicle Weighing and removing the "Note" reference. These proposed changes are needed because in 2022 the NCWM agreed to amend paragraph G-A.1. Commercial and Law-Enforcement Equipment of NIST Handbook 44 to explicitly make clear weighing and measuring equipment used for the purpose of providing a weight or measure for a fee constitutes commercial use of that equipment. Paragraph UR.3.3. currently requires a vehicle or vehicle combination to be weighed "commercially" on a vehicle scale only as a single draft except as noted in subparts (a) and (b) of the paragraph. The "Note" in UR.3.3. currently exempts highway-law-enforcement scales and scales used for the collection of statistical data from having to comply. Multi-independent platform vehicle scale systems typically weigh vehicles and vehicle combinations in multiple drafts yet comply with paragraph UR.3.3. because subpart (b) makes this permissible. When installed at a truck stop, the predominant commercial use of these vehicle scale systems is to weigh vehicles and vehicle combinations for a fee. All axles and axle groups of some oversized vehicles, however, are not able to fit onto one of the live platforms of a vehicle scale system and be weighed simultaneously. This necessitates the weighing of the portion of the vehicle that doesn't fit separately from the rest of the vehicle (i.e., split weighing). Weights and Measures officials have typically allowed this practice when the only use of those weight determinations is to verify compliance with highway legal load limits. Because a fee is charged, this too constitutes commercial use of the scale systems, but violates current paragraph UR.3.3. It is for this reason OWM has proposed a change to paragraph UR.3.3.

- SCL-22.3 also adds a new HB 44 Scales Code user requirement to make clear the acceptable use of multi-platform vehicle scale systems to charge a fee for the commercial service of providing customers (usually truckers) axle weights, axle group weights, and total weight of their vehicles to enable them to determine compliance with state and federal legal load limits.

NIST OWM Executive Summary for SCL-22.3 Single-Draft Vehicle Weighing., and UR.3.4. Axle and Axle Group Weight Values.

- OWM amended this item in May 2023 based on feedback received from the SMA during and after the 2023 NCWM Interim Meeting. OWM requests the Committee replace the current proposal in SCL-22.3 with the following, which OWM hopes the SMA membership and others will be able to support:

  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 established highway weight requirements and safe distribution of the load.**

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

  And

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

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

NIST OWM Executive Summary for SCL-22.3 Single-Draft Vehicle Weighing., and UR.3.4. Axle and Axle Group Weight Values.

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 as the legal gross vehicle weight unless subparts (a) or (b) of paragraph UR.3.3. Single-Draft Vehicle Weighing is met.

(Added 20XX)

Renumber existing paragraphs UR.3.4 through UR.3.12.

- OWM notes this item is currently in a "Developing" status. OWM encourages a review of the most current proposal and continues to seek feedback from all interested parties or individuals.

Table 2. Summary of Recommendations
SCL-22.3 Single-Draft Weighing., and UR.3.4. Axle and Axle Group Weight Values

	Status Recommendation	Note*	Comments
Submitter		1	This item was submitted by NIST OWM and recently updated by OWM. Refer to OWM's Executive Summary for this item to view the most recent updated version
OWM	Developing		
WWMA	Developing		SCL-22.1 and SCL-22.3 were blocked together at the time of SWMA's 2022 Annual Meeting. The status recommendation provided was for both items in the block.
NEWMA	Developing		
SWMA	Developing		SCL-22.1 and SCL-22.3 were blocked together at the time of SWMA's 2022 Annual Meeting. The status recommendation provided was for both items in the block.
CWMA	Developing		
NCWM	Developing		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed

3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 scale~~s~~ 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.

NIST OWM Detailed Technical Analysis:

OWM developed the two proposals in SCL-22.1 and SCL-22.3 to address perceived gaps in HB 44 Scales Code requirements pertaining to the design and use of multi-independent platform vehicle scale systems commercially used to charge a fee for the service of providing axle- and axle-group weights, as well as total vehicle weight to those needing them (typically commercial truck drivers). These systems are most often used commercially to verify compliance with federal and state vehicle load limits but at times may also be used to establish the net loads of products that are bought and sold by weight, establish transportation charges, and for other commercial purposes.

These proposals were developed as the result of an OWM inquiry from a state questioning the permissible use of a multi-independent platform vehicle scale system (each platform having its own A/D conversion circuitry and weight indicator) that printed total vehicle weight from summing the axle- and axle-group loads of vehicles weighed when not all parts of those vehicles were able to fit onto a live portion of the scale and be weighed simultaneously. That is, the scale was being used on occasion to "split weigh" in two different drafts the different axle and axle groups of "over-sized" coupled-vehicle combinations because not all axle and axle groups would fit onto a live portion of the scale at the same time, which thus necessitated weighing those particular vehicles in multiple drafts. Even though the printed ticket for those weight determinations provided clear indication that the total vehicle weight value recorded was "non certifiable," it is questionable whether or not a scale system is permitted to record this weight since HB 44 Scales Code paragraph UR.3.3. Single-Draft Vehicle Weighing currently requires a vehicle or coupled-vehicle combination to be commercially weighed on a vehicle scale only as a single draft. Note: The manufacturer of this particular scale system advised us that most vehicles and coupled-vehicle combinations that are weighed on the scale can be weighed as a single draft. That is, all axle and axle groups can be positioned onto a live portion of the scale to be weighed simultaneously. It is only the occasional oversized vehicle or coupled-vehicle combination that exceeds the length of the scale that must therefore be split weighed.

We purposely chose to simplify these proposals to only address multi-independent platform vehicle scale systems. These systems have been installed at truck stops (and perhaps other locations) throughout the US for many years and are used primarily to determine axle loads, axle-group loads, and total vehicle weight of vehicles and coupled-vehicle combinations for a fee. Although we recognize that single-platform vehicle scales may also sometimes be used for this same purpose, we don't view them as being suitable for the application. This is because the approach requirements for vehicle scales and axle-load scales in NIST HB44 are very different and few vehicle scales in commercial service have approaches that comply with the approach requirements for axle-load scales. Axle-load scales are required to have a straight paved approach in the same plane as the platform on each end of the platform. The approaches must be the same width as the platform and of sufficient length to ensure the level positioning of vehicles during weight determinations. If vehicles aren't level when the different axle and axle groups are weighed, a portion of the force of the load transfers to other axle and axle groups that aren't positioned on the scale resulting in false weight. It is important to recognize that not all multi-independent platform vehicle scale systems may be installed with approach requirements meeting the HB 44 approach requirements for an axle-load scale. Many do, but we are unable to confirm that all do. We view this as somewhat of an important concern given that these proposals, if adopted, would make it permissible to split weigh vehicles and coupled-vehicle combinations for a fee providing the only use of the weighing results from doing so is to verify whether or not the different axle-, axle-group loads, and total vehicle weight are compliant with highway weight limits.

Another reason we elected to limit these proposals to only address multi-independent platform vehicle scale systems is that we do not believe it to be a very common practice to use single-platform vehicle

scales to determine axle loads and axle-group loads of vehicles and coupled-vehicle combinations to verify compliance with federal and state vehicle load limits. Those that are using them for this purpose usually don't charge a fee, i.e., the weighing is usually done as a complimentary service.

NIST HB 44 does not currently require a multi-independent platform vehicle scale system to be equipped with a ticket printer and whether or not one should be required, is something to be considered. We have not proposed it, but perhaps others will conclude this would be an important HB 44 addition. We believe most (perhaps all) of the multi-independent platform vehicle scale systems currently in commercial service have been equipped with a ticket printer and this is likely because the few scale manufacturers of these systems recognize the need for the multiple indications displayed by these systems to be made available in printed form to the operator and customer. We also believe most of the systems currently in service comply with both newly proposed sub-paragraphs of S.1.15. We developed these two new sub-paragraphs (S.1.15.1. and S.1.15.2.) because it is important for scale operators, customers, and enforcement officials to be able to clearly identify from a weigh ticket the different scale platforms utilized at the time a vehicle was weighed and their corresponding scale indications so that the accuracy of those values (including the summed total) can be verified. It is also important to clearly specify on a weigh ticket generated from one of these scale systems that any recorded total vehicle weight value determined from summing the different axle- and axle-group loads of a vehicle or coupled-vehicle combination weighed in multiple drafts (i.e., split weighed) is "Not-Legal-For-Trade."

Paragraph UR.3.3. needs to be amended to address the current use of multi-independent vehicle scale systems to split weigh oversized vehicles for a fee. The current paragraph does not take into consideration both the past and present use of these scales to provide a total vehicle weight that's most often only used to verify compliance with maximum legal load limits and safe distribution of the load. These systems have been in existence at truck stops for many years and their primary commercial use is to provide axle weights, axle group weights, and total vehicle weight to commercial haulers for a fee so that those haulers are able to determine whether or not their loads are distributed safely and within legal load limits. Years ago, (prior to the existence of multi-independent platform vehicle scale systems) axle-load scales served this same purpose at truck stops throughout the US and summing of the different axle and axle groups to determine total vehicle weight undoubtedly occurred to ensure total vehicle weight didn't exceed maximum legal load limits when using those scales. It is also important to recognize that the weight values corresponding to the different axle- and axle-group loads of vehicles weighed on a multi-independent platform vehicle scale system are not constant; but rather fluctuate/change depending on the position of those axles and axle groups on the different platforms of the system when the vehicle is weighed. That is, a change of the scale indication of one platform is offset by a change in the opposite direction of the indication from one or both of the other platforms if the position of a vehicle being weighed is changed slightly forward or backwards from its initial position. It is only the summed total of all indications that is constant; although it too changes minimally since not all sections of all platforms are typically adjusted the same. For these reasons, OWM has provided the Committee an updated proposal to amend Scales Code paragraph UR.3.3., which would make it permissible to weigh in multiple drafts (i.e., split weigh) a vehicle or coupled-vehicle combination and charge a fee for the service of providing weights of the different axle- and axle-group loads when the only use of those values is to determine compliance with highway legal load limits.

Summary of Discussions and Actions:

During open hearings at the 2022 NCWM Annual Meeting, Richard Harshman (NIST OWM) provided the Committee a high-level summary of its analysis of the two remaining items in Block 6, which included much of background information that had led OWM to submit the two proposals in Block 6 as

well as the GEN-22.1 G.A.1. Commercial and Law-Enforcement Equipment item, which the Committee had previously removed from Block 6. Richard Harshman reported that OWM had recently provided the Committee an updated version of the proposal in SCL-22.1 and requested the Committee replace the version of SCL-22.1 in its current agenda with the updated version recently received. Richard Harshman also reported that OWM planned to revise the proposal in SCL-22.3 and would later (sometime following the 2022 NCWM Interim Meeting) submit the revised version to the Committee in hopes it could be reviewed by one or more of the regional weights and measures associations meeting in the Spring and/or fall of 2022. Richard Harshman recommended both items remain in a developing status to allow stakeholders time to review and recommend any changes they felt necessary.

Russ Vires (Mettler Toledo LLC) speaking on behalf of the SMA reported that the SMA recommends Block 6 be broken apart into three individual items (i.e., GEN-22.1 Commercial and Law-Enforcement Equipment, SCL-22.1 Recorded Representation of Axle or Axle Group Weights, and SCL-22.3 UR.3.3. Single-Draft Vehicle Weighing and UR.3.4. Axle and Axle Group Weight Values). Russ Vires then provided the SMA's position and rationale for each of these items speaking verbatim from the SMA's November 2, 2021 report titled "SMA Positions on the NCWM Specification and Tolerances Committee Report (For the NCWM Interim Meeting, January 2022, Developed November 2, 2021). *NIST Technical Advisors note: Refer to the subheading shown below titled, "Scale Manufacturers Association (SMA-Fall 2021 Meeting)" to view the different positions and rationales provided by Russ Vires on behalf of the SMA for the items in Block 6.* Russ Vires also reported that the SMA had had the opportunity during its Fall 2021 meeting to review the updated version of the proposal in SCL-22.1 that OWM had provided the Committee for replacement of the one in its current agenda and that the SMA supported the changes OWM had made.

These were several officials who spoke in support of further development of the two items in Block 6.

Lou Straub (Fairbanks Scale) reported that Fairbanks Scale had been manufacturing the multi-platform "CAT" vehicle scale system for over forty years and the systems had been installed in approximately 2,000 locations. He also reported that he fully supported the GEN-22.1 item that the Committee had earlier removed from Block 6. Referencing the proposal in SCL-22.1, Lou Straub stated he agreed that the recorded representation of weights from individual axle or axle groups need to be clearly identified as "not-legal-for- trade" on the printed ticket unless the entire vehicle is positioned on live elements of the vehicle scale system and all axles/axle groups are weighed simultaneously. He voiced disagreement with the second sentence proposed in paragraph S.1.14. noting that when one considers a truck with six to eight axle groups that cannot fit onto the different independent platform and be weighed simultaneously, identifying which platform weighed each of these axle and axle groups becomes unnecessary.

The Committee, in consideration of the comments received during open hearings, agreed to replace the Block 6 SCL-22.1 proposal in its Interim Meeting agenda (2022 NCWM Publication 15) with the updated version provided by OWM just prior to the 2022 NCWM Interim Meeting and maintain a developing status on the two remaining items in Block 6. The following proposal represents the Block 6 SCL-22.1 item appearing in the 2022 version of NCWM Publication 15 that the Committee agreed to replace with the Item under Consideration now shown in SCL-22.1:

Item under Consideration as it appeared in the 2022 NCWM Publication 15:

Amend Handbook 44, Scales Code as follows:

S.1.14. Recorded Representation of Axle or Axle Group Weights. – The recorded representation of weights from individual axle or axle group weights shall clearly be identified

as "not legal for trade" or "non-commercial" weight values unless the entire vehicle is positioned on live elements of a multiple-platform vehicle scale and where all axles/axle groups are weighed simultaneously. All recorded weights of axles/axle groups shall be identified as representing only a portion of the vehicle's total gross weight (e.g., by axle groupings such as: "axle group 1," "axle group 2," "axle group 3," or by individual axle description such as: "steering axle," "drive axles," "trailer axles").

Any total gross weight of the vehicle included in the recorded representations determined by summing axle weights shall be clearly identified as "not-legal-for trade" or "non-commercial" unless those axle weights were recorded when all parts of the vehicle rested simultaneously on live portions of the scale, or the individual components were uncoupled, positioned completely on the live elements, and weighed separately on the scale.

[subsequent requirements to be renumbered as appropriate]

On May 19, 2022, OWM provided S&T Committee Chair Bachelder an electronic file containing the following revised version of the B6: SCL-22.3 proposal as replacement for the current proposal in 2022 NCWM Publication 16. OWM requested he share it with the Committee to be considered as replacement for the current proposal in the Committee's agenda.

OWM's Revised Replacement Proposal for B6: SCL-22.3 UR.3.3. Single-Draft Vehicle Weighing, and UR.3.4. Axle and Axle Group Weight Values.

Amend NIST 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)

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.

During the 2023 NCWM Interim Meeting the committee received several comments supporting the further development of this item. The committee recommended the submitter work with interested parties to further develop SCL-22.3.

Regional Association Reporting:

Central Weights and Measures Association

At CWMA's 2023 Annual Meeting, NIST OWM submitted corrected language based on SMA concern about the term "legal" being confused with legal-for-trade. These are commercial devices, but they aren't commercial weight values. These are for highway load requirements. Thomas Schuller (SMA) SMA supports this item. Konrad Crockford (North Dakota) had a similar situation in his state. Concern with charging of fees: presumption is that if a weight ticket / value is purchased from a commercial scale, it is considered a commercial value. Something needs to be added regarding signage saying weight value provided is not legal for trade.

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

Western Weights and Measures Association

The following comments were received during 2022 WWMA's Interim Meeting on SCL-22.1 and SCL-22.3, which at the time, were together in a Block (i.e., Block 6):

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.

Southern Weights and Measures Association

The following comments were received during 2022 SWMA Annual Meeting on SCL-22.1 and SCL-22.3, which at the time, were together in a Block (i.e., Block 6):

Robert Huff (Delaware) questioned whether this would allow law enforcement officials to split weigh.

The SWMA S&T Committee asked how legal split weighing would be initiated? How would it 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.

Northeastern Weights and Measures Association

At NEWMA's 2023 Annual Meeting, Doug Bowland (SMA) supported the development of this item and has given feed back to the submitter.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Developing status, and the body concurred.

Scale Manufacturers Association Spring 2023 Meeting

The SMA supports the further development of this item and submitted feedback to the submitter.

SCL-23.1 W S.1.12. Manual Weight Entries

Source: NTEP Weighing Sector

Submitter's Purpose and Justification:

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

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.

The submitter initially requested a Voting status. During the 2023 NCWM Interim Meeting, the submitter requested to withdraw the item.

Table 2. Summary of Recommendations
SCL-23.1 – S.1.12. Manual Weight Entries

	Status Recommendation	Note*	Comments
Submitter	Withdrawn		
OWM	Withdrawn		

WWMA	Developing		
NEWMA	None	2	
SWMA	Developing		
CWMA	None	2	
NCWM	Withdrawn		

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend Handbook 44, Scales Code, as follows:

S.1.12. Manual Weight Entries. – ***A device w~~W~~hen*** *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**)

NIST OWM Detailed Technical Analysis:

Item SCL-23-1 proposes that the conditions stated in UR.3.9 are copied to the scales specification section.

UR.3.9 states:

Manual entries are permitted in the following applications only when:

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

(b) 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 scales generate weight tickets to correct erroneous tickets.

The justification given by the submitter consists of two elements:

- The ability to evaluate the restrictions on manual weight entry during type evaluation.
- To provide specific requirements to the manufacturer.

In the proposal, the requirements from UR.3.9 are literally copied into S.1.12. However, as these requirements are written they remain requirements on the device application and not the device itself. Therefore, they remain user requirements.

The key here is that the requirements in UR.3.9 should not be implemented in S.1.12 as requirements but as conditions instead. As a matter of fact, one of the restrictions is already mentioned as a condition in S.1.12. The current specification states "*A device **when being used for direct sale** shall accept an entry of a manual gross or net weight value only when …*". This means that the manual weight entry can only exist on devices used for direct sale. Yet, it is considered a condition and not a requirement.

During type evaluation the manufacturer can be asked about its intended application (if this is not already clear by the instruments characteristics). The fact that the conditions for manual weight entry are laid down in the user requirement section instead of the specification sections does not mean they cannot be taken into consideration during type evaluation. Furthermore, the limitation of a manual weight entry function can be mentioned in the NTEP Certificate of Conformance.

Regarding the second part of the justification (provide guidance to the manufacturer), the user requirements in UR.3.9 are part of the scales code of HB44 and therefore already available to the manufacturer. Simply copying the user requirements to the specification section as proposed seems to have little added value.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting, the following comments were received Kurt Floren (County of Los Angeles, California) 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. Kurt 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. Kurt Floren believes the item is not ready for Voting and supports a Developing status.

Raymond Johnson (Fairbanks Scales, representing the Scale Manufactures 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.

Matt Douglas (State of California, Division of Measurement Standards) agreed with Kurt 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. 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 recommended that this item be assigned a Developing status.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, no comments were received on this item.

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

Northeastern Weights and Measures Association

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

At the 2023 NEWMA Annual Meeting this item was not discussed.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Loren Minnich (Kansas) remarked it should not change the application, it 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. It is only allowed in direct sale manual weight entries.

Greg VanderPlaats (Minnesota) suggested a 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.

At the 2023 CWMA Annual Meeting, this item was not discussed.

Scale Manufacturers Association (SMA)

At the 2022 SMA Fall Meeting the SMA supported the item. Rationale: this item provides clarity in the specification when a manual weight entry is permitted.

At the 2023 SMA Spring Meeting, the SMA took no position on this Item.

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

Submitter's Purpose and Justification:

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

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.

NIST OWM Executive Summary for SCL-23.2 – Table S.6.3.a. Marking Requirements, and Table S.6.3.b. Notes for Table S.6.3.a. Marking Requirements

NIST OWM Recommendation: NIST OWM does not support the item as it is and recommends it is to be deescalated to the developing status. Alternatively, NIST OWM supports the voting status if the proposed marking for vehicle restriction is removed from the proposal.

- Should this proposal be accepted as is (without the removal of the vehicle restrictions), we encourage NTEP to consider identifying specific language to ensure uniformity in marking of vehicle restrictions. This will assist manufacturers and regulators in identifying appropriate markings.

Table 2. Summary of Recommendations
SCL-23.2 – Table S.6.3.a. Marking Requirements, and Table S.6.3.b. Notes for Table S.6.3.a. Marking Requirements

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	Voting		

SWMA	Developing		
CWMA	Voting		
NCWM	Voting		

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Table S.6.3.a. Marking Requirements

	Weighing Equipment				
To Be Marked With ⇓	**Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC1**	**Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC**	**Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC**	**Load Cell with CC (11)**	**Other Equipment or Device (10)**
Minimum and Maximum Speed (25)		**X**	~~**X**~~		
Maximum Speed Change (26)		**X**	~~**X**~~		
Vehicle Direction Restriction (27)		**X**	~~**X**~~		
Vehicle Type Restriction (28)		**X**			

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 a vehicle type restriction, if applicable, which shall be readily apparent when viewing the reading face of the scale indicator. (Added 20XX)

NIST OWM Detailed Technical Analysis:

This detailed technical analysis is based on the revised proposal that was posted on the NCWM website on 12/19/2022.

This item originated during a discussion at the 2022 Weighing Sector meeting about the suitability of certain single draft weigh-in-motion (DS-WIM) vehicle scales to weigh tanker trucks carrying a liquid product. Some SD-WIM vehicle scales may not be able to weigh these trucks properly due to the dynamic behavior of the fluid in the tank.

In case a scale fails the test with a tanker truck carrying liquid product, or the scale has never been tested with a tanker truck, the device application should be limited to non-liquid carrying vehicles only. Such limitation should be marked on the instrument making the operator aware of the limitation.

Although the proposal originated because of inaccurate weighments of trucks carrying liquids, restrictions may be imposed on any vehicle type that cannot be accurately weighed on a certain installation. Therefore, it is important that the proposed marking requirement can be applied to any type of vehicle. To avoid confusion with the vehicle types defined by FHWA, the proposed requirement does not use the term "Vehicle Type".

NIST OWM supports the proposed move of the markings for "Minimum and Maximum Speed", "Maximum Speed Change" and "Vehicle Direction Restriction" to the indicating element. It makes sense that all these markings are grouped together with the proposed marking for vehicle restrictions. And since the markings should be clearly visible to the operator, they should be affixed to the indicating element instead of the weighing and load-receiving element, as proposed by the originator of this item.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, The Committee updated the item per recommendations from the submitter, and 34 comments were received. With the modifications, the Committee believes this item is fully developed and has assigned it a Voting status

Regional Association Reporting:

Western Weights and Measures Association

At the 2022 WWMA Annual Meeting, the Committee recommended this item move forward as a Developing Item.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, there were no comments heard. The SWMA S&T Committee recommended this item move forward as a Developing Item.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, no comments were heard from the floor. The NEWMA S&T Committee does not have a recommendation as to the status of this item.

At the 2023 NEWMA Annual Meeting, Doug Bowland (SMA) supports this item. Jan Konijnenburg (NIST OWM) stated there are concerns with additional markings. The way the item under consideration is written could allow ambiguous descriptions on the nomenclature plate but agrees with the need to list restrictions.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Loren Minnich (Kansas) remarked 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. May it 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) stated he does not like the word "type". Does it differentiate between liquids and solids in a tanker? He recommends item be Developing.

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

At the 2023 CWMA Annual Meeting, Jan Konijnenburg supports move from load receiving element to indicating element. Concerns with vehicle restriction and that footnote 28 could lead to confusion. Language is vague and open ended and can lead to ambiguous markings in the field on ID plates.

Thomas Schuller (SMA) stated the SMA supports this item.

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

Scale Manufacturers Association (SMA)

At the 2022 SMA Fall Meeting, the SMA supported the item. Rationale: The Weighing Sector has already reviewed and placed this into the test method.

At the 2023 SMA Spring Meeting, the SMA supported this item.

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

Submitter's Purpose and Justification:

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)

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

NIST OWM Recommendation: NIST OWM acknowledges the importance of this item and supports the work of the task group. We recommend that the NCWM Task Group (TG), which includes OWM Technical Advisor participation, continue to develop this item. OWM continues to evaluate and analyze the proposal and plans to continue to work with the TG to provide suggestions and recommendations to language, as well as discuss additional concerns that need to be vetted within the TG:

- Portions of the current proposal remain confusing and difficult to follow without the overall picture. We emphasize that for this proposal to succeed, a good understanding by all stakeholders is essential. Since the proposal will impact guidance and training previously provided to inspectors and manufacturers in the application of these requirements, OWM recommends the TG develop high-level guidelines to assist those applying the revised version of the code. For example, bullet points with instructions on points such as:
    - the use of "e" versus "d" in the calculation of tolerances,
    - the determination of accuracy class, and
    - the determination of recommended minimum loads.
- In addition, NIST OWM encourages the task group to simplify the language of some proposed changes. Some examples where the current language may lead to confusion in the correct application of the requirements are:
    - the use of unfamiliar OIML R 76 terminology throughout the item
    - the reference to additional associated requirements in NIST HB 44 when applying a particular requirement. One example are the changes proposed to note 3 of Table S.6.3.b., which instructs those applying the requirement to refer to proposed new Note 4, which only includes exceptions to Note 3. Another example is the parenthetical instruction appearing in Table 8 Recommended minimum load which specifies, "see also notes 3 and 4 in Table S.6.3.b.
- Table 8 in the proposal suggests that the minimum load should be based on the scale division, d, rather than on the verified scale interval, e. This conflicts with the conclusions reached at the 2018 NTEP Lab Meeting and the 2019 Weighing Sector Meeting. NIST OWM is concerned that these contradicting positions may endanger the adoption of the entire proposal. One possible solution is to define the minimum recommended load in terms of verified scale division, e, and submit a separate proposal for amendment of Table 8. Recommended Minimum Load.

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

- With respect to harmonization with OIML R 76, it is important to recognize that OIML R 76 has restrictions and additional requirements for scales used for "direct sales to the public", where NIST HB44 does not. NIST OWM is of the opinion that scales with a differentiated scale interval cause confusion to the general public and should not be used in such applications. The current proposal does not include a similar limitation of use.

- We believe the current proposal still needs a substantial amount of work to make clear how the proposed changes are to be applied and to correct inconsistencies.

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

	Status Recommendation	Note*	Comments
Submitter			
OWM	Assigned		
WWMA	Assigned		
NEWMA	Assigned		
SWMA	Assigned		
CWMA	Assigned		
NCWM			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 scale division (d).

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**~~ **in the order of magnitude** of 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]

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

(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]

$$n = Capacity/e$$

(Added 20XX)

Table 6. Maintenance Tolerances (All values in this table are in scale divisions)

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

(Amended 20XX)

T.N.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 IIII. – 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** ~~d~~ 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)** ~~**(d)**~~ and be within tolerance limits.
(Amended 1986 **and 20XX**)

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

T.N.6.1. Test Load.

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

2. 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 ~~**division**~~ **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**)

T.2. Sensitivity Requirement (SR).

T.2.2. General. – Except for scales specified in paragraphs T.2.3. Prescription Scales through T.2.8. Railway Track Scales: 2 **(e)** ~~**d**~~, 0.2 % of the scale capacity, or 40 lb, whichever is least.
(Amended 20XX)

T.2.4. Jewelers' Scales.

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

(Amended 20XX)

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

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

(Amended 20XX)

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

(Amended 20XX)

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

(Amended 20XX)

S.1.1.1. Digital Indicating Elements.

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

(b) ***After zero setting (gross zero or net zero after a tare operation) the effect of zero deviation on the result of the weighing shall be not more than ± 0.25 e. [Nonretroactive as of January 1, 20XX]***

~~***(b)***~~***(c)*** ~~***A digital indicating device shall either automatically maintain a "center-of-zero" condition to ± ¼ scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± ¼ of a scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).***~~ ***A digital indicating device shall have a "center-of-zero" indicator that indicates a zero balance condition when the deviation from zero is not more than ± 0.25 e. A "center-of-zero" indicator may operate when zero is indicated for gross and/or net mode(s). The "center-of-zero" indicator is not mandatory on a device equipped with an auxiliary indicating device or equipped with a zero tracking mechanism.***
[Nonretroactive as of January 1, 1993]

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

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)

Table S.6.3.a. Marking Requirements

To Be Marked With ⇓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC[1]	**Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC**	**Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC**	**Load Cell with CC (11)**	**Other Equipment or Device (10)**
Manufacturer's ID (1)	X	X	X	X	X
Model Designation and Prefix (1)	X	X	X	X	X
Serial Number and Prefix (2)	X	X	X	X	X (16)
Certificate of Conformance Number (CC) (23)	X	X	X	X	X (23)
Accuracy Class (17)	X	X (8)	X (19)	X	
Nominal Capacity (3)(18)(20)	X	X	X		
Value of Scale Division, "d" (3)**(4)**	X	X			
Value of **Verification Scale Division**, "e" **(3)**(~~4~~)	X	X			
Temperature Limits (5)	X	X	X	X	

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

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

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

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

3. The device shall be marked with the nominal capacity. **The nominal capacity may be prefaced by the terms "capacity" or "Max."**

   ~~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., 15 × 0.005 kg, **~~30 × 0.01 lb,~~** or capacity = 15 kg~~,~~ d = 0.005 kg, **or Max 15 kg e = 0.005 kg**) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device. Each scale division value **"d" or "e"** **~~or weight unit~~** with its associated nominal capacity shall be marked on multiple range or*

multi-interval scales. For any scale that has no "d" or any scale where "e" does not equal "d" refer to Note 4.
[Nonretroactive as of January 1, 1983]
(Amended 2005 **and 20XX**)

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

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

(b) For a scale where e does not equal d, such as a scale equipped with an auxiliary 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).

[Nonretroactive as of January 1, 1986]

(Amended 20XX)

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".

For scales in classes I, II, III, III L, and IIII, the value of "e" shall equal the value of "d." On a multi-interval scale or on a multiple range scale, the value of "e" shall be equal to the value of "d" for each partial range or range.

The requirement that e = d does not apply to:

(a) a scale equipped with an auxiliary indicating device conforming to S.1.2.2.1., or

(b) a weight classifier marked for special use and complying with S.1.2.2.4., or

(c) an ungraduated scale, such as an equal arm scale where the scale graduations do not represent a fixed weight quantity. Ungraduated devices are marked with "e" but have no scale divisions "d."

(Added 20XX)

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

~~d < e < 10 d~~

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

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

~~(Added 1999)~~

Scales Equipped with an Auxiliary Indicating Device. – Only a Class I or II scale 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.

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 < 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. – A scale with an auxiliary indicating device shall not be equipped with an 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 (~~d or~~ e[1])*	*Number of Verification Scale[4] Divisions (n)*	
		Minimum	*Maximum*
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	*--*
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*

(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:

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

~~"e" is the value of the scale division immediately preceding the auxiliary means.~~ The verification scale division e does not always equal the displayed scale division d. To ensure the correct value for e is used, refer to required markings on the device (see also notes 3 and 4 in Table S.6.3.b.).

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

(Added 1986) (Amended 2003)

[3] *The value of a* ***verification*** *scale division* ***(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,* ***~~d~~ e,*** *for a specific scale using National Type Evaluation Program (NTEP) certified load cells shall comply with the following formulae where N is the number of load cells in a single independent[1] weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):*

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

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

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

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

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

- *the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;*
- *the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and*
- *the complete weighing/load-receiving element or scale is equipped with an automatic zero-tracking mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.*
  [Nonretroactive as of January 1, 1994]

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

UR.3. Use Requirements.

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

(Amended 20XX)

Table 8. Recommended Minimum Load

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

~~***For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."***~~

The displayed scale division d is not always equal to the verification scale division e. To ensure the correct values are used, refer to required markings on the device (see also notes 3 and 4 in Table S.6.3.b.).

For an ungraduated device, the scale division d shall be replaced with the verification scale division e in the last column.

A minimum load of ~~10 d**~~ **5 e** is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

(Amended 1990 **and 20XX**)

Purpose and Justification:

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

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

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.

NIST OWM Detailed Technical Analysis:

OWM disagrees that the value of the scale division (d) be used to establish the recommended minimum loads in Table 8 on Class I and II scales in which d and e are different values. We wonder if, perhaps, members of the TG, wanting to harmonize the recommended minimum load values in Table 8 of HB 44 with the Minimum Capacity values in Table 3 of OIML R76 failed to consider or misunderstood how the Table 3 values are intended to apply to commercial application scales. That is, although clause 3.4.3. Minimum capacity of R76 specifies that the verification scale interval (e) is to be replaced by the actual scale interval (d) in last column of Table 3, clause 4.13.7 Auxiliary and extended indicating devices prohibits the use an auxiliary indicating device (for which a differentiated scale division (d) is one) on Class II, III and IIII scales designed to be used for direct sales to the public. Because a differentiated scale division is considered a type of auxiliary indicating device according to R 76, one would not be permitted on a Class II, III, and IIII scales used for direct sales to the public. Consequently, Class II, III, and IIII scales used for direct sales to the public would only display in verification scale intervals and the minimum capacity specified in Table 3 would need to be based on this value.

It is important to recognize also that the application of R76 is not only to commercial scales, but also noncommercial scales, e.g., those used in a laboratory. Thus, a minimum load of 20 d or 50 d on a Class II scale might be acceptable loads for scales used as a mass comparator in the lab to make mass comparisons, but not so for scales used for buying or selling (i.e., commercial applications).

Portions of the current proposal remain confusing and difficult to follow without the overall picture. We emphasize that for this proposal to succeed, a good understanding by all stakeholders is essential. Since the proposal will impact guidance and training previously provided to inspectors and manufacturers in the application of these requirements, OWM recommends the TG develop high-level guidelines to assist those applying the revised version of the code. For example, bullet points with instructions on points such as:

- the use of “e” versus “d” in the calculation of tolerances,
- the determination of accuracy class, and
- the determination of recommended minimum loads.

Summary of Discussion and Actions:

During the 2022 NCWM Interim Meeting, Richard Harshman (NIST OWM) commented that the items in this block represent very significant changes to the Scales Code of NIST HB 44 in that they are an attempt to clarify which value, the value of the scale division (d), or verification scale division (e), are the paragraph requirements to be based. It is important that everyone agree; however, but this has not yet been the case. Richard Harshman noted that OWM disagreed with several of the changes proposed by the different items in this block as shown in the Committee’s current agenda. Richard Harshman also reported that the various Block 2 items in the Committee’s current agenda fail to reflect changes agreed to by members of the NCWM’s Verification Scale Division (e) Task Group (TG) as indicated in its second report to the Committee. That is, the proposals hadn’t been updated following the TG’s submission of its second report to the Committee. There seemed to be a misunderstanding between the TG and Committee

on who would perform this work and it never got done. OWM looked forward to reviewing the proposals once this updating had been completed.

Doug Musick (Kansas and Chair, Verification Scale Division (e) TG) acknowledged the accuracy of Richard Harshman's reporting of the misunderstanding between the TG and Committee. He then requested the Committee either reassign the Block 2 items to the TG, or, if the Committee preferred, the Committee could perform the updating itself based on the TG's most recent report. TG Chair. Musick also noted that the TG's second report was included in Appendix A of the Committee's 2022 Interim Agenda (NCWM Publication 15).

Russ Vires (Mettler Toledo, LLC and speaking on behalf of the SMA) stated that the SMA supports the further development of this item and the work of the Verification Scale Division (e) TG. The SMA would also like to encourage the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in this item.

The Committee also received several comments in support of reassigning the block of items to the TG for further revision.

The Committee, in consideration of the comments received, agreed to reassign the block of items to the Verification Scale Division (e) TG for additional updating.

Prior to the 2023 NCWM Interim Meeting, the NCWM, in consultation with the chairperson of the NCWM Verification Scale Division (e) Task Group agreed to consolidate all of the Block 2 items that were on the committee's 2022 agenda into a single item titled "SCL-23.3 – Verification Scale Division e: Multiple Sections Including, T.N.1.3., Table 6., T.N.3., T.N.4., T.N.6., T.N.8., T.N.9., T.1., T.2., S.1.1.1., T.N.1.2., Table S.6.3.a., Table S.3.6.b., Appendix D, S.1.2.2., Table 3., S.5.4., UR.3., Table 8" The following represents a summary of the NCWM discussions and actions relative to the items in Block 2 prior to them being consolidated:

During the 2023 NCWM Interim Meeting, TG Chair Musick asked for this item to replace Block 2 items. He also requested the Committee to give it an Informational status as wordsmithing efforts are ongoing. Russ Vires supports the further development of this item although he questions the moving from block 2 items to SCL 23.3. He noted that the SMA had provided written comments for block 2.

The Committee looks forward to further development from the task group to which this item is Assigned.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting, during open hearings, 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.

Southern Weights and Measures Association

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.

Northeastern Weights and Measures Association

At the 2023 NEWMA Annual Meeting, Loren Minnich (NIST OWM) indicated support for the continued development of this item. Lou Sakin (Hopkinton, Massachusetts and Chair of the Cannabis Scales FG) stated that this will be critical for SCL-22.2 due to lack of current clarity and urged that this TG take action forthwith. Doug Bowland (SMA) stated support for further development and encourages the task group to make final changes or remove it from consideration. He also requested that in each instance in the item under consideration that "verification interval" be used for e and "scale division" for d.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a assigned status. The Committee also noted that this Task Group has been without a Chair and encourages the NCWM Chair to appoint a new chair to continue the work of the group. The body concurred with the Committee.

Central Weights and Measures Association

At the 2023 CWMA Annual Meeting, the SMA supported further development from TG and encourages TG to submit final changes or otherwise withdraw this item.

Thomas Schuller (SMA) stated the SMA supports the further development from the Verification Scale Division (e) Task Group. The SMA would encourage the workgroup to make the final changes and present it to the S&T Committee and Membership, otherwise remove it. The SMA encourages the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in the Handbook.

Scale Manufacturers Association

At the 2022 FALL SMA Meeting (Block 2 items), the SMA supports the further development from the Verification Scale Division (e) Task Group. The SMA would encourage the workgroup to make the final changes and present it to the S&T Committee and Membership, otherwise remove it.

The SMA encourages the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in the Handbook.

At the 2023 SMA Spring Meeting, the SMA supports the further development from the Verification Scale Division (e) Task Group. The SMA would encourage the workgroup to make the final changes and present it to the S&T Committee and Membership, otherwise remove it.

The SMA encourages the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in the Handbook.

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

Submitter's Purpose and Justification:

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.

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.

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

NIST OWM Executive Summary for WIM-23.1 – Remove Tentative Status and Amend Numerous Sections Throughout

NIST OWM Recommendation: NIST OWM is of the opinion that the item currently has merit, but that it is not yet fully developed. NIST OWM recommends making this item Informational to give the submitters the opportunity to work with the Committee and address all raised concerns.

- The submitter has demonstrated there is a need for permanent and direct enforcement. The proposed code is intended to address this need.

- The proposed tolerances and test procedures are comparable to the OIML recommendation R 134 which is used in multiple countries as the standard for weighing road vehicles in motion (for both direct enforcement and other applications).

However, there are several issues that need to be addressed:

- The proposal should contain provisions to support unattended operation in order to prevent any reasonable doubt about the measurement. The different stakeholders involved in the future development of the proposal should decide on the different provisions that need to be part of the code (e.g., pictures of the vehicle, license plate and its position on the road, and other registrations of the circumstances).

- The selected reference vehicles must be representative to the traffic that can be expected traveling over the WIM installation. E.g., vehicles carrying fluids or vehicles with a steel leaf spring suspension. The current proposal excludes fluid carrying vehicles from the test schedule. Since these systems are to be installed on public roads, fluid carrying vehicles are expected to pass the WIM system. Therefore, this type of vehicle should be included in the evaluation of a WIM system.

- The proposed set of requirements should be comparable to the requirements applicable to other weighing devices to achieve a similar level of confidence in the instrument. The submitters have been supplied with the results of a gap analysis performed by NIST OWM.

- As states apply different 'forgiveness' margins to weighing and measuring results used for law enforcement, it is to be expected that states will also have different requirements on the tolerance of a WIM system used for law enforcement. The required tolerance may also depend on the specific application of the WIM system. To give states more flexibility to determine the appropriate tolerance for a certain application, NIST OWM encourage the submitters to introduce additional classes with different tolerances, and to align the tolerances with the tolerances in OIML R 134.

Table 2. Summary of Recommendations
WIM-23.1 – Remove Tentative Status and Amend Numerous Sections Throughout

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Informational		
WWMA	Developing		
NEWMA	Informational		
SWMA	Developing		
CWMA	Informational		
NCWM	Informational		

	Letters of Support	Letters of Opposition	Comments
Industry	1		International Road Dynamics (November 15, 2022) New York University (November 14, 2022)
Manufacturers			
Retailers and Consumers			
Regulators			
Trade Association	1		Maryland DOT (November 15, 2022)

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration (as submitted to the NCWM S&T Committee 5/5/2023):

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

Table of Contents

Weigh-In-Motions Systems Used for Vehicle Enforcement~~— Tentative Code~~

…

T.2. Tolerance Values for Accuracy Class A and Class E.

…

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.

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

(a) 1, 2, or 5; or

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

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

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

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

S.1.4. Value of Other Units of Measure.

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

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

(a) meters and decimal submultiples of a meter;

(b) feet and inches; or

(c) feet and decimal submultiples of a foot.

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

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

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

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

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

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

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

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

S.1.7. Recorded Representations.

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

(a) transaction identification number;

(b) station ID;

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

(d) vehicle speed;

(e) number of axles;

(f) weight of each axle;

(g) weight of each axle group;

(h) identification and weight of axle groups;

(i) axle spacing;

(j) total vehicle weight;

(k) weight limits as specified in paragraph S.2.1;

(l) <u>total vehicle length;</u>

(m) all fault conditions that occurred during the weighing of the vehicle;

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

(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 **<u>and Class E</u>**.

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: 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.**

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 scale capacity or > 90 % of the maximum capacity of the vehicle, whichever is less) for a minimum of 30 runs per test vehicle type

N.1.3. Reference Scale. – Each reference vehicle **for the dynamic test** shall be weighed statically **either** on a multiple platform vehicle scale **or a single platform vehicle scale**.

N.1.3.1. Multiple Platform Vehicle Scale – It is 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 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.~~1~~.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 **at the designated speed(s).**

N.1.4.1. Test Speeds for Class A – Speed shall be within 20 % below or 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 – less than 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.

Table N.1.5. Number of Test per Each Test Vehicle for Class E

Load Condition	Speed	Vehicle Position
Fully Load (30 runs)	High Speed (10 runs)	Left (2 runs), Center (6 runs), Right (2 runs)
	Low Speed (10 runs)	Left (2 runs), Center (6 runs), Right (2 runs)
	Operation Speed (10 runs)	Left (2 runs), Center (6 runs), Right (2 runs)
Empty Load (15 runs)	High Speed (5 runs)	Left (1 run), Center (3 runs), Right (1 run)
	Low Speed (5 runs)	Left (1 run), Center (3 runs), Right (1 run)
	Operation Speed (5 runs)	Left (1 run), Center (3 runs), Right (1 run)
45 runs	15 runs x 3 speeds	9 runs (left) + 27 runs (center) + 9 runs (right)

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 and Table T.2.2-2 for enforcement.**

T.2.2.1. Tolerance Value for Class A for Screening Purpose

Table T.2.2-1. Tolerances for Accuracy Class A

Load Description*	Tolerance as a Percentage of Applied Test Load
Axle Load	± 20 %
Axle Group Load	± 15 %
Gross Vehicle Weight	± 10 %

* No more than 5 % of the weighments in each of the load description subgroups shown in this table shall exceed the applicable tolerance.

T.2.2.2. Tolerance Value for Class E for Enforcement Purpose

Table T.2.2-2. Tolerances for Accuracy Class E

Load Description*	Tolerance as a Percentage of Applied Test Load
Axle Load	**± 15 %**
Axle Group Load	**± 10 %**
Gross Vehicle Weight	**± 6 %**

* No more than 5 % of the weighments in each of the load description subgroups shown in this table shall exceed the applicable tolerance. No single error may exceed a GVW tolerance of ± 10 % (100 % compliance).

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.
E	**Enforcing of vehicles based on axle, axle group, and gross vehicle weight**

Note: 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-axles 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-axles 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]

NIST OWM Detailed Technical Analysis:

Permanent installed WIM systems are used in several countries around the world and are generally used for permanent protection of fragile and critical infrastructure. The submitters clearly showed that there is a need for direct and permanent enforcement.

The submitters have requested that the proposal is given a Voting status. However, changing the application of the code from screening to direct enforcement requires a new level of reliability. The

submitters have used the existing code, that was adopted by the conference in 2015, as basis for their proposal. The test procedures and tolerances are comparable to internationally used standards which builds confidence. Therefore, it can be assumed that the proposal is a good base to start from. But there are still some concerns to be addressed in order for it to be suitable for direct enforcement application.

The current code in section 2.25 is meant for screening applications only. That means that for the actual citation another certified scale is being used, not the WIM installation. In case of the proposed code, the citation is based on the output of the WIM installation. Since the weighing process is done without the intervention of a law enforcement officer, the records of the weighment must be unambiguous and beyond reasonable doubt. That means that the records should contain:

- The measured weight value
- The corrected weight used for the citation (if a correction is applied)
- Proof of the vehicle's identity (e.g., picture of the vehicle including license plate)
- Date and time
- Location
- Any other record that may be necessary to avoid any doubt about the violation (e.g., vehicle speed)

It is unclear whether this kind of supporting evidence should be part of the code. The conference should decide whether to add this to the code or whether this is covered by other legislation.

To build confidence in the proposed WIM, adequate performance and reliability of such system should be demonstrated. Also, the effectiveness and completeness of the proposed test procedures should be demonstrated. Regarding the test procedures, NIST OWM has some concerns:

- One of the most critical vehicle types to be weighed on a weigh in motion system is a vehicle with a shifting load, e.g., a tanker truck carrying fluids. Therefore, these kinds of vehicles should be included in the selection of test vehicles. Certain vehicle types can be excluded only when the instrument has provisions that prevent weighment of these vehicle types.
- Other vehicles with characteristics that could influence the measurement (e.g., vehicles with conventional steel leaf spring suspension as prescribed by OIML R 134) should be considered too.
- How does the "fully load condition" of a test relate to the specified scale capacity? E.g., is it sufficient to test a 200,000 lb installation with an 80,000 lb test vehicle?
- The objective of the WIM system is to detect and accurately weigh overweighed vehicles. Therefore, correct operation of the scale above the weight limit is essential. The proposal should answer the following questions:

- Is it the intend to use test vehicles that weigh more than the weight limit of the road the WIM system is supposed to protect? If so, what precautions need to be taken to limit the damage to the road due to testing?

- If no overweight vehicles are to be used during testing, how is guaranteed that the WIM system is providing an accurate weight within tolerance for loads over the weight limit up to the capacity of the WIM system?

Since a WIM is a weighing device, the requirements should be comparable to the requirements of other types of weighing devices. NIST OWM has done a gap analysis and compared the proposed code with the existing code in Handbook 44, sections 1.10 (General Code), 2.20 (Scales), and OIML R 134. As it turns out, there are some significant differences where certain aspects are not covered by the proposed code for WIM installations but are covered for other devices. NIST OWM is of the opinion that the proposed code should be extended with:

- Differentiation between acceptance tolerance and maintenance tolerance
- Requirements for temperature effect on zero-load condition
- Requirements on the susceptibility of voltage variations
- Requirements for the detection of an accidental breakdown of the system
- Requirements for zero-setting and zero-tracking
- Provisions to guarantee proper weighment when citations are issued automatically

And last but not least, states apply different margins on weighing results before issuing citations. With the current proposal for WIM systems, the margins are partly determined by the tolerances in the proposal. A classification system will give the states more flexibility, and it will encourage the industry to increase the accuracy of WIM systems. The current proposal already defines two different classes (A and E) for screening (class A) and enforcement (class E). This classification can be extended with more classes to allow WIM systems with different accuracies. If the classification is to be extended, then NIST OWM encourage alignment of the tolerances with the OIML R 134 classification.

Summary of Discussions and Actions:

At 2023 NCWM 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 NIST HB 44. The Committee continues to work on this item, including User Requirements, to address concerns it heard during the NCWM 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 Association Reporting:

Western Weights and Measures Association

At the 2022 WWMA Annual Meeting, Tanvi Pandya (New York City DOT) stated technologies have moved on. Tanvi Pandya noted New York City DOT has data since 2019 showing that accuracy can be met on the devices. Tanvi 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. Tanvi Pandya recommended a Voting status.

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

Jess Helmlinger (Kistler Group) clarified Chaekuk Na's comments regarding test loads with testing occurring with both loaded and unloaded vehicles in live traffic and static weights for fairness. Jess Helmlinger noted changing the test procedure on live traffic and status weights had no impact. Jess 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. Jess Helmlinger confirmed this is for law enforcement and not commercial weighing and the submitters have worked with NIST and a multitude of states. Jess Helmlinger stated the item is intended for states that want to use automated enforcement and would not force any jurisdiction to use it. Jess Helmlinger recommended a Voting status.

Matt Douglas (State of California, Division of Measurement Standards on behalf of S&T Committee) 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 %.

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

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

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

Matt Douglas commented he believes that there is some merit to some of the item. Douglas recommended keeping the accuracy class "A" and add accuracy class "E".

Kenn Burt (San Luis Obispo County, California on behalf of S&T Committee) 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?

Tanvi Pandya addressed Kenn Burt's question regarding industry reviewing this item. Tanvi Pandya commented the submitters have met regularly and developed a task force. Tanvi Pandya commented the

task force has discussed this for the past several months. Tanvi Pandya commented they have not directly engaged with the trucking industry but have spoken with some freight industry in general.

Jess 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 recommended that this item be assigned a Developing status.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Dr. Nasif presented a 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.

Peter Fedechko (International Road Dynamics) stated that he supports this item.

Tim Chesser (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.

Paul Floyd (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 recommended this item move forward as a Developing Item.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, a presentation was given from the submitters of this item. The submitters reminded the body that this item deals exclusively with law enforcement scales, and not commercial scales.

John McGuire (New Jersey) inquired about a 10 % leeway in gross weight and believes that if a law enforcement agency is writing summonses, the tolerance should be tighter. He also inquired if the SMA and NIST had a position on this proposal.

Dawn Harrison (New York City Department of Transportation) indicated that the 10 % leeway was chosen as a local enforcement policy because they believe that percentage on gross vehicle weight falls

within tolerances of WIM systems and wants to target heaviest offenders. Any violations written by law enforcement have to be reviewed prior to issuance.

Jess Helmlinger indicated that the system will be tested to a 6 % tolerance and fines would be issued at 10 %.

Jim Willis (New York) stated that his understanding is there is a concern with both axel weights and gross weights of the overweight vehicles.

Diane Lee (NIST OWM) inquired if this system will be used to provide official weight or estimation, and if weight is not correct are they going to weigh station to get official weight.

Jess Helmlinger indicated that during testing, they will be tested with a certified field reference scale and vehicles.

Jason Flint (New Jersey) pointed out that the 10 % leeway is a local enforcement decision and will not appear in the handbook as a tolerance.

Jim Willis has concerns with the number of runs required to test the system. Mr. Czinku stated that WIM is a mature technology and can provide reliable output and weighments.

John McGuire (New Jersey) recommended the item as developing so a further look can be taken into the dynamics of WIM. Jason Flint (New Jersey) suggested that an on-site demonstration be made available so regulators can view the system being used.

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

At the 2023 NEWMA Annual Meeting, the submitters of this item gave a presentation to that outlined new information, changes to language in the item under consideration and a synopsis on a live demo that occurred in Wisconsin. The submitters stated that this system is for enforcement purposes only, not commercial, and weigh-in-motion sensors are more efficient than using a static scale in high traffic areas where overweight vehicles are a problem. The submitters met with many stakeholders, industry and government officials for feedback to change certain testing procedures such as requiring a straight run only, instead of left/right, and possibly replacing the empty load test with a half load test.

Jim Willis (New York) stated that the demo was good experience. He indicated that this is a sensor system and not a scale. Sensors are good at what they do, but they are not a scale. During the demonstration, the only issue with reliability was an empty truck where the back wheel bounced and registered 17 % light.

NIST noted that the system constantly “optimizes” the sensor system using previous readings to make corrections, can the system be rechecked?

The submitters stated that the system has an audit trail and a data logger that is locked with a tag that collects all calibrations that are done and can give a report.

Michael Keilty (Endress + Hauser) asked how weather effect the system. The submitters stated there is data collection ongoing and there is system based compensation for temperature.

After hearing comments from the floor, the Committee recommended to the body that this item maintain an Informational status, and the body concurred. The Committee commends the submitters for the hard work in developing this item and involving all stakeholders.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Mr. Nassif stated that 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 stated that the 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. The 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) stated that testing involves three truck classes, three different loads, and three different speeds. Is the intention that there are different classes of trucks which are all tested at all three different loads and speeds? What does FHWA mean? Spell out the acronym. Is that in a CFR. which can be referenced?

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

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

At the 2023 CWMA Annual Meeting, Greg VanderPlaats (Minnesota) recently attended a demonstration of a WIM system for highway weight screening and compared contrasted the WIM with a stationary scale. The WIM met tolerances, but they are large i.e., 10 % to 20 %. The WIM system can meet the tolerances but work still needs to be done. How will the tolerances be used for actual enforcement? Adding the tolerance to the weight limit before enforcement is taken. Will have to coordinate with DOT / enforcement because W&M officials will not be applying this code. WIMs are needed in populated northeast where static scales cannot be located near aging infrastructure (bridges).

Thomas Schuller (Scale Manufacturers Association) remarked that the S SMA opposed this item with the following concerns:

- Highway weight enforcement scales are already defined as Class IIII in the Scales code.
- -Dynamic weighing should not perform worse than what has already been established and is acceptable.
- These devices will suffer major usage, so an acceptance and maintenance tolerance should be established similar to Class IIII values.
- Tighter tolerances will contribute to better performance and would detect more overweight vehicles and generate higher revenue.

- If added to the WIM Code, law enforcement code would exist in both the Scales code and the WIM code that needs to be reconciled.

- If this item stays in WIM and does move forward, our recommendation would be to harmonize tolerances with OIML R134.

- The WIM code was not intended to be used in Commercial applications. Commercial and Law enforcement weighing applications, including WIM applications, are covered in the Scales Code.

Jan Konijnenburg (NIST OWM) spoke that this item has merit and supported further development. Does not agree with the SMA's position. The WIM Code will not be commercial and will be for law enforcement use only. Agrees with aligning with OIML R134.

The CWMA S&T Committee recommends this item remain Informational.

Scale Manufacturers Association (SMA)

At the 2022 SMA Fall Meeting, the SMA supported removing the Tentative status from this code and it to remain used for Vehicle Screening only.

Rationale: This code is not intended to be used in Commercial applications. Commercial weighing applications, including WIM applications, are covered in the Scales code.

At the 2023 SMA Spring Meeting, the SMA opposes this item with the following concerns.

Major points of concern:

- Highway weight enforcement scales are already defined as Class IIII in the Scales code. Dynamic weighing should not perform worse than what has already been established and is acceptable.

- These devices will suffer major usage, so an acceptance and maintenance tolerance should be established similar to Class IIII values. Tighter tolerances will contribute to better performance and would detect more overweight vehicles and generate higher revenue.

- If added to the WIM code, law enforcement code would exist in both the Scales code and the WIM code that needs to be reconciled.

- If this item stays in WIM and does move forward, our recommendation would be to harmonize tolerances with OIML R134.

Rationale:
The WIM code was not intended to be used in Commercial applications. Commercial and Law enforcement weighing applications, including WIM applications, are covered in the Scales code.

LMD – Liquid Measuring Devices

LMD-23.4 V N.3.5. Wholesale Devices.

Source: American Petroleum Institute

Submitter's Purpose and Justification:

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

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 3rd 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?

Small Volume Prover	Volumetric (Can) Prover
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.

NIST OWM Executive Summary for LMD-23.4 – N.3.5. Wholesale Devices.
NIST OWM Recommendation: NIST supports these proposed changes to N.3.5 with adjustments to the item under consideration as shown in Table LMD-23.4, Table 1. This proposal helps to broaden the original intent of the paragraph. We believe the requirements for test drafts were written around the most

NIST OWM Executive Summary for LMD-23.4 – N.3.5. Wholesale Devices.

common test methods at that time. Future requirements for test drafts may be better addressed in the General Code with additional guidance in the Fundamental Considerations or another guidance document.

- This item is one of three items (LMD-23.4, B1: LMD-23.1 and B5: LMD-23.2) that propose changes to LMD code paragraph N.3.5. All items are on the agenda as voting items. As currently written, they are in conflict with each other and if all are adopted there will be different changes adopted to the same paragraph. To prevent this, the item under consideration must be adjusted for these items so that each proposal reflects an appropriate change to the paragraph. See Table LMD-23.4, Table 1. below with options for changes to these items on the agenda.

- NIST HB 44 was written to be non-technology specific, but test draft criteria were written around the current technology most common at that time. When testing a positive displacement meter using an open neck prover there are ramp-up and ramp-down errors that are associated with the test. As such, the test draft must contain enough volume so that these errors do not contribute greatly to the test of the meter. With the use of different test standards, the ramp-up and ramp-down errors may not be factors that will affect the test but there may be other factors that contribute to error in the test procedure.

- Over the years some changes have been made to the N.3. Test Draft paragraph so that the requirement is more inclusive of other technology such as the change that was made to N.3.5 in 1996 to remove the term "Test Draft" and replace it with the term "The delivered quantity" to recognize the use "of Small Volume Provers in Routine Field Testing". The item was adopted as part of the consent calendar that year.

- Technology will continue to evolve, and we will need to respond to this evolution. As new technology is determined to be suitable for use as a standard, the community must carefully consider how test conditions are affected. We will need to ensure an appropriate amount of material is measured so the errors of the test method and the device under test do not contribute greatly to the determination of accuracy for the device.

- Considering what is already in the Appendix A: Fundamental Considerations regarding the selection of test standards and what is being proposed in Items Gen-23.1 and Block 8, we believe a solution may be to add a general code requirement, with additional guidance in Appendix A, to define what is a suitable amount of material to determine the accuracy of a meter. This would allow the removal of the various Test Draft paragraphs from the individual codes. With no alternate proposal currently in place, we believe the changes proposed in LMD-23.4, LMD-23.1 (B1), and LMD-23.2 (B5) with the suggested NIST OWM changes in Table XX would assist in determining the appropriate test procedure for other standards in use.

Table 2. Summary of Recommendations
LMD-23.4 – N.3.5. Wholesale Devices

	Status Recommendation	Note*	Comments

Submitter	Voting		• Proposed Revisions by Submitter (09-28-2020) • Further Comments (01-13-2021)
OWM	Voting		
WWMA	Developing		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry	9		
Manufacturers			
Retailers and Consumers		1	*Henry Opperman (Weights and Measures Consulting, LLC)
Trade Association			

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

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)

NIST OWM Detailed Technical Analysis:

The proposed changes to LMD-23.5 N.3.5 Wholesale Devices are being made because the base volume of some SVPs is smaller than that which is noted in paragraph N.3.5. Wholesale Devices. SVPs operate by collecting a smaller volume, using pulse interpolation, and averaging several runs. As such the portion of

paragraph N.3.5 that states "…shall in no case be less than 50 gal is interpreted to restrict the use of SVP's to those with a base volume greater than or equal to 50 gal.

NIST HB 44 was written to be non-technology specific, but test draft criteria were written around the current technology that was most common at that time, which were likely positive displacement meters. As such the proposals LMD-23.4 and Block 5 seek to keep the existing paragraph and make it broader to encompass other field standards.

The current test draft criteria gives consideration to the ramp-up and ramp-down errors associated with a positive displacement meter and the test draft criteria was selected based on these and other factors that would affect a fair test. The size of the test draft was selected such that these operational errors do not contribute greatly to the test measurement.

With other technologies these errors may not exist but there may be other factors that contribute to error in the test that would affect the test draft.

Over the years some changes have been made to the N.3. Test Draft paragraph so that the requirement is more inclusive of other technology such as the change that was made to N.3.5 in 1996 to remove the term "Test Draft" and replace it with the term "The delivered quantity" to recognize the use "of Small Volume Provers in Routine Field Testing". The item was adopted as part of the consent calendar that year.

Technology will continue to evolve, and we will need to respond to this evolution. As new technology is determined to be suitable for use as a standard, the community must carefully consider how test conditions are affected. We will need to ensure an appropriate amount of material is measured so the errors of the test method and the device under test do not contribute greatly to the determination of accuracy for the device.

Considering what is already in the Appendix A: Fundamental Considerations regarding the selection of test standards and what is being proposed in Items Gen-23.1 and Block 8, we believe a solution may be to add a general code requirement, with additional guidance in Appendix A, to define what is a suitable amount of material to determine the accuracy of a meter. This would allow the removal of the various Test Draft paragraphs from the individual codes. With no alternate proposal currently in place, we believe the changes proposed in LMD-23.4, LMD-23.1 (B1), and LMD-23.2 (B5) would assist in determining the appropriate test procedure for other standards in use.

This item is one of three items (LMD-23.4, B1: LMD-23.1 and B5: LMD-23.2) that proposed a change to LMD code paragraph N.3.5. All are on the agenda as voting items. As currently written, they are in conflict with each other and if all are adopted there will be different changes adopted to the same paragraph. To prevent this, we suggest the committee carefully consider how the items are presented on the addendum sheets and the process by which they are voted on.. See LMD-23.4, Table 1. options to consider.

LMD-23.4, Table 1.

Item Under Consideration (as presented in Pub 16)
LMD-23.4 V N.3.5. Wholesale Devices. **Source:** American Petroleum Institute **Purpose:** 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)**
B1: LMD-23.1 V N.3.5. Wholesale Devices. **Source:** Endress+Hauser Flow USA, Inc. **Purpose:** Define the minimum test draft size when using a field standard meter. **Item Under Consideration:** Amend Handbook 44, Liquid Measuring Devices Code 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)***
B5: LMD-23.2 V N.3.5. Wholesale Devices **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. **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)**~~.
Items in Conflict **LMD-23.4, B1: LMD-23.1, & B5: LMD-23.2.**
LMD-23.4 moves the language in **N.3.5. Wholesale Devices** from that paragraph to a new paragraph, **N.3.5.1. Test Drafts,** with amended language. **LMD-23.1 (BLK 1)** does not include the language for N.3.5 wholesale device

LMD-23.2 (BLK 5) amends **N.3.5. Wholesale Devices** with the same language that **LMD-23.4 moves to N.3.5.1. Test Drafts**.

Conflict: Adoption of all three in their current form, depending on the order in which they are voted on, would either override the language in an item adopted during the same voting session, then duplicate the language in/create similar language in both **N.3.5. Wholesale Devices** and new paragraph **N.3.1. Test Drafts.**

The new paragraph could look like this:

N.3.5. Wholesale Devices. –The delivered quantity shall be equal to at least the amount delivered by the device in one minute at its maximum discharge rate

N.3.5.1. Test Drafts. – The delivered quantity shall be equal to at least the amount delivered by the device in one minute at its maximum discharge rate.
(Added 20XX)

N.3.5.2. 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.
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

N.3.5.3. 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) .

Suggested Resolution:

1. Keep all three items separate from a Consent Calendar if one is put forth for consideration.

2. Vote on **LMD-23.2 (B5)** first. If adopted, it would not change **N.3.5. Wholesale Devices** and would add ***N.3.5.X. Field Standard Meter Test.*** as a sub-paragraph. If not adopted there's no effect on the other items

3. Vote on **LMD-23.4** second. If adopted, it would move the language in **N.3.5. Wholesale Devices** to sub-paragraph **N.3.5.1. Test Drafts.** with the amended language as proposed in **LMD-23.1** and would add a new sub-paragraph which would be designated as **N.3.5.2. Small Volume Prover Test. T**he item in **LMD-23.2** would then be designated ***N.3.5.3. Field Standard Meter Test.*** **LMD-23.1** could then be withdrawn by the Committee as the language it proposed would now be included in **N.3.5.1. Test Drafts**, however numbered and named as suggested above.

4. If **LMD-23.4** is not adopted, **LMD-23.1** could then be voted on.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, the submitter agreed to change paragraph N.3.5.1. Test Drafts and add N.3.5.X. Small Volume Prover Test 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 Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Prentiss Searles (API) wanted to re-enforce the 1996 goal to remove test conditions that restrict the use of small volume provers. The director has the authority to use or not use the device. Spoke about what a captive displacer is. Worked with NIST on this. There was a concern at the NCWM 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 0.029 %.

Letitia Arriaga (Marathon Petroleum) supported this item. Acknowledges the change from 1996 and removes the restriction that prohibits it.

Brent Price (Gilbarco) supported this item. He is concerned that this could be restrictive, 50 gallons is a lot for a proving size. He likes the wording as is with 1-minute maximum flow rate. Agrees with the Central Region's edits.

Prentiss Searles stated the proposed language from the presentation is ready for a vote.

Michael Keilty (Endress+Hauser) would not disagree with the use of small volume provers. Works on these standards all of the time. As it pertains here in changes to HB 44, he can't support this revision and does not support this moving forward as a Voting item. It doesn't address the issue at hand, which is the small sample size. This only massages the language. He recommends that this item should be a sub-paragraph, as in Block 1. He recommends that this item remain Developing.

Prentiss Searles remarked it is not capturing the entire amount that is being delivered, it's 20 gallons. You will recognize a representative sample, that's what the 20-gallon prover does. The captive displacer can test holding 20 gallons with a resolution of 4 digits from the decimal. It is capable of hitting the accuracy that is required. We believe that it is ready for a vote.

Michael Keilty stated it is because of the math that Prentiss described, if it is a 20-gallon captive displacement prover the flow computer math says that it's 40 gallons. It's double and that's what the volume is.

During open hearings, the submitter provided a presentation (which will be submitted to the NCWM) which contained updated language to the proposal. The WWMA S&T Committee recommended that this item be assigned a Developing status with the further recommendation that the submitter of this item and Block 5 item LMD-23.2 work together to develop language that will support both of their purposes, including taking into consideration the testimony heard during open hearings.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Prentiss Searles gave a presentation on this item. He stated that the 50-gallon minimum draft size is not relevant to adequate testing and should be removed.

Tim Chesser (Arkansas) stated that SVP tolerances are much tighter than traditional methods.

Michael Keilty (Endress+Hauser) stated that he agrees with Prentiss Searles and supports this item. He also stated that he believed this item could describe SVPs separately from fixed neck Provers. He recommended this move forward as a Developing Item.

Nicholas Suemnick (Marathon Petroleum) supports this item. Brent Price (Gilbarco) stated that he supports this item with Prentiss Searles' changes.

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

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Prentiss Searles gave a presentation on this item. Prentiss Searles indicated that there has been a language change to the proposed item after hearing comments from CWMA. John Hathaway (Total Control Systems/Murray Equip) inquired about the use of "should" in the language instead of "shall" or "must". Michael Keilty 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. Michael Keilty suggested that this item should be a line item, separate from wholesale, and should be explained explicitly. Michael Keilty pointed out that there are three different proposals on this subject and recommends developing status. Tisha Arriaga (Marathon Petroleum) commented that she supports the item as Voting. Tisha Arriaga feels that the change that occurred in the handbook in 1996 has accepted this test measure. Diane Lee (NIST OWM) appreciated the presentation and stated that NIST has been working with API. Diane Lee noted that the requirements for provers in the handbook were created in 1937 and this technology did not exist. Walt Remert (Pennsylvania) commended the outstanding work done by the group and supports the item as developing. Jim Willis (New York) 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 agreed that this item has merit. The Committee agreed with the commenters and believed that this item should have a Developing status.

At the 2023 NEWMA Annual Meeting, Prentiss Searles gave a presentation that combined Items 23.4 with Item 23.2 that covered the changes in the item under consideration pertaining replacing "should" to "shall". This item updates codes as the gallon requirement does not apply due to current technology, adds small volume provers (SVP) in N.3.5.X for terminal racks where the SVPs are used. Intention is that we have recognized SVP per HB44, but there was confusion as to whether SVP needed to be run at 50 gal/min. Walt Remmert asked why does this only apply to wholesale devices? Prentiss Searles explained that with retail devices, you are not going to use an SVP because the size is small. Loren Minnich (NIST OWM) is supportive of the item, however, there are concerns that there are multiple items tied together with slightly different language (N.3.5, this item, Block 1, and Block 5) that creates a potential issue of how they would interact if voted on and adopted. Review is needed and an email from NIST regarding these concerns will be forthcoming. Michael Keilty explained that section N.3.5 will be itemized. NCWM S&T would have to work out the numbering. SVPs are accurate and calibrated with standard provers.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Prentiss Searles stated the goal is to reinforce that SVPs are allowed, approved, and are recognized. Wants fair test conditions. This change is only an additional allowance, not a requirement. Feels this is developed and ready for Voting. The approach when using a SVP is to start with a primed line, no air is present. After that, it is accurate at both the ramp up and ramp down portion of the meter operation.

Doug Musick (Kansas) interpretation of maximum discharge rate can change from state to state. Is it the marked rate or the rate of the installation? It needs to be clarified.

Dmitri Karimov (Liquid Controls) supported "the meter's" is confusing. Should stay at "its". Also, add the word "continuous" may help. As written, it could imply that tests can be performed by starting and stopping.

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

Matthew Jambor (Marathon) remarked that 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 Alabama and Minnesota with traditional provers and SVPs and they netted the same results.

Michael Keilty stated these are used extensively and are of very high precision. Standards and requirements from API are stricter than NIST Handbook 44. Nomenclature LMD-23.2 is also assigned to a separate item in Block 5.

Doug Musick stated 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 NIST 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) stated their office compared a SVP to a 1000 gal prover in 2005. No longer has the data.

The Committee requested 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)

At the 2023 CWMA Annual Meeting, Prentiss Searles presented a slide show overview of SVP design and use. Prentiss Searles supported the item and noted that it is ready for vote.

Michael Keilty stated that API defines repeatability requirements for repeat runs. He also stated that if there is a change in the Block 5 Item, the section numbers for this item will change. Michael Keilty supports moving this item forward as Voting.

Loren Minnich supported this item as a voting. This was amended in 1996 with the intent to allow SVPs and noted that continued misunderstanding will be eliminated going forward with addition of this item to NIST HB 44.

John Hathaway supported this item and noted that removing the 50-gallon minimum is a good thing and also supports "shall" to be used instead of "should."

Greg VanderPlaats (Minnesota) opposed this item. There is no guidance in the handbook for testing these devices. The passing of GEN-23.1 would make this item a moot point. The director has the authority to deny use within their jurisdiction, which already exists anyway in Fundamental Considerations.

Matt Jambor (Marathon) stated that technicians are trained for open neck provers and also SVPs and that open neck provers are used in states that don't allow SVPs.

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

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 <u>on a multiple-product, single discharge hose.</u>

(**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.)

(**Note:** At the 2022 Annual Meeting, this item did not receive sufficient votes to pass or to fail and was returned to the Committee.)

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

Submitter's Purpose and Justification:

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.

NIST OWM Executive Summary for VTM-18.1 – 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.

NIST OWM Recommendation: OWM believes the proposed changes represent a reasonable solution that will help minimize the potential for fraud with the use of manifold flush systems while allowing companies access to the safety-related benefits from the use of such systems in distributing products on VTMs. With the most recent version of the Item Under Consideration, OWM believes this item is ready for vote.

- A manifold flush system allows liquid to be diverted from the discharge line on single hose multi-product VTMs so that liquid of one product is not mixed with liquid of another in the discharge line.
- NIST Handbook 44 already includes provisions allowing the use of manifold flush systems.
  - However, without appropriate safeguards, these systems represent a significant potential for fraud.
  - OWM believes the current Item Under Consideration offers additional safeguards that are not present in the current NIST HB 44 language.
  - These changes will reduce the potential for facilitation of fraud with the design and use of these devices.
- When presented for a vote in 2019, this item (though revised multiple times in response to comments) failed to obtain sufficient votes to "pass" or "fail" and was returned to Committee.
  - Several additional variations to address comments and concerns were subsequently considered.
- In January 2020, this item was combined with a related Item VTM-20.1 (which proposed limits on the use of these systems with specific product types) with the goal of having the submitters of both items work together to reach a reasonable compromise between the two proposals.
- Since January 2020, the submitters of both items have worked to find a compromise that best meets the needs of the community.
- In developing the current proposal, the submitters considered concerns raised regarding the use of these systems, including:
  - the potential for facilitation of fraud with the use of these systems;
  - the potential for cross contamination of products in different tank compartments; and
  - the suitability of using a single meter for multiple product types.
- These concerns were balanced against comments indicating:

NIST OWM Executive Summary for VTM-18.1 – 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.

- these same product handling practices have occurred for many years without the use of such systems; and
- manifold flush systems can offer distinct safety advantages for drivers when flushing product.

- OWM continues to have concerns regarding the safety of delivering products such as gasoline and home heating oil through the same meter (and questions whether a single meter is suitable for such purposes)
  - However, OWM recognizes this is already a widespread practice in the industry and placing a blanket limitation in NIST Handbook 44 may not best serve the community.
- OWM acknowledges the safety advantages of such a systems to the drivers since the drivers do not have to climb on top of the VTM truck to flush product from the line before delivering another product.
- OWM notes that such changes do not preclude a jurisdiction from implementing policies regarding the use of a single meter to dispense multiple different product types.

Table 2. Summary of Recommendations
VTM-18.1 – 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.

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		
NEWMA	Voting		
SWMA	Voting	1	Supports as V w/proposed amendment
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers	1		NY State, Murray Equipment, & NIST OWM (1/2022)
Retailers and Consumers			

Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 ~~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:

(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)

NIST OWM Detailed Technical Analysis:

Tina Butcher (NIST OWM), Jim Willis (New York), and Jim Hathaway (Murray Equipment) met on December 2, 2021 to discuss the proposed changes to VTM-18.1. There were specific concerns raised with VTM-20.1, which was previously included with this proposal that still needed to be addressed which included concerns with contamination, safety, and fraud. It was agreed that in order to further develop a joint proposal, there was a need to resolve the concerns addressed in VTM-20.1 to the extent possible. Tina Butcher (NIST OWM), Diane Lee (NIST OWM), Jim Willis (New York), and John Hathaway

(Murray Equipment) met again on January 3, 2021. As a result of this meeting all parties agreed with the existing Item Under Consideration. In addition, the meeting participants agreed with adding a new User Requirement under UR.2.6. Clearing the Discharge Hose to the Item Under Consideration to address the concerns with the use of manifold flush systems with dissimilar fluids as follows:

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.

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)

Discussion points during the December 2, 2021, and January 4, 2022 meetings are outlined below:

Contamination and Safety:

- There is no disagreement over concerns about contamination and safety that can come about from inadvertent mixing of products in a storage tank.
- These concerns, however, are not unique to the use of manifold flush systems.
    - Whether product is flushed using a manifold flush system or by flushing into a compartment from the top opening, the risk of contamination is present and is of concern.
- If flushing is to be prohibited and/or the use of single meter/multiple product applications, it should be universally applied and presented as a separate proposed change to NIST Handbook 44, not just to systems equipped with manifold flush systems.
- Establishing minimum flush requirements might also assist with minimizing contamination.
- See recommendations below under “Dissimilar Fluids” and “Minimum Measured Quantity” that might help address these two concerns.
- It might also be acknowledged that the use of manifold flush systems is intended to address a different aspect of safety and that is safety of the driver when conducting a flush operation; the manifold flush system provides a safer way of accomplishing the task than climbing onto the top of a vehicle tank.

Dissimilar Fluids:

- The original proposal in 20.1 (from Murray Equipment) expresses concerns about the use of a single meter to deliver multiple products and suggests language that would limit the use of manifold flush systems only to those systems which have individual meters dedicated to individual products.

- Such concerns would appear to apply to all systems, not just those equipped with manifold flush systems.

- If a prohibition is to be added to NIST Handbook 44 regarding the use of individual meters for multiple products, this should be done as a separate requirement not included as part of paragraph S.3.1.

Minimum Measured Quantity (MMQ):

- The concept of establishing a minimum delivery size would seem to help minimize concerns over possible contamination however it may be problematic to craft a requirement to adequately cover all applications.

Fraud.

- The concerns about potential fraud are quite valid and have been expressed in OWM's comments from the inception of these requirements.

- The provisions for manifold flush were modified to include various provisions to limit that potential.

- Proposed changes to the existing language in the original Item 18.1 and as shown in the current "Item Under Consideration" include additional recommendations to minimize the potential for fraud when installing and using manifold flush systems. If the additional provisions are adopted, this would help reduce that potential.

Additional Points – Mechanical Metering Systems:

- Some manufacturers raised questions regarding whether communication between the manifold flush system and mechanical metering systems is feasible, raising concerns about the newly proposed changes to S.3.1.1. Means for Clearing the Discharge Hose paragraphs (f) and (g).

- Those manufacturers expressed intent to explore this point more carefully.

NIST OWM provided previous comments to this item. Some oppose modifications that will restrict the use of manifold flush systems with only certain products. Some oppose use of manifold flush systems unless there is a restriction placed on the products with which the system can be used. The submitters (including NIST OWM) will need to work together to find a solution amenable to both views.

- As noted by Jim Willis (New York) during the NEWMA meeting, New York, Murray Control Systems, and NIST OWM will work together to finalize a recommendation for this item.

- NIST OWM looks forward to working with the other submitters (New York and Murray Equipment) to find a solution that is more widely supported.

- For reference, OWM has retained the technical comments offered in its original analysis below.

Background to Consider:

- Based on comments at the 2019 NCWM Annual Meeting from the submitters of Item VTM-18.1 (New York & NIST OWM) and with support from the Meter Manufacturers Association, the Committee agreed to modify items (f) and (g) in the proposal and to designate part (g) as nonretroactive as of January 2022 to become retroactive January 2025.

- At the July 2019 meeting, comments from Murray Equipment noted significant problems with fraud in Europe where they are permitted, suggesting the item be withdrawn.

- Comments from Florida at the July 2019 meeting suggested limiting the application to only certain products. This issue is addressed in the new Item 20.1 from Murray Equipment, which was subsequently withdrawn and is now included in this item (VTM-18.1).

- When presented for a vote, the revised item failed to obtain sufficient votes to "pass" or "fail" and was returned to Committee.

- In reviewing the proposals, one needs to recall that a manifold flush system allows liquid to be diverted from the discharge line on single hose multi-product VTMs so that liquid of one product is not mixed with liquid of another in the discharge line.

- OWM acknowledges the safety advantages of such a system since the operator does not have to climb on top of the VTM truck to flush product from the line before delivering another product.

- However, without appropriate safeguards, these systems represent a significant potential for fraud. Concerns have been voiced over this potential at multiple national and regional meetings.

OWM offered the following comments on Item 18.1:

- At its Fall 2019 meeting, NEWMA recommended changes to extend the nonretroactive date. OWM recognizes this extension may help move the item forward and, thus, help reduce the potential for fraud when using these systems. OWM would also like to hear from the Meter Manufacturers Association regarding the difficulty designing communications between the metering system and the flushing system and the feasibility of an earlier nonretroactive date.

- At its Fall 2019 meeting, NEWMA also recommended eliminating the retroactive date. Given the potential to facilitate fraud and a number of comments received to that effect over the past several years, OWM is concerned with the proposed elimination of the retroactive date. However, if this will allow the item to progress it may represent a viable solution. OWM heard from New York regarding the extensive number of systems already in the field, particularly mechanical ones which may not lend themselves to modification. OWM is also interested in how others view the proposal to eliminate the retroactive date.

- The remaining regional associations recommended the item be given Developing status to permit the submitters to address concerns raised during the Annual Meeting.

- Comments from the SWMA voice serious concern about the potential for cross contamination of products. The proposal in Item 20.1 may help to address this by including limitations on the type of products with which these systems can be used.

- WM believes the term "operational" should be deleted from proposed paragraph UR.2.6.1. since the key point is that the system should not be used when a commercial transaction is in progress.

OWM offered the following comments to consider in addressing the recommendations originally presented in VTM-20.1 and now included as part of this item (VTM-18.1):

- OWM notes that one jurisdiction (New York) in NEWMA specifically opposes the limitation of product types. The S&T Committee will have to consider how to address this.

- After discussing the proposed limitation of using manifold flush systems to only products other than engine fuels with News York W&M, OWM recognizes there may be instances where a VTM is used to transport only engine fuels of different types and grades. OWM recognizes that a blanket limitation may unintentionally impact applications that may not have been considered under Item 20.1.

- While OWM continues to have concerns regarding the safety of delivering products such as gasoline and home heating oil through the same meter (and questions whether a single meter is suitable for such purposes), OWM recognizes this is already a widespread practice in the industry and placing a blanket limitation may not best serve the community. OWM suggests working with the submitter of 20.1 to see if there are ways to resolve specific concerns without impacting other applications.

- In its review of these issues, OWM also noted the need to clarify when paragraph S.3.1.1. applies and suggests the addition of the terms "multiple-product, single discharge hose" to both the title and preamble.

Summary of Discussions and Actions:

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

The obvious concern is that this makes it very easy for the driver to circulate product through the meter prior to 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 the tanker and clears the hose. The submitter has voiced concerns involving the safety of this practice noting that the operator could be subject to falls from the tanker. The distance between the flush system and the hose reel is also a factor in how easy it is for the driver to facilitate fraud.

Manifold flush systems are available from OEMs and can be found in various catalogs. Looking on multiple websites, these systems are being installed across the country and for some manufacturers seem to be standard equipment for new trucks. The submitter of VTM-1 has also seen these systems installed on trucks that are for sale where the seller notes the system as a selling point. He can foresee these

systems being mandated in the future as a safety requirement and would like W&Ms to have a clear policy before that happens.

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

This item was originally submitted by New York Department of Agriculture as a Developing Item. The item was intended to encourage uniformity in how manifold flush systems were being designed, installed, and regulated with the goal of minimizing the facilitation of fraud through the use of these systems while realizing the safety benefits provided by such systems.

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

In the period between 2018 and 2021, the Item Under Consideration underwent multiple changes based on feedback received at regional and national meetings and, more recently based on collaborations amongst the submitter of this and other related items, which resulted in the current Item Under Consideration. In developing the current proposal, the submitters considered concerns raised regarding the use of these systems, including the potential for facilitation of fraud with the use of these systems; the potential for cross contamination of products in different tank compartments; and the suitability of using a single meter for multiple product types. These concerns were balanced against comments indicating that product handling practices have occurred for many years without the use of such systems and there are distinct safety advantage for drivers when these manifold flush systems are used.

At the 2022 NCWM Interim Meeting, the Committee heard from Jim Willis 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. James Willis 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 (MMA), John Hathaway (Murray Equipment), Cheryl Ayer (New Hampshire), and John McGuire (New Jersey) also voiced support for the amended language and urged the item be given a Voting status. Hal Prince (Florida) opposed 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.

At the 2022 NCWM Annual Meeting, the Committee heard in its open hearings and voting session that some commenters were in favor of making the item retroactive.

Dmitri Karimov (speaking on behalf of the MMA) commented that the proposed changes are intended to reduce the potential for fraud and increase driver safety and the MMA supports the proposal as written.

Tina Butcher reiterated comments presented in the NIST OWM's Executive Summary (as shown earlier in this item). She commented that OWM believes the proposed changes are a reasonable solution to

incorporate additional provisions that will help further reduce the potential for fraud when these systems are in use and acknowledges the potential benefits to driver safety during a flushing operation. The proposed changes offer additional safeguards to already existing language. She also shared that the three submitters (New York, Murray Equipment, and NIST) have done a lot of work on this item since January 2020 and have strived to balance the concerns and comments expressed over fraud and cross-contamination with those of the distinct safety advantages for the driver. She also observed that the practice of flushing is already a widespread practice, but additional provisions are needed to limit fraud when manifold flush systems are used.

James Willis shared that these manifold flush systems are already in widespread use in New York. Smaller businesses use them and this provides a safer method for the flushing operation. He believes the item is fully developed and ready for a vote.

John Hathaway stated his support for the item and indicated he agrees with most of the changes made and supports the item as a voting item. Contamination is not eliminated entirely with these systems, but is minimizes, particularly with the addition of the proposed user requirement UR.2.6.2. Minimizing Cross Contamination. He continues to believe, however, that companies should not dispense dissimilar fuels through a single manifold system. In those cases, there needs to be two sets of meters and two manifold systems.

The Committee also heard comments in opposition to the proposal and original paragraph and also heard questions and concerns regarding the proposed nonretroactive status of some portions of the proposal.

Hal Prince opposed the proposal, noting he cannot endorse a device that can facilitate cross contamination of fuel. He stated that Florida will not allow these systems to be used. His major concern is with systems delivering engine fuels; he believes manifold flush systems should be prohibited on such systems. Hal Prince also noted the irony of changes made to ASTM standards relative to ensuring high quality fuels and then two weeks later considering the approval of a proposal such as this. He commented that the proposed language in UR.2.6.2. Minimizing Cross Contamination is a bit misleading, noting the act of properly flushing a system can cause contamination.

Charlie Stutesman (Kansas) observed that product flushing is already being done, but in a less safe manner. He commented that drivers should probably not go to the top of the vehicle tank for safety reasons and, if it's safer to carry out that procedure on the ground, this is the direction to go. Charlie Stutesman also noted his state is starting to see meters equipped with multiple calibration factors and he expects more vehicles will be going to a single meter system so we need something to address this. He questioned whether manifold systems can be retrofitted and asked if the requirements can be made retroactive rather than allowing these systems to operate without the additional safeguards.

Kevin Schnepp (California) indicated he agrees with the concerns shared by Hal Prince and Charlie Stutesman. He also opposed the last sentence in the recommended UR.2.6.2. Minimizing Cross Contamination, noting that the word "recommended" is not sufficient for regulatory action. He also observed that the phrase "radically different" is rather subjective making enforcement difficult.

Angela Godwin (San Bernadino County, California) agreed with the concerns regarding the nonretroactive status of some portions of the proposal and recommends those be made retroactive.

Cheryl Ayer supported the item but likes the idea of making the nonretroactive portions of the proposal retroactive.

During the voting session, James Willis suggested some changes that might help address Hal Prince's concern. He offered a proposed change of adding the phrase "at the discretion of the jurisdiction" to portions of the proposal to make it clear that the use of these systems is up to the jurisdiction with regulatory authority and allow decisions to be made within the jurisdiction regarding their use. However, this suggestion did not appear to satisfy the concerns raised.

In its addendum sheets, the Committee also recognized comments from previous meetings that time may be needed to facilitate the changes required. The Committee recommended no change to the Item Under Consideration in Publication 16 and presented the item for a vote. At the voting session, the Committee again heard comments opposing the non-retroactive status. However, the Committee presented the item as written based on the rationale shared in its addendum sheets.

This item did not receive sufficient votes to pass or to fail and was returned to the Committee. The Committee hopes the submitters will consider the comments heard during the meeting and continue work on the item.

Regional Association Reporting:

Western Weights and Measures Association

During the 2021 WWMA Annual Meeting Open Hearing the following comments were heard:

Matt Douglas (California - DMS) remarked that California supported further development. Has there been any further development since the Annual Meeting?

The WWMA S&T Committee recommended the status remain Developmental. The Committee recommended that the submitters (NIST, New York, and Murray Equipment) continue their work together to further develop the item.

During the WWMA 2022 Annual Meeting the following comments were received:

Scott Simmons (Colorado Division of Oil and Public Safety) supported this item. Flushing is happening already. It is dangerous to flush into the tank. You can run different products through the electronic meters very easily due to multipoint calibration. They need to be able to flush products through and do so safely. He thinks this is fully developed and it's time for it to pass and be part of the code.

Michael Keilty (Endress+Hauser and Chair of the NTEP Measuring Sector) stated they 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 was described that you cannot do this with an analog system.

Kevin Schnepp (California Division of Measurement Standards) stated he did not opposed to this item, wants to bring up that his concerns have not been addressed, "radically different characteristics" and "not recommended" is not an avenue for enforcement. Needs further developing.

Scott Simmons remarked 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. Does not need to be retroactive. Agrees with Kevin Schnepp to a point but doesn't want that to prevent this from going forward.

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

Southern Weights and Measures Association

During the 2021 SWMA Annual Meeting Open Hearing, no comments were received on this item. NIST requests this item remain Developmental.

This Committee recommended the status remain Developing at the request of the submitter.

The following comments were received during the 2022 SWMA Annual Meeting:

Jason Glass (Kentucky and NCWM S&T Committee member) proposed the following amendment to this proposal:

TM 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.

Hal Prince stated that he has been concerned with weak language on cross contamination in the past.

Michael Keilty stated that "electronic" should be added between hose and metering on page 187 line 10.

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

Northeastern Weights and Measures Association

During the 2021 NEWMA Interim Meeting open hearings, comments were heard from Jim Willis (New York) as submitter of this item. He stated that communication was in process with Murray Controls in regard to changes to this proposal. The flushing "systems" have been around for decades and not just as OEM systems. The driver would climb on top the truck to flush a line. Now they can flush the hose without the danger of falling off the truck. Some suggestions have been made to limit the products carried on the truck to similar products. NYS does not support such language as the flush system actually allows for the safe clearing of the hose and minimizes contamination. A flush manifold enables a truck to carry different products at the same time.

James Willis recommended further development. Lou Sakin (Hopkinton/Northbridge, Massachusetts) asked when development may be finished. James Willis responded that hopefully by the NCWM Interim Meeting. John McGuire (New Jersey) supported Developing status.

The NEWMA Specifications and Tolerances Committee recommended that this item remain in Developing status and encouraged New York, NIST, and Murray Controls to continue working towards full development.

During the 2022 NCWM Interim Meeting James Willis recalled a recent incident in New York 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. James Willis urged a Voting status on this item due to safety considerations. Michael Keilty (Measuring Sector Chair) 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. John Hathaway 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. John 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. John McGuire, James Willis, James Cassidy (Massachusetts), Cheryl Ayer, and Marc Paquette (Vermont) 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.

At the 2023 NEWMA Annual Meeting, Cheryl Ayer stated that this technology is currently being used in the marketplace and needs regulations.

Support for this item was voiced by Walt Remmert (Pennsylvania), Ethan Bogren (Westchester, New York), James Cassidy (Massachusetts), Loren Minnich (NIST OWM), James Willis, and Jason Flint.

Adam Simons (St. Lawrence County, New York) was on site during an inspection where an explosion occurred, and this technology may have prevented it.

Michael Keilty (spoke as Chair of the Measuring Sector) noted that this is not for analog meters, only electronic meters, and they will be writing test procedures to be put into NCWM Publication 14.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a voting status with no changes, and the body concurred.

Central Weights and Measures Association

During the CWMA 2021 Interim Meeting, the CWMA heard comments from the floor. Diane Lee (NIST OWM) commented about this item in the NCWM Annual report. Charles Stutesman (Kansas) asked if the intent of this item was for vehicle motor fuel or for all items such as home heating oil.

CWMA S&T Committee recommended item as a Developing Item.

During the 2022 CWMA Annual Meeting, the CWMA heard no comments from the floor and recommended this item remain a Voting item.

During the 2022 CWMA Interim Meeting Dmitri Karimov (Liquid Controls) noted that 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.

At the 2023 CWMA Annual Meeting, Loren Minnich commented that this item is fully developed and OWM supports as voting. The item is a reasonable solution to help minimize fraud for systems that utilize

this equipment. Mixing products already occurs, and this is not intended to address that. Use of this equipment makes flushing safer.

John Hathaway commented that manifold flush systems are already allowed in HB44. This adds detail and improves existing code to minimize fraud and apply additional user guidance. Additional language that describes more detailed "single hose single meter" system. Delivery trucks are often multiple compartments which have 2 different meters/systems/hoses. When fluids are changed and no manifold system is in place, they either flush into customer's tank or climb on top of truck and flush into truck. This system makes it safer and more accurate. Can be more accurate if we adopt this item? Move forward as voting.

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

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 NCWM Interim Meeting.)

(**Note:** The Item Under Consideration was removed from the voting consent calendar at the 2021 NCWM Annual Meeting and the S&T Committee made this a Developing Item.)

Source: POUL TARP A/S

Submitter's Purpose and Justification:

Change tolerances to accommodate more efficient milk-metering systems.

NIST OWM Executive Summary for VTM-20.2 – Table T.2. Tolerances for Vehicle Mounted Milk Meters.
NIST OWM Recommendation: OWM supports the Assigned status for this item and encourages the task group to continue its review of the proposed OIML tolerances for Vehicle Tank Milk Meters. • One of the questions raised concerning the current proposal that includes the OIML tolerances is that the proposal includes tolerances for the system and a separate tolerance for the meter. • NIST OWM observed that a separate tolerance for the meter would apply during OIML type evaluation. However, NIST HB 44 only includes requirements for the entire measurement system and not separate main elements nor does it have separate tolerances for main elements known to be metrologically significant. • NIST OWM will look forward to more discussion of this item during task group meetings.

Table 2. Summary of Recommendations
VTM-20.2 Table T.2. Tolerances for Vehicle Mounted Milk Meters.

	Status Recommendation	Note*	Comments
Submitter			
OWM	Assigned		
WWMA	Assigned		
NEWMA	Assigned		
SWMA	Assigned		
CWMA	Assigned		
NCWM	Assigned		

	Letters of Support	Letters of Opposition	Comments
Industry		4	
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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~~

~~Indication (gallons)~~	~~Maintenance Tolerance (gallons)~~	~~Acceptance Tolerance (gallons)~~
~~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)

NIST OWM Detailed Technical Analysis:

A Milk Meter Task Group Meeting last met on January 3, 2022 to further discussed the proposed tolerances for Milk Meters. This is a proposal to increase the tolerances for vehicle mounted pump metering systems that measure milk and the proposed tolerance are those used in OIML for milk measuring systems.

	Proposed Tolerance		**Current NIST Tolerance**		**Proposed Tolerance**		**Current NIST Tolerance**	
Collected volume	**Maintenance**		**Maintenance**		**Acceptance**		**Acceptance**	
	Gallon	Percent %	Gallon	Percent %	Gallon	Percent %	Gallon	Percent %
50 Gallon	0.25	0.5 %			0.25	0.5 %		
100 Gallon	0.5	0.5 %	0.5	0.50 %	0.5	0.5 %	0.3	0.30 %
200 Gallon	1	0.5 %	0.7	0.35 %	1	0.5 %	0.4	0.20 %
300 Gallon	1.5	0.5 %	0.9	0.30 %	1.5	0.5 %	0.5	0.17 %
400 Gallon	2	0.5 %	1.1	0.275 %	2	0.5 %	0.6	0.15 %
500 Gallon	2.5	0.5 %	1.3	0.26 %	2.5	0.5 %	0.7	0.14 %

The submitter explained that use of vehicle mounted pump metering systems to measure milk reduces the amount of time needed to collect and process the milk which reduces the cost and loss of product that would occur with a slower measurement process. But, with the use of vehicle mounted pump measuring

systems, entrained air is produced that cannot be removed and this air is measured as product. As such, with the use of a pump metering system there is an inherit loss to the buyer. Although the system has means for air elimination, not all entrained air can be removed and this is the submitter's reason for requesting that the tolerances currently in the HB be increased.

Poul Tarp also noted that it is recognized by the European Standardization Agencies: Measuring Instrument Directive (MID) and Organization of Legal Metrology (OIML) Recommendation (R) 117 *Dynamic measuring systems for liquids other than water* and the dairy industry in general that it is not possible to remove all the air from milk before measuring it. Poul Tarp notes that the MID and OIML (R) 117 standards specify that measurements of a vehicle mounted milk metering system must not result in inaccuracy of more than 0.5 % at any given amount being collected from a minimum of 50 gallons and up to +500 gallons. NIST HB 44 Section 3.31.has a designated tolerance table in volume for vehicle-mounted milk meters that was added to the code in 1989 with an acceptance tolerance of 0.3 and maintenance tolerance of 0.5 gallons for the first 100 gals and these tolerances decrease in percent tolerance as the indicated volume increases, as was reported in a presentation from Poul Tarp:

NIST OWM's initial points to consider as the Committee began to deliberate on the proposal were:

- Are there other methods that can be employed to remove entrained air from the milk?
- Can the amount of error introduced from entrained air be determined?
- Should NIST HB 44 tolerances be aligned with OIML R 117 less stringent tolerances, as recommended by the submitter.
- Should there be a separate tolerance table to address vehicle mounted pump metering systems?

During the 2019 NCWM Interim Meeting another company stated that they met the current tolerances in HB 44 and were issued an NTEP certificate and believe that the current tolerances are appropriate. Other State regulators commented that the current certificate was limited to testing up to 300 gallons. At that time the S&T Committee assigned a task group to this item and NIST OWM expressed interest in working with the task group.

Charlie Stutesman (Kansas), Chair of the Task Group, sent an email to the Milk Meter Tolerance Task Group (TG) providing a list of the TG members and the TG's mission. Charlie Stutesman also informed the Task Group that most communication will be conducted via e-mail and that face-to-face meetings will be planned at Interim and Annual Meetings.

The following list contains the names of members on the Milk Meter Tolerance TG:

Chair – Charlie Stutesman (Kansas)
NEWMA Representative – Jim Willis (New York)
SWMA Representative – TBD
WWMA Representative –Jeff Cambies (California)
NTEP Technical Advisor – Mike Manheim
NIST Technical Advisor – Diane Lee
Measurement Canada Technical Advisor –Luciano Burtini
Industry Representative – Carey McMahon (Poul Tarp)
Industry Representative – Leigh Hamilton (Piper Systems)
Industry Representative –Brandon Meiwes (Dairy Farmers of America)

Industry Representative – Bob Fradette (Agri-Mark)
Mitch Marsalis (Los Angeles County, California) has agreed to be the SWMA representative. I am just waiting on formal assignment by the NCWM Chair for Mitch.

Milk Meter TG Mission:

The mission of the Task Group is to review and possibly recommend changes to the tolerances that apply to milk meters, which may include milk measuring systems, in Sections 3.31. Vehicle Tank Meters, Section 3.35. Milk Meters, Section 3.37. Mass Flow Meters, and Section 4.42. Farm Milk Tanks. This TG will consider the tolerances proposed in S&T item VTM-20.2 and the tolerances in OIML R 117-2 "Dynamic measuring systems for liquids other than water" in their discussion."

Charlie Stutesman provided the Task Group with milk meter tolerances and requirements from OIML-R117-2: 2007, NIST HB 44 Tolerances for Milk Meters that are located in the VTM Code Section 3.31, the Mass Flow Meter Code Section 3.37, and the Farm Milk Code Section 4.42 and Measurement Canada's tolerances for milk meters and requested feedback from the task group on appropriate tolerances to apply. A Task Group member from Poul Tarp, the original submitter of the item, recommended that the proposal be changed to align NIST HB 44 with the tolerances for milk meters in OIML R-117-2. Charlie Stutesman circulated a proposal for consideration by the task group that would aligns the tolerances in NIST HB 44 Section 3.31 Table 2 with OIML to tolerances. OIML Tolerances seem to apply two different tolerances. 0.5 % tolerance for milk meters in a system and 0.3 % tolerance for a meter outside of a system that is used to measure milk. The proposed tolerances and changes to NIST HB 44 are provided below:

Table 2. Tolerances for Vehicle-Mounted Milk Meters

~~Indication (gallons)~~	~~Maintenance Tolerance (gallons)~~	~~Acceptance Tolerance (gallons)~~
~~100~~	~~0.5~~	~~0.3~~
~~200~~	~~0.7~~	~~0.4~~
~~300~~	~~0.9~~	~~0.5~~
~~400~~	~~1.1~~	~~0.6~~
~~500~~	~~1.3~~	~~0.7~~
~~Over 500~~	~~Add 0.002 gallon per indicated gallon over 500~~	~~Add 0.001 gallon per indicated gallon over 500~~

Table 2. Tolerances for Vehicle-Mounted Milk Meters

Indication (gallons)	Acceptance Tolerance	Maintenance Tolerance
Complete Measuring System	0.5 %	0.5 %
Meter Only	0.3 %	0.3 %

Proposed change to Handbook 44- Simple rewrite of table 2 and paragraph T.4. in 3.31 VTM Code and Table 1 in 3.35 Milk Meter Code.

3.31. Vehicle Tank Meters

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**)

If changes to the product depletion test tolerances in Handbook 44 are made to match OIML R117-1 paragraph 2.10.1:

T.4. Product Depletion Test. – The difference between the test result for any normal test and the product depletion test shall not exceed 0.5 % of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated higher than 380 Lpm (100 gpm) or 0.6 % of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated 380 Lpm (100 gpm) or lower. Test drafts shall be of the same size and run at approximately the same flow rate. **For vehicle tank meter measuring systems used to measure milk, the effect due to the influence of the air or gases on the measuring result shall not exceed 1.0 % of the quantity measured.**

Charlie Stutesman also asked the Task Group if consideration should be given to updating all of the codes pertaining to milk metering devices in NIST HB 44 and if all milk metering requirements should be included in a single code.

The NCWM Milk Meter Tolerance Task Group met virtually on January 7, 2020. During this meeting the Task Group discussed:

- the system of milk collection from farm to processer (seller to buyer),
- the operation of metering systems that measure milk to include discussion of air elimination systems,
- review of the milk measuring tolerances in NIST HB 44 from 1919 to 2020,
- review of the proposal to harmonize the NIST HB 44 VTM code milk metering tolerances with OIML tolerances for single milk meters and milk meter measuring systems, and
- whether or not the task group wanted to consider expanding its scope to include combining all milk metering requirements in NIST HB 44 to a single code.

By consensus the Task Group agreed with harmonizing the VTM milk metering tolerance with OIML R 117 tolerances and that those tolerance be presented during the NCWM 2021 Interim Meeting for discussion. The Task Group also agreed that a request should be made to the S&T Committee to expand the scope of the Task Group to include combining milk meter requirements in NIST HB 44 to a single code.

Charlie Stutesman (TG Chair) proposed the TG visit a location to review Milk Measuring systems in use as its next step. The Task Group last met on July 1, 2021.

NIST OWM is looking forward to gaining additional information on the various systems for milk metering and their capabilities and believes the task groups plans to visit a site will be helpful in determining the best approach for acceptable solution for milk metering systems. In the meantime, harmonizing with OIML tolerances may be an acceptable path forward. OWM reiterates its original questions concerning the operation of milk metering systems. OWM encourages the task group to continue its investigation of these systems.

Summary of Discussions and Actions:

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

Charlie Stutesman
Kansas Department of Agriculture
(785) 564-6681, **charles.stutesman@ks.gov**

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

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

The submitter provided the following:

> During the past 20 years, the need for improved efficiency in the collection of milk has resulted in the use of milk pumping equipment being installed on milk tankers.
>
> One of the most obvious places for a modern Dairy to optimize is the amount of time that the milk tanker uses to make a collection. If you can reduce the collection time at each farmer, the Dairy will be able to get a significant reduction in collection and transport cost for the benefit of the Farmer, Consumer and the Dairy itself. At the same time, you will get an environmental benefit as a result of reduced CO2 in the milk collection process.
>
> The consequence of introducing pump systems on milk tankers is that it causes air to be mixed with the milk which again will influence the accuracy of the magnetic flow-meter mounted in the system. Milk entrains air unlike petroleum liquids which do not. As you know, the flow meter will count anything that passes through the meter – liquid as well as air – and it is therefore essential that as much air as possible is removed from the milk before it reaches the flow-meter. However, it is widely recognized that it is not possible to remove all the air from the milk, which will result in an inaccuracy.
>
> It is therefore essential that the tolerances for vehicle mounted milk pump systems using magnetic flow-meters for determining milk volume reflects todays way of collecting milk. This means that existing Tolerance for milk meters cannot be used when the milk meter is a part of a system where different system parts will influence the accuracy of the count. Such milk metering systems will need to be classified with their own tolerances.

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

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

Yours sincerely

Poul Tarp
President POUL TARP A/S

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

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 31st, 2004 on measuring instruments (MID) with later amendments.

Issued to:	**Ingeniørfirmaet Poul Tarp A/S** **Jomfruløkken 4** **DK - 8930 Randers NØ** **Denmark**
Reference No.:	115-24938
Type of instrument:	Milk Measuring System on road tankers (or stationary)
Type designation:	PT LVMS - Poul Tarp Liquid Volume Measuring System
Type variants:	type 2, type 3 and type 4
Valid until:	August 10, 2025
Number of pages:	38 including appendix
Date of issue:	August 10, 2015

Approved by
Lene Savstrup Kristensen
Certification Manager

Processed by
Lars Parmo
Examiner

The conformity markings may only be affixed to the above type approved equipment. The manufacturer's Declaration of Conformity may only be issued and the notified body identification number may only be affixed on the instrument when the production/product assessment module (D or F) of the Directive is fully complied with and controlled by a written inspection agreement with a notified body.
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Appendix to

EC-Type Examination Certificate
Measuring Instrument Directive

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

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

The measuring system has the following characteristics

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

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

MS/Meter Type	GED Type	Qmax [m³/h]	Qmax [L/m]	Qmin [m³/h]	Qmin [L/m]	MMQ [L]	Inlet [mm]
Type2+4/C51	PTø355	22,2	600	4	67	300	51
Type3/C63	PTø506	80	1334	5	84/(250)*	300/(100)*	63,5
Type3/C76	PTø506	90	1500	12	200	300	75
Type3/C102	PTø506	90	1500	18	300	300	102

Note: The ratio between Qmax and Qmin of the measuring system, shall be at least 5 (5:1) within the flow rate range of the actual meter sensor in combination with relevant Gas elimination device.
*) MMQ 100 liter only after first delivery on full system.

Primary display on flow computer S12:

Indication:

Maximum capacity	99999 L	or	99999,9 L
Minimum increment of registration	1 L		0,1 L

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Applied documents

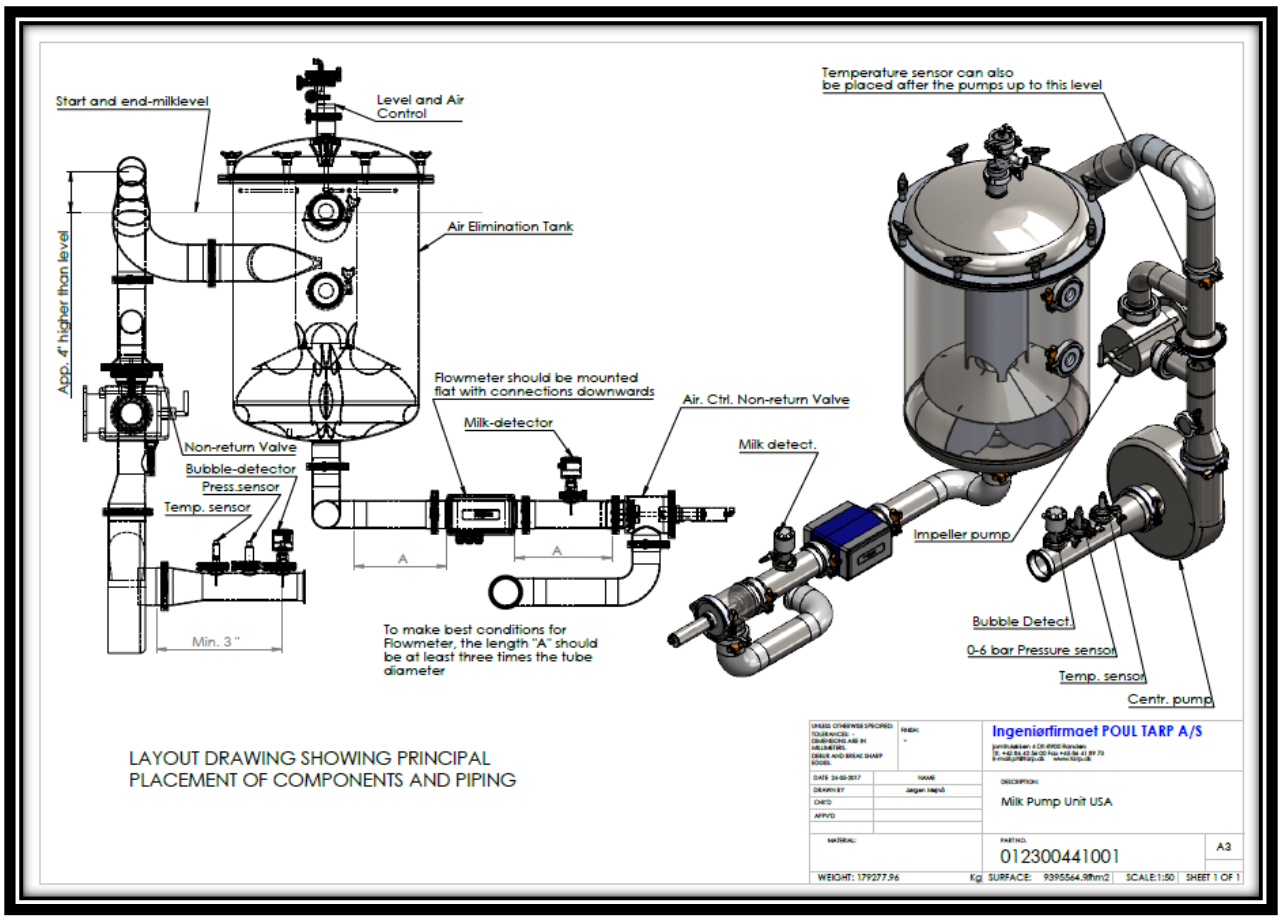
Recommendations	Guides
OIML R117 (1995)	WELMEC Guide 10.5 Marking of fuel dispensers (2006)
OIML R117-1 (2007)	WELMEC Guide 10.6 Sealing of fuel dispensers (2008)
OIML D11 (2004)	
OIML R117-2 Annex – E (CD2)	

Applied Evaluation Certificates belonging to this Type Examination Certificate:

- Evaluation Certificate Force Certification No. 115-24938.05, issued 10.08.2015
- Evaluation Certificate and Description NMI no. TC7204 rev 6, issued 26 august 2014
- Documentation folder NMI no. TC7204-4

Technical documentation
Reference no.: 114-30557.

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



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

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. Leigh Hamilton 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.

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

Doug Musick (Kansas) 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. Michael Keilty (Endress + Hauser) commented that he had concerns with Piper's certificate. Leigh Hamilton noted that Piper followed and followed guidelines as provided during the NTEP evaluation. Diane Lee (NIST OWM) stated that the Committee may want to consider a Developing status for this item and that more information is needed concerning air elimination methods for milk metering systems.

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

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

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

Tim Chesser (Arkansas) questioned whether the flow meter used in the system is appropriate and noted that there are many unanswered questions surrounding this issue. Jim Willis (New York) recommended a Developing status for this item. Kevin Schnepp (California) stated that although he is opposed to relaxing existing tolerances, he supports the development of this proposal by an assigned task group.

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

The NCWM 2020 Annual Meeting, due to the 2020 COVID-19 pandemic, 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.

At the 2021 NCWM Interim Meeting, the Committee heard from Charlie Stutesman who gave an update on the task group activities. Charlie Stutesman reported that the Milk Meter TG worked via e-mail communication and reviewed and discussed the proposed Milk Meter Tolerances in Agenda item VTM-20.2. The Milk Meter Task Group also discussed the tolerances that are included in NIST HB 44 for Milk meters in various parts of HB 44 which include the VTM, Section 3.31, Farm Milk Tanks, Section 4.42., Mass Flow Meters, Section 3.37, and Milk Meters, Section 3.35. Charlie Stutesman also reported that the TG reviewed OIML tolerances for milk meters. Charlie Stutesman stated that after a review of the various tolerances, the Task Group agreed that the OIML tolerances provide tolerances that encompassed the system of measuring milk and not just a tolerance for the performance of the meter. The Milk Meter TG agreed with proposing the use of the OIML milk meter tolerance as the milk meter tolerances in the VTM code. Charlie 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. Charlie Stutesman requested that this item move forward as a Voting item. The Committee also heard from Clark Cooney (California) 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 Committee's 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 group's 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 TG and that align with OIML tolerances.

At the 2021 NCWM Annual Meeting, Charlie Stutesman provided an update on the Milk Meter Task Group activities. Charlie 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 Charlie 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 Committee's work session, they agreed to a Voting Status for this item and added it to its voting consent calendar.

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

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

Table 2. Tolerances for Vehicle-Mounted Milk Meters

Indication (gallons)	Maintenance Tolerance (gallons)	Acceptance Tolerance (gallons)
100	0.5 0.6	0.3 0.5
200	0.7 1.2	0.4 1.0
300	0.9 1.8	0.5 1.5
400	1.1 2.4	0.6 2.0
500	1.3 3.0	0.7 2.5

At the NCWM 2022 Interim Meeting, Charlie Stutesman spoke as Chair of the Milk Meter TG. He requested that this item be assigned back to the Task Group for further development. Charlie Stutesman provided an update on the Task Group meeting in January 2022 in which they discussed tolerances in both 3.31 Vehicle Tank Meters and 3.35 Milk Meters and the need to have the tolerance be applied to both vehicle mounted and station meters as the manufacturers are developing meters that will be capable of being installed in either application. The tolerance tables can be found in the supporting documents. Charlie Stutesman also renewed the Task Group's request to expand its scope to include possibly creating a new code that contains requirements of both vehicle mounted and stationary milk meters and metering systems due to the unique properties of milk as a liquid. Speaking on behalf of himself, Charlie Stutesman stated that he has provided a document in the supporting documents that outlines the four active and five inactive NTEP certified meters and metering systems in terms of test draft size and applicable tolerances. He noted that the active four have a range of 0.12 % to 0.6 %. He also noted that milk meters are the only liquid measuring device where the volume tolerance decreases as the draft size increases and suggests percentages more in line with OIML tolerance would be more appropriate. Ken Ramsburg suggested combining the two tolerances to be used for field evaluations. Diane Lee commented that the Task Group should work toward making all test methods uniform. Diane Lee also suggested that the Task Group and Committee look at the comments from various companies concerning different tolerance along the distribution line for milk. Doug Musick and Matt Douglas (California) supported assigning this item to the Task Group for further development. During Committee work sessions, the Committee agreed to assign this item back to the Milk Meter TG so they may continue to ascertain data. In addition, the Committee agreed to request that NCWM Chair Hankins expand the scope of the TG to include all reference to milk meters, meter systems and related test methods, specifications and tolerance in an effort to harmonize the codes.

The Committee agreed to an Assigned status for the item.

At the NCWM 2022 Annual Meeting, the Milk Meter TG Chair Stutesman, provided a status update the TG activities. He mentioned the TG continues to support proposed tolerances as provided in the Item Under Consideration. He also noted that the goal is consistency of the tolerances for milk meter measuring. He also noted that another representative from the Western is need on the Milk Meter TG.

At the Committee's work session, the Committee agreed to keep an Assign status for this item.

At the 2023 NCWM Interim Meeting, Dr. Matt Curran (Florida), stated that it appears that this item is lowering the tolerance to get a device to fit and supports as voting if that is the case. Tina Butcher (NIST OWM) commented in support of an assigned status and that the application systems and meter needs clarification. The Committee decided to leave this item as an Assigned status and hopes a new TG group Chair steps forward.

Regional Association Reporting:

Western Weights and Measures Association

During the 2021 Annual Meeting Open Hearings the following comments were heard:

Diane Lee put forth by TG working on milk meters. They are still in process of reviewing. It was put forth to vote but last-minute change to make it non retroactive. This put it back to Developing. What would happen to devices that are currently in the field? During the Annual Meeting this was returned back to Developing and NIST supports Developing.

The WWMA S&T Committee recommended the status remain Developmental. During the 2021 S&T Work Session Diane Lee was asked for further clarification on her testimony. She provided the following clarification: "During the Annual Meeting a proposal was made to add a non-retroactive date. Because questions were raised as to how this would affect existing devices the item was moved from Voting to Developing." The Committee looks forward to hearing from the working group.

During the WWMA 2022 Annual Meeting the submitter was not present, and no comments were heard.

During open hearings, 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. The WWMA S&T Committee recommended that this item remain Assigned.

Southern Weights and Measures Association

During the 2021 SWMA Annual Meeting Open Hearing no comments were received on this item.

This Committee would like to see more evidence and reasoning on why these devices should not have to meet the existing tolerances, and why the tolerances listed are appropriate.

This Committee recommended the item remain Developing so that the submitters can gather more evidence about the accuracy of these devices.

At the 2022 SWMA Annual Meeting, the following comments were received:

Matt Curran (Florida) stated he was concerned about increasing the tolerance for new technology.

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

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

Northeastern Weights and Measures Association

During the 2021 NCWM Interim Meeting Open Hearing the following comments were heard.

Jim Willis (New York) commented as a member of the Task Group about the field trip that was taken in Rochester New York just prior to the NCWM meeting in July to witness the truck mounted Milk Meters in action. The Task Group is asking for recommendations in regard to a tolerance value that people would be comfortable with. James Willis commented that the tolerance of 0.5 % is considered too large by some, but we have 0.4 % in the handbook now in-regards to checking a milk tank with a meter.

Jimmy Cassidy (Massachusetts) asked if any systems currently meet the requirements in the handbook and James Willis replied that currently there is one milk meter system on tank trucks that meets the requirements currently in the handbook.

The NEWMA Specifications and Tolerances Committee recommended that this item remain in Developing Status.

During the 2022 NEWMA Annual Meeting Open Hearings, James Willis commented as a member of the Milk Meter Task Group. He indicated that the Task Group has made strides and hopes for ability to perform additional work on the item.

After hearing comments from the floor, the Committee recognized the need for further development of the item and recommended that the item retain an Assigned status. The Committee recommended the NCWM Milk Meter Task Group continue to work with stakeholders to further develop this item.

During the 2022 NEWMA Interim Meeting, no comments were heard from the floor, however the Committee recommended that this item retain an Assigned status with the Milk Meter Tolerance Task Group.

During the 2023 NEWMA Annual Meeting, James Willis stated that the Task Group does not have a Chair and no work on this item has not moved forward. He stated that he was in favor of this item at first as it would have relaxed the tolerances a little, but meters are now able to meet the tolerances that currently appear in the handbook. More data is needed from the system that is already type approved.

After hearing comments from the floor, the Committee recommended to the body that this item maintain an Assigned status, and the body concurred.

Central Weights and Measures Association

During the 2021 Interim Meeting Open Hearing, the Committee heard comments from the floor. Charles Stutesman (Kansas) would like to see item be returned to Task Group.

CWMA S&T Committee recommended that the item be assigned to Milk Meter Tolerance Task Group and be an Assigned Item.

During the 2022 CWMA Annual Meeting Open Hearing, Charlie Stutesman remarked that following the 2022 NCWM Interim Meeting, this item was sent back to the MMTTG. Moving forward with staying with original tolerances that were proposed. Request to expand scope has been submitted. There will be a MMTTG meeting prior to the July NCWM Annual Meeting. Hoping to move forward and elevate to Voting status for next cycle.

The CWMA S&T Committee recommended this item to remain an Assigned Item.

During the 2022 CWMA Interim Meeting, no comments were heard from the floor.

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

During the 2023 CWMA Annual Meeting no comments were received. The CWMA S&T Committee recommends this item remain as Assigned to the Task Group.

LPG – Liquified Petroleum Gas and Anhydrous Liquid-Measuring Devices

LPG-15.1 V N.3. Test Drafts.

(Note: 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

Submitter's Purpose and Justification:

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

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

Michael Keilty
Endress + Hauser Flowtec AG
(970) 586-2122, **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.

NIST OWM Executive Summary for LPG-15.1 – N.3. Test Drafts.

NIST OWM Recommendation: Along with the proposed agenda items GEN-23.1, Block 7 and Block 8 which address the use of field reference meters NIST OWM supports this item as a Voting item.

- Agenda item GEN-23.1 provides a General Code requirement for all devices and those standards that can be used to test those devices including those approved by the State Director.
- Agenda item 7 changes the language in the tolerance paragraphs to provide consistency with the changes in the combined amended proposals of 2022 S&T Agenda Item Block 8.
- Block 8 clarifies what has long been recognized in NIST HB 44 concerning the responsibility for acceptance of a standard.
- State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use.
- NIST OWM is also supporting the use of various types of field test standards through the purchase of several meters and the collection of data throughout the U.S.
- Currently the NIST OWM meter for testing CNG dispensers has been circulated to Colorado and Florida for data collection. The CNG meter, after it is returned from Florida, will be recalibrated before sending it out to other participating States.

  The NIST OWM is preparing to collect laboratory data on its two Coriolis units that will be used to test LPG dispensers. The laboratory data will be used to evaluate the Coriolis units and to identify any problem prior to circulating the units to participating States.

NIST OWM Executive Summary for LPG-15.1 – N.3. Test Drafts.

- The NIST OWM Coriolis unit that will be used to test loading racks is currently in NIST shop for repairs to the base of the units that likely happened during shipping. Once repairs are complete laboratory testing may be conducted before the unit is circulated to participating states.
- Plans are to keep all units in circulation as data is collected and analyzed.
- GEN-23.1 provides a requirement for all devices to avoid the need to specifically reference individual test methods in each specific code, it avoids the potential of implying that test methods not specifically referenced in a code would not be appropriate.

Table 2. Summary of Recommendations
LPG-15.1 – N.3. Test Drafts

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Withdraw		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

	Letters of Support	Letters of Opposition	Comments
Industry	3	4	
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 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)

NIST OWM Detailed Technical Analysis:

State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use.

NIST OWM is also supporting the use of various types of field test standards through the purchase of several meters and the collection of data throughout the U.S.

Currently the NIST OWM meter for testing CNG dispensers has been circulated to Colorado and Florida for data collection. The CNG meter, after it is returned from Florida, will be recalibrated before sending it out to other participating States.

The NIST OWM is preparing to collect laboratory data on it's two Coriolis units that will be used to test LPG dispensers. The laboratory data will be used to evaluate the Coriolis units and to identify any problem prior to circulating the units to participating States.

The NIST OWM Coriolis unit that will be used to test loading racks is currently in NIST shop for repairs to the base of the units that likely happened during shipping. Once repairs are complete laboratory testing may be conducted before the unit is circulated to participating states.

Plans are to keep all units in circulation as data is collected and analyzed.

Along with the proposed agenda items GEN-23.1, Block 7 and Block 8 which address the use of field reference meters. NIST OWM supports this as a Voting item.

Summary of Discussions and Actions:

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

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 recommended that NIST update EPO 28 for CNG dispensers and EPO 26 for LPG Liquid Measuring Systems to include transfer standard meter tests. NIST Handbook 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 NIST 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.

At the 2019 NCWM Interim Meeting the 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.

At the 2019 NCWM Annual Meeting, Brett Gurney (NCWM Chair) 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:

Jason Glass
Kentucky Department of Agriculture
(502) 573-0282, **jason.glass@ky.gov**

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

Russ Vires (SMA) supports the Scale item, SCL 18.1; in this block, Dimitri Karimov (Meter Manufacturers Association) supports the Task Group activities, 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.

Kurt Floren (Los Angeles County, California) 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. Kurt Floren also questioned the statement in the definition "tested over a range of environmental and operational conditions that the measuring devices is used…" Kurt Floren noted that he was unsure if all laboratories will have the capabilities to test over this wide range of conditions. Kurt 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.

Steve Harrington (Oregon) echoed Kurt 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.

At the 2021 NCWM Interim Meeting the NCWM Field Standard TG Chair Glass provided an update on the Task Group activities. Jason 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. Jason Glass also reported that he would be stepping down as the TG Chair. Michael Keilty 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. Michael 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. Henry Oppermann (WM-Consulting), stated that data is needed to ensure that master meters can be used over a range of conditions. Robert 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. Michael 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. 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. 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.

At the 2021 NCWM Annual Meeting Jason 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. Michael 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.

At 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 Chair. 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.

At the 2022 NCWM Interim meeting, the Item Under Consideration is provided below:

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)

Michael 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 examples of master meters. An abbreviated copy of the presentation is available on the NCWM website in the interim meeting documents archive. Michael 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 Robert 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 Charles Stutesman (Kansas) echoing these concerns. Diane Lee (NIST OWM) requested that more data be made available so that NIST is able to compare worldwide data against test data compiled within the U.S. 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 OWM) expressed that she recognizes the use and importance of master meters but is concerned with the purpose of this item. Tina Butcher suggested that the statement for use be reworked as test draft criteria is so critical. Tina Butcher 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.

During the 2022 Annual Meeting Ms. Tina Butcher provided the NIST OWM Technical Analysis for this item and as addressed in this report she pointed out that a new general code requirement will be proposed for the new 2023 cycle that not only avoids the need to specifically reference individual test methods in each specific code, it avoids the potential of implying that test methods not specifically referenced in a code would not be appropriate.

Further comments were provided that OWM believes the purpose for this item, as specified by the submitter, is better addressed from a technical standpoint in Item Block 8. OWM proposes that since the purpose of the proposal is to allow field standard meters to be used to test and place into service dispensers and delivery systems, and the responsibility for allowance of these field test standards are already addressed in the NIST Handbook 44 Fundamental Considerations, and Item Block 8 clarifies these responsibilities, Consideration be given to the proposal in Item Block 8 which clearly states the responsibility for allowance of field standards along with a 2023 new proposal to add a general code requirement.

Tina Butcher also noted that State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace and that NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use. But the proposed addition of another paragraph N.3.2 in the LPG Code that specifically references test draft for an individual test method (Field Standard Meter Test), potentially implies that test methods not specifically referenced in a code would not be appropriate.

The submitter of the item pointed out that the CWMA recommended that the item move forward as a vote and noted that a presentation was given at the CWMA about using meters to test devices. Also during open hearings, a weights and measures official spoke on the ease of use of meters to test device. Although NIST, OWM provided comments in support of the use of various standards to test commercial devices when data supports their use, and that the proposed paragraph N.3.2 in the LPG Code for this item would potentially imply that test methods not specifically referenced in a code would not be appropriate, the submitter of this item noted that he failed to understand why there was opposition the use of meters to test in use commercial meters and asked States to support the item.

During the Committee's work session, the Committee agreed to a Developing status for this item based on the comments heard on this item.

At the 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 the item forward as voting.

Michael Keilty commented on LPG-15.1 and MFM-15.1, he believes the meters can and will meet requirements and supports item as voting.

Robert Murnane also supported LPG-15.1 as voting item.

Tina Butcher 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 related items (LPG15.1, MFM-15.1, GEN-23.1, Block 7 and Block 8 are 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 Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received. Michael Keilty 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 from Michael Keilty who 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 Michael Keilty asked the S&T Committee to revise the titles to provide clarity; that revised language is now before us. Michael 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; Tina Butcher is not a submitter of this item. I will provide my comments to the Committee by email. In conjunction with this item Michael 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.

Robert Murnane 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.

Matt Douglas (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. 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.

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.

Kurt Floren (Los Angeles County, California) 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.

Michael Keilty recommended a Developing status.

Ed Williams (Ventura County, California) supported the recommendation for a Developing status.

Austin Shepherd (San Diego County, California) requested clarification on the reasoning for the Committee's 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.

Kurt Floren 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.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting, Michael Keilty recommended it move forward as a Voting Item with the new language.

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

Northeastern Weights and Measures Association

At the 2022 Interim Meeting, Michael Keilty 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. Michael Kielty indicated that he polled some states and he believes that having language in HB44 would enable those states to use field standard meters. Michael Kielty also noted that he has submitted a letter to the NEWAM S&T Chair with changes to the purpose statement and other modifications to the language and recommends a Voting status.

Robert Murnane asked what changed in the purpose statement and it was shared with the body. Robert 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. Robert Murnane also believes there is an issue with a 1-minute test. Robert Murnane does not believe this item is needed and

urged that submitter to work with submitters of Block 8. Michael 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.

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.

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. Diane Lee noted that Block 8 is just clarifying what I needed for selection of appropriate standards.

Robert Murnane indicated that he also called states referenced by Keilty and they are using the Fundamental Considerations for field standards.

Jim Willis (New York) believes this item is redundant, noted that as a Director, he already has the authority through Fundamental Consideration, and recommended withdrawal.

John McGuire (New Jersey), Walt Remert (Pennsylvania), James Cassidy (Massachusetts) and Lou Sakin (Holliston, Massachusetts) all recommended withdrawal of this item.

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

At the 2023 NEWMA Annual Meeting, Michael Keilty spoke as the submitter and noted that this item is based on other code sections that allow field standards, master meters, etc. Master meters are extremely reliable and allow for testing in a shorter period of time with higher flow rates. Robert Murnane concurs with Michael Keilty that the item is ready for a vote. Loren Minnich (NIST OWM) supported the item. Michael Keilty mentioned that there was a revision to the item for minimum test under test drafts. The language would replace "should" with "shall".

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 Interim Meeting, Michael Keilty recalled that the CWMA recommended this as a Voting Item for the 2022 NCWM. In May CWMA voted and approved this item. Larger drafts than 1 minute can be used.

Robert Murnane noted that the purpose statement does not align with proposed change to N.3.

Numerous meters are 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.

At the 2023 CWMA Annual Meeting, Michael Keilty provided language to understand minimum test draft for field standard meter (1 minute) and supports this item. N.3.1. was not part of the original proposal. N.3.1. was added during the S&T Committee work at the 2023 NCWM Interim Meeting. Loren Minnich supported this item as voting. Robert Murnane fully supports this item as a voting item. John Hathaway, (Murray Equipment) supported the item and likes the change of "should" to "shall".

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

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 Item Under Consideration has been updated since the 2022 Interim Meeting. The current item is a combined effort of the National Propane Gas Association and U-Haul International, Inc.

Note: At the 2022 Annual Meeting this item was designated as Developing. During the 2022 Fall Regional Meetings, the submitter requested that this item be Withdrawn and that consideration be given to Item LPG-23.)

Source: National Propane Gas Association

Submitter's Purpose and Justification:

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

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 **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 %).

Table 2. Summary of Recommendations
LPG-22.3 – S.2.5. Zero-Set-Back Interlock., S.2.5.2. Zero -Set-Back Interlock for Stationary Customer -Operated Electronic Retail Motor-Fuel Devices.

	Status Recommendation	Note*	Comments
Submitter	Withdraw		
OWM	Withdraw		
WWMA	Withdraw		
NEWMA	Withdraw		
SWMA	Withdraw		
CWMA	Withdraw		
NCWM	Withdraw		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held

4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Cod 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 <u>Customer-Operated Electronic</u> 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)

NIST OWM Detailed Technical Analysis:

A similar proposal LPG-22.2, submitter U-Haul International, Inc. was withdrawn and both U-Haul International, Inc. and National Propane Gas Association collaborated to further develop LPG-22.3. Initially, the proposed changes, were made to an older version of the handbook. The current Item Under Consideration has been edited and changes are being proposed to the current version of NIST HB 44.

Per review of the discussion provided by the submitter, propane dispensed into a vehicle requires a trained operator to dispense the propane. From other proposals on the 2022 Interim Meeting report, it is NIST OWM understanding that some stationary propane dispensers have been retrofitted to dispense

propane as fuel for vehicles. As such these dispensers are now retail motor fuel dispensers and must meet the requirements for these devices in the LPG code.

The submitters explained in their justification that only trained operators can dispense propane into a vehicle and that these propane retail motor fuel dispensers do not meet the requirements for Zero-Set Back Interlock for Stationary Retail Motor-Fuel Devices. As such, the submitter is proposing that since these are not customer operated dispensers, and that the dispensers are operated by trained staff, the requirements in S.2.5.2. Zero-Set-Back Interlock for Stationary Retail Motor Fuel Devices should be revised to only apply to Customer Operated Electronic Retail Motor Fuel Devices The following are NIST OWM comments to this proposed change.

- If a dispenser is operating as a retail motor fuel device the current requirements for zero-set-back interlock apply whether or not it is operated by the customer or trained staff.

- The purpose of the Zero-Set-back Interlock is to ensure that an automatic interlock prevents subsequent delivery until the indicating element is returned to zero.

- With the proposed changes, any propane retail motor fuel device that is operated by trained staff could possibly not be returned to zero at the start the next transaction.

- Retail motor fuel dispenser such as gasoline dispensers are required to meet these requirements in a self-serve (Customer operated) or full Service (Trained staff operated) locations.

- Propane retail motor fuel devices, that are not customer operated, would not be required to meet S. 2.5.2. in the LPG Code.

- The title of the proposal will need to be updated with the current handbook paragraphs.

- In reference to requirements for a 5-minute timeout, the timeout was discussed by the conference in 2021. During those discussions 2, 3 and 5 minutes were discussed. The conference adopted a 3- minute timeout which was added to NIST HB 44 in 2021. Although timeout was discussed in the submitter's justification, the revised Item Under Consideration did not include a proposal for a change to the timeout requirements for LPG.

- NIST OWM is not in support of this proposal to change S.2.5.2 requirements in the LPG Code and feel that this creates different requirements for retail motor fuel devices used for other products. Also, a proposal is needed for consideration of changes to timeout for LPG.

Summary of Discussions and Actions:

During the 2022 NCWM Interim Meeting, Bruce Swiecicki (National Propane Gas Association), working in collaboration with U-Haul International, requested the Committee replace the proposal in its 2022 Interim Meeting agenda for this item with the following revised version:

Amend Handbook 44, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code 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)

S.2.6.2. Zero-Set-Back Interlock, Electronic Vehicle Mounted Meters.–- A device shall be so constructed 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 position. For individual deliveries, if there is no product flow for a maximum of five minutes the transaction must be completed before additional product flow is allowed. The 5-minute timeout shall be a sealable feature on an indicator.
[Nonretroactive as of January 1, 2021]

During Committee open hearings, Bruce Swiecicki acknowledge the proposal was based on an earlier version of NIST Handbook 44 and the paragraph numbering had changed. Consequently, the proposal needed modification to correspond to the 2022 version of the handbook. Bruce Swiecicki reported a two-minute time out was difficult to accomplish and suggested this be changed to five minutes.

During the Committee's work session, members of the Committee reviewed the revised proposal, which includes 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 (U-Haul International) to harmonize the two proposals.

Two officials supported Bruce Swiecicki's comments and were also in favor of a five-minute time out.

Diane Lee (NIST OWM) commented the proposal needed to be cleaned up to match the 2022 version of NIST Handbook 44. There was also a suggestion for the submitter to work with NIST OWM to further develop the proposal.

No comments were heard in opposition to the continued development of this item.

Following the 2022 NCWM Interim Meeting, the submitter of this item and Item LPG-22.2 collaborated on a joint proposal as requested and submitted it to the Committee in time that it could be added to the Committee's agenda for the 2022 NCWM Annual Meeting. See the Item Under Consideration for the new joint proposal. Because the submitters combined the two items into one, the Committee was able to withdraw LPG 22.2. from its agenda.

Based on limited notes, during the 2022 NCWM Annual Meeting, comments were heard from the submitters of this item that they opposed the changes as currently written in the Item Under Consideration because when LPG is dispensed it should be dispensed by a trained operator not customer operated. The submitters expressed that they do not believe separate requirements are needed for bottle filling and vehicle fueling. The submitters argued that that LPG dispensed as motor fuel is currently only 3 % of the market and that emphasis should be placed on the predominate use of these dispensers. The updated version that appears in the Item Under Consideration is the updated version provided by the submitters to

correct the item to the current NIST HB 44 code numbering. The S&T Committee informed the submitters that they can submit updated language to the regions since they have opposed what is currently in the Item Under Consideration.

During the Committee working session the Committee agreed that this item would retain a Developing status.

Editor Note 2: Although the submitter of this item appears to have proposed new language at the 2022 Interim Meeting, the language that appears in Interim Meeting write-up combines automatic timeout and zero setback interlock language under the section for Automatic Timeout. A new proposal was submitted separately for the 2023 NCWM review cycle that is the same proposal with the same structure errors (See the 2023 Interim Meeting agenda LPG-23.2). In addition, another proposal was submitted for the 2023 NCWM review cycle that appears to be a replacement for this item LPG-22.3 (See 2023 Interim Meeting agenda item LPG-23.1). If the submitters intend to withdraw LPG-22.3 and replace it with LPG-23.1 they can request that LPG-22.3 be withdrawn.

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

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comment was received, Konrad Philatowicz 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 recommended that this item be withdrawn.

Southern Weights and Measures Association

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 recommended this item be Withdrawn.

Northeastern Weights and Measures Association

During the 2022 NCWM Interim Meeting, Steve Timar (New York), pointed out that the 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 be Withdrawn.

Central Weights and Measures Association

During the 2022 CWMA Interim Meeting there were no comments from the floor.

The CWMA S&T Committee recommended this remain a Developing Item.

During the 2023 CWMA Annual Meeting, this item appeared as a withdrawn item on the agenda.

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

Source: National Propane Gas Association and U-Haul International

Submitter's Purpose and Justification:

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

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

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

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

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

For the minimal amount of retail motor fuel customers that a typical LP-Gas dispenser serves, both U-Haul and NPGA feel that this proposal represents the most equitable approach to date for balancing the

need to ensure fair transactions and consistent standards with how the LP-Gas industry currently dispenses LP-Gas and LP-Gas's future transportation applications as envisioned by the proposed changes to NFPA 58 without conducting costly industry-wide retrofits of existing, functioning multi-use equipment. Handbook 44 needs to work with industry to make technical standards economically feasible lest it risk the advancement of LP-Gas as a viable and clean motor-fuel.

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

The submitter requested that this be a Voting item.

NIST OWM Executive Summary for LPG-23.1 – S.2.5. Zero-Set-Back Interlock

NIST OWM Recommendation: NIST OWM believes additional discussion is needed concerning this item and how it will be enforced when other LPG devices are in use that require zero-setback interlock and also the impact of the proposed requirement on other retail motor fuel devices of other products used to fuel vehicles. We recommend changing the status of this item to Informational to allow the community additional time to contemplate the effect of adopting this item.

- Zero set-back interlock ensures that a device is returned to zero before another customer or services person uses the device for another transaction (to ensure that an automatic interlock prevents subsequent delivery until the indicating element is returned to zero) thus preventing the facilitation of fraud per G-S.2. Facilitation of Fraud.

- The LPG Code paragraphs S.2.5.1 and S.2.5.2 address electronic stationary and other stationary devices because the process for zero-set-back interlock operates differently for an electronic stationary device than it does for a stationary retail motor fuel device as described in S.2.5.2. but both devices are required to return to zero before another transaction is made.

- The submitter states that only a few transactions for LPG dispenser are for fueling vehicles and they are limited to use by trained staff. Paragraphs S.2.5.1 and S.2.5.2 are not dependent on who is dispensing the product or how often the device is used as a retail motor dispenser; the paragraphs are intended to ensure that the device is so designed that each new transaction starts at zero. What happens if they are used more frequently for use in fueling vehicles?

- According to the requirements both electronic stationary and stationary retail motor fuel dispensers must have a zero-setback interlock.

- If this proposal is adopted "***Devices Used Exclusively as"*** would be added to both S.2.5.1. and S.2.5.2. to exempt stationary retail motor-fuel devices that are used for purposes other than dispensing retail motor-fuel from having a zero-set-back interlock and a note would be added to S.2.5.1. that would exempt Analog devices used for purposes other than dispensing retail motor-fuel from having a zero-set-back interlock.

- Is this equitable to other products dispensed, such as gasoline dispensers. Gasoline dispensers are required to have a zero-setback interlock, and some are used to fill containers used for gasoline- powered equipment. Granted, the majority of gasoline dispensers are used to fill

NIST OWM Executive Summary for LPG-23.1 – S.2.5. Zero-Set-Back Interlock

vehicles; but does this create an unfair market situation where some fueling dispensers are required to have zero set-back interlock and others are not?

- The submitter also stated that proposed changes were introduced for consideration in 2023 to allow public refueling of LP Gas with safety precautions and with these new requirements zero-setback interlock is needed. How will LPG devices with and without zero-setback interlock be fairly- regulated?

Table 2. Summary of Recommendations
LPG-23.1 – S.2.5. Zero-Set-Back Interlock

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Informational		
WWMA	Voting		Item has revisions since recommendation was provided
NEWMA	Voting		
SWMA	Voting		Item has revisions since recommendation was provided
CWMA	Voting		
NCWM	Voting		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 <u>Devices used Exclusively as</u> 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:*

(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)

NIST OWM Detailed Technical Analysis:

Zero set-back Interlock ensures that a device is returned to zero before another customer or services person uses the device for another transaction (to ensure that an automatic interlock prevents subsequent delivery until the indicating element is returned to zero). The LPG Code paragraphs S.2.5.1 and S.2.5.2 address electronic stationary meters and other stationary retail motor-fuel devices because the process for zero-set-back interlock operates differently for an electronic stationary meter than stationary retail motor-fuel devices as described in S.2.5.2. but both devices are required to return to zero before another transactions is made.

The submitter states that only a few transactions for LPG dispensers are for fueling vehicles and they are limited to use by trained staff. These paragraphs are not dependent on who is dispensing the product or how often the device is used as a retail motor dispenser; the paragraphs are intended to ensure that the device is so designed that each new transaction starts at zero. What happens if they are used more frequently for use in fueling vehicles?

According to the current requirements both electronic stationary and stationary retail motor fuel dispensers must have a zero-setback interlock. If this proposal is adopted "***Devices Used Exclusively as***" would be added to both S.2.5.1. and S.2.5.2. to exempt stationary retail motor-fuel devices that are used for purposes other than exclusively for the dispensing of retail motor-fuel from having a zero-set-back interlock and a note would be added to S.2.5.1. that would exempt Analog devices used for purposes other than exclusively for the dispensing of retail motor-fuel from having a zero-set-back interlock.

As such the zero-setback interlock requirement would only apply to those devices that are used exclusively to fuel vehicles. Is this equitable to other devices, such as gasoline dispensers. Gasoline

dispensers are required to have a zero-setback interlock, and some are used to fill containers used for gasoline-powered equipment. Granted, the majority of gasoline dispensers are used to fill vehicles, but does this create an unfair market situation where some fueling dispensers are required to have zero set-back interlock and others are not?

The submitter also stated that proposed changes were introduced for consideration in 2023 to allow public refueling of LP Gas with safety precautions and with these new requirements zero setback interlock is needed. How will LPG devices with and without Zero-Setback Interlock be fairly regulated?

NIST OWM believes additional discussion is needed concerning this item and how it will be enforced when other LPG devices are in use that require a zero-setback interlock and to also consider the impact of the proposed requirement on other retail motor fuel devices that dispense other products used to fuel vehicles.

Summary of Discussions and Actions:

During the 2023 NCWM Interim Meeting, Wes Strawn (Red Seal) submitted changes to the Committee to modify this item. The Committee agreed to add 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.

Scott Johnson (U-Haul International) recommends item move forward as voting. He supported the zero-set-back interlocks but not for dual-use meters (that don't exclusively dispense vehicle fuel). Dmitri Karimov (Meter Manufacturers Association) supports the item with the changes submitted by Wes Strawn. Scott Simmons (Colorado Division of Oil and Public Safety) also supported the item with the changes submitted by Wes Strawn.

Kevin Schnepp (California Division of Measurement Standards) also supported the item with the changes submitted by Wes Strawn.

With the added note to S.2.5.1. the Committee believes this item is fully developed and assigned it a Voting status.

Regional Association Reporting:

Western Weights and Measures Association

During the 2022 WWMA Annual Meeting the following comments were received:

Konrad Philatowicz (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.

Scott Simmons 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 recommended that this item be assigned a Voting status.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, no comments were received on this item. The SWMA S&T Committee recommended this item move forward as a Voting Item.

Northeastern Weights and Measures Association

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

At the 2023 NEWMA Annual Meeting, Steve Timar (New York) opposed this item as it leaves the possibility of "hanging the nozzle".

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, there No comments were heard from the floor.

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

At the 2023 CWMA Annual Meeting there were no comments received on this item. The CWMA S&T Committee believes this item is fully developed and recommends Voting status.

LPG-23.2 V S.2.6. Automatic Timeout.

Source: National Propane Gas Association

Submitter's Purpose and Justification:

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.

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.

NIST OWM Executive Summary for LPG-23.2 – S.2.6. Automatic Timeout.

NIST OWM Recommendation: Different device types may require varying timeouts; as such, if 5 minutes is deemed appropriate for electronic vehicle tank meters NIST OWM supports this change.

- The Automatic time-out feature helps to prevents the use of the device by another customer when the preceding customer completes the transaction. This is achieved by requiring that the device automatically time-out after a specified time.
- The submitter is requesting that the automatic time out that is currently specified as 3 minutes for electronic vehicle mounted meters in the LPG code be removed from S.2.6.1 in the LPG code and another paragraph be created, S.2.6.3 for electronic vehicle tank meters and,
- The submitter is requesting that the automatic time out be extended to 5 minutes for electronic vehicle tank meters to account for the initiation time at the truck and moving the discharge hose to the customer tank which can exceed 150 feet.
- Discussion may be needed to determine how this will impact the VTM code requirements with Timeout requirements of three-minutes.
- Different device types will require varying timeout. As such, if the 5 minutes suggested is the appropriate industry standard for this device, NIST OWM supports this change.

Table 2. Summary of Recommendations
LPG-23.2 – S.2.6. Automatic Timeout

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Voting		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 an indicator.
(Added 20XX)

NIST OWM Detailed Technical Analysis:

The Automatic time-out feature helps to prevents the use the device by another customer, when the preceding customer completes the transaction. This is achieved by requiring that the device automatically time-out after a specified time. The submitter is requesting that the automatic time out that is currently specified as 3 minutes for electronic vehicle mounted meters in the LPG code be removed from S.2.6.1 in the LPG code and another paragraph be created, S.2.6.3 for electronic vehicle tank meters and, the submitter is requesting that the automatic time out be extended to 5 minutes for electronic vehicle tank meters to account for the initiation time at the truck and moving the discharge hose to the customer tank which can exceed 150 feet.

Discussion may be needed to determine how this will impact the VTM code requirements with Timeout requirements of three-minutes, but different device types will require varying timeout. As such, if the 5 minutes suggested is the appropriate industry standard for this device, NIST OWM supports this change.

Summary of Discussions and Actions:

At the NCWM 2023 Interim Meeting, the Committee believes this item is fully developed with the changes of "a" to "the" in paragraph S.2.6.3. and assigned the item a Voting status.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

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.

Kevin Schnepp (California Division of Measurement Standards) agreed with Scott 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 recommended that this item be assigned a Voting status.

Southern Weights and Measures Association

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

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

Northeastern Weights and Measures Association

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

At the 2023 NEWMA Annual Meeting, Loren Minnich (NIST OWM) stated that the steps to dispense LPG would necessitate a 5-minute timeout and supports the item.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, there were no comments from the floor. The CWMA S&T Committee recommends this item be Withdrawn.

At the 2023 CWMA Annual Meeting no comments were heard during open hearing. The CWMA S&T Committee believes this item is fully developed and recommends Voting status.

MLK – Milk Meters

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

Source: Milk Meter Tolerances Task Group

Submitter's Purpose and Justification:

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

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

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

The Submitter requested a Voting status for this Item.

NIST OWM Executive Summary for MLK-23.2 – Table T.1. Tolerances for Milk Meters

NIST OWM Recommendation: A review of this item by the Milk Meter Task Group when a new chair is appointed may be useful. We agree with other regionals that this item be assigned to the Milk Meter Task Group.

- The Milk Meter Task Group reviewed all the varying tolerances in HB 44 for Milk meters. Instead of keeping a decreasing tolerance as the test draft increases, as the tolerance in the Milk meters code, the Task Group is proposing that the tolerances as included in the 2023 interim Meeting Agenda for VTM-20.2 for milk meter also be adopted in the Milk Meter code.

NIST OWM Executive Summary for MLK-23.2 – Table T.1. Tolerances for Milk Meters
• With the Task Group Chair currently not assigned since Charlie Stutesman no longer works with Kansas Weights and Measures and is no longer Chair of the Milk Meter Task Group, a review of the item by the Task Group when a new chair is appointed may be useful. We agree with other regionals that this item be assigned to the Milk Meter Task Group when a new task group chair is assigned.

Table 2. Summary of Recommendations
MLK-23.2 – Table T.1. Tolerances for Milk Meters

	Status Recommendation	Note*	Comments
Submitter			
OWM	Assigned		
WWMA	Assigned		
NEWMA	Assigned		
SWMA	Assigned		
CWMA	Assigned		
NCWM	Assigned		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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**)

Table 1. Tolerances for Milk Meters

~~Indication (gallons)~~	~~Maintenance Tolerance (gallons)~~	~~Acceptance Tolerance (gallons)~~
~~100~~	~~0.5~~	~~0.3~~
~~200~~	~~0.7~~	~~0.4~~
~~300~~	~~0.9~~	~~0.5~~
~~400~~	~~1.1~~	~~0.6~~
~~500~~	~~1.3~~	~~0.7~~

~~Indication (gallons)~~	~~Maintenance Tolerance (gallons)~~	~~Acceptance Tolerance (gallons)~~
~~Over 500~~	~~Add 0.002 gallon per indicated gallon over 500~~	~~Add 0.001 gallon per indicated gallon over 500~~

~~(Added 1989)~~

Table 1. Tolerances for Milk Meters

	Acceptance Tolerance	Maintenance Tolerance
Complete Measuring System	0.5 %	0.5 %
Meter Only	0.3 %	0.3 %

(Amended 20XX)

NIST OWM Detailed Technical Analysis:

The Milk Meter Task Group reviewed all the varying tolerances in HB 44 for Milk meters. Instead of keeping a decreasing tolerance as the test draft increases, as the tolerance in the Milk meters code, the Task Group is proposing that the tolerances as included in the 2023 Interim Meeting Agenda for VTM-20.2 for milk meter also be adopted in the Milk Meter code.

With the Task Group Chair currently not assigned since Charlie Stutesman no longer works with Kansas Weights and Measures and is no longer Chair of the Milk Meter Task Group, a review of the item by the Task Group when a new chair is appointed may be useful. We agree with other regionals that this item be assigned to the Milk Meter Task Group when a new Task Group Chair is assigned.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received: Michael Keilty (Endress+Hauser) alerted the Committee that the Chair of the Task Group no longer works for the State of Kansas, leaving a vacancy for the Chair position. Matt Douglas (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 recommended that this item be assigned to the Milk Meter Tolerance Task Group and that this item be blocked with VTM-20.2.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting: Matt Curran (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 recommended this item be Assigned to the Milk Meter Tolerance Task Group.

Northeastern Weights and Measures Association

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

At the 2023 NEWMA Annual Meeting, Jim Willis (New York) stated the Task Group does not have a Chair and no work on this item has not moved forward.

After hearing comments from the floor, the Committee recommended to the body that this item maintain an assigned status, and the body concurred.

Central Weights and Measures Association

At the 2022 Interim Meeting, Doug Musick (Kansas) stated 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) stated that 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.

At the 2023 CWMA Annual Meeting no comments were received. The CWMA S&T Committee recommends this item remain as Assigned to the Task Group.

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

Submitter's Purpose and Justification:

Amend Handbook 44 to allow field reference standard meters to be used to test and place into service dispensers and delivery system flow meters. This item has been assigned to the submitter for further development. For more information or to provide comment, please contact:

Michael Keilty
Endress + Hauser Flowtec AG USA
(970) 586-2122, **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 HB 44 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.

NIST OWM Executive Summary for MFM-15.1 – N.3. Test Drafts.

NIST OWM Recommendation: OWM supports this item as a voting item with the changes that were made to the item under consideration along with the proposed agenda GEN-23.1, Block 7, and Block 8 which address the use of field reference meters.

- Agenda item GEN-23.1 provides a General Code requirement for all devices and those standards that can be used to test those devices including those approved by the State Director.

- Agenda Item 7 changes the language in the tolerance paragraphs to provide consistency with the changes in the combined amended proposals of 2022 S&T Agenda Item Block 8.

- Block 8 clarifies what has long been recognized in NIST HB 44 concerning the responsibility for acceptance of a standard.

- State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use.

- The NIST OWM is also supporting the use of field test standards through the purchase of several meters and the collection of data throughout the U.S.

- Currently the NIST OWM meter for testing CNG dispensers has been circulated to Colorado and Florida for data collection. The CNG meter, after it is returned from Florida, will be recalibrated before sending it out to other participating States.

  The NIST OWM is preparing to collect laboratory data on its two Coriolis units that will be used to test LPG dispensers. The laboratory data will be used to evaluate the Coriolis units and to identify any problem prior to circulating the units to participating States.

- The NIST OWM Coriolis unit that will be used to test loading racks is currently in NIST shop for repairs to the base of the units that likely happened during shipping. Once repairs are complete laboratory testing may be conducted before the unit is circulated to participating states.

- Plans are to keep all units in circulation as data is collected and analyzed.

Table 2. Summary of Recommendations
MFM-15.1 – N.3. Test Drafts

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Withdraw		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

	Letters of Support	Letters of Opposition	Comments
Industry	3		0ld opposition letters
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

(**Note:** The Item Under Consideration represents a change that was made to paragraph N.3.2. "**except for tests of the minimum measured quantity specified for the meter" was added** at the 2023 NCWM Interim Meeting.)

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. (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 except for tests of the minimum measured quantity specified for the meter.
(Added 20XX)

NIST OWM Detailed Technical Analysis:

Although this item has been on the agenda for a number of years, this item was group in a block of other similar items then removed from the block and placed back on the NCWM agenda as it originally appeared on the agenda.

Changes were made to the item under consideration at the 2023 NCWM Interim Meeting to address the issues with the minimum test draft being collected in less than 1 minute and along with the proposed agenda Item GEN-23.1, Block 7 and Block 8 which address the use of field reference meters, NIST supports this item.

Agenda Item GEN-23.1 provides a General Code requirement for all devices and those standards that can be used to test those devices including those approved by the State Director.

Agenda Item Block 7 changes the language in the tolerance paragraphs to provide consistency with the changes in the combined amended proposals of 2022 S&T Agenda Item Block 8.

Item Block 8 clarifies what has long been recognized in NIST HB 44 concerning the responsibility for acceptance of a standard.

State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use.

NIST OWM is also supporting the use of field test standards through the purchase of several meters and the collection of data throughout the U.S. NIST OWM is working with States using Coriolis meters to collect data on the use of these meters as standards to test liquid measuring devices. This data will be shared with all regulatory officials to assist them with their approval of meters as standards.

Currently the NIST OWM meter for testing CNG dispensers has been circulated to Colorado and Florida for data collection. The CNG meter, after it is returned from Florida, will be recalibrated before sending it out to other participating States.

NIST OWM is preparing to collect laboratory data on its two Coriolis units that will be used to test LPG dispensers. The laboratory data will be used to evaluate the Coriolis units and to identify any problem prior to circulating the units to participating States.

NIST OWM Coriolis unit that will be used to test loading racks is currently in NIST shop for repairs to the base of the units that likely happened during shipping. Once repairs are complete laboratory testing may be conducted before the unit is circulated to participating states.

Plans are to keep all units in circulation as data is collected and analyzed.

Summary of Discussions and Actions:

In the fall of 2016, Michael 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.

At the 2019 NCWM 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 NCWM 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 NCWM 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.

At the 2019 NCWM Annual Meeting, Chair Gurney 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:

Jason Glass
Kentucky Department of Agriculture
(502) 573-0282, **jason.glass@ky.gov**

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

Russ Vires (Scale Manufacturers Association [SMA]) supports the Scale item, SCL 18.1; in this block, Dimitri Karimov (Meter Manufacturers Association) supports the Task Group activities, 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.

Kurt Floren (Los Angeles County, California) 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. Kurt Floren also questioned the statement in the definition "tested over a range of environmental and operational conditions that the measuring devices is used…". Kurt Floren noted that he was unsure if all laboratories will have the capabilities to test over this wide range of conditions. Kurt 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.

Steve Harrington (Oregon) echoed Kurt Floren's comments. 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.

At the 2021 NCWM Interim Meeting, Chair Glass provided an update on the Task Group activities. Chair 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. Jason Glass also reported that the TG does not have a recommendation for this item. Chair Glass also reported that he would be stepping down as the TG Chair. Michael Keilty 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. Michael 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. Henry Oppermann (W&M Consulting) stated that data is needed to ensure that master meters can be used over a range of conditions. Robert Murnane 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. Michael 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. 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. 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.

At the 2021 NCWM Annual Meeting, Chair 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. 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 Chair. 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.

At the 2022 NCWM Interim Meeting, the Item Under Consideration presented at this meeting is provided below.

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)

Michael 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. Michael 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 requested that the Committee provide specific guidance if a Developing status is assigned. A comment from Robert Murnane 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 requested that more data be made available so that NIST is able to compare worldwide data against test data compiled within the U.S.

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 expressed that she recognizes the use and importance of master meters but is concerned with the purpose of this item. Tina Butcher suggested that the statement for use be reworked as test draft criteria is so critical. Tina Butcher 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 recommended that the submitter develop the item further by aligning language to existing language in NIST 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.

During the 2022 NCWM Annual Meeting, S&T Committee open hearings Tina Butcher provided the NIST OWM Technical Analysis for this items when she address NIST OWM comments to LPG-15.1 and as addressed in this report she pointed out that a new general code requirement will be proposed for the new 2023 cycle that would not only avoid the need to specifically reference individual test methods in each specific code, it avoids the potential of implying that test methods not specifically referenced in a code would not be appropriate.

Further comments were provided that OWM believes that the purpose for this item, as specified by the submitter, is better addressed from a technical standpoint in Item Block 8 and that NIST OWM proposes that since the purpose of the proposal is to allow field standard meters to be used to test and place into service dispensers and delivery systems, and the responsibility for allowance of these field test standards are already addressed in the NIST Handbook 44 Fundamental Considerations and Item Block 8 clarifies these responsibilities, that consideration be given to the proposal in Item Block 8 which clearly states the responsibility for allowance of field standards along with a 2023 new proposal to add a general code requirement.

Tina Butcher also noted that State and industry have a need to use various types of field test standards to evaluate commercial devices installed in the marketplace and that NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports its use. But the proposed addition of another paragraph N.3.2 in the MFM Code that specifically references test draft for an individual test method (Field Standard Meter Test), potentially implies that test methods not specifically referenced in a code would not be appropriate.

The submitter of the item pointed out that the CWMA recommended that the item move forward as a vote and noted that a presentation was given at the CWMA about using meters to test devices. Also, during open hearings, a weights and measures official spoke on the ease of use of meters to test device. Although NIST OWM provided comments in support of the use of various standards to test commercial devices when data supports their use, and that the proposed paragraph N.3.2 in the MFM Code for this item would potentially imply that test methods not specifically referenced in a code would not be appropriate, the submitter of this item noted that he failed to understand why there was in opposition and asked States to support the item.

During the 2022 NCWM Annual Meeting during the Committee work session, the Committee agreed to a Developing status for this item based on the comments heard on this item.

During the 2023 NCWM 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. Michael Keilty noted that for LPG-15.1 and MFM-15.1, the meters can and will meet requirements and supports the item as voting. Robert Murnane also supported S&T S&T MFM-15.1 as Voting item. Tina Butcher (NIST OWM) provided written OWM Technical Analysis, the two parties have met and come to an agreement and with the changes that have been made and being proposed, all three items are 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 Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

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.

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.

Michael Keilty commented on Robert Murnane's comments. Robert Murnane has submitted comments in June and Michael 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 three 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.

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.

Robert Murnane 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.

Matt Douglas (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.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Michael Keilty 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 recommended this item move forward as a Voting Item with the language above included.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Michael Keilty 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. Michael Kielty indicated that he polled some states and he believes that having language in HB44 would enable those states to use field standard meters. Michael Kielty also noted that he has submitted a letter to the NEWAM S&T Chair with changes to the purpose statement and other modifications to the language and recommends a Voting status. Robert Murnane asked what changed in the purpose statement and it was shared with the body. Robert 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. Robert Murnane also believes there is an issue with a 1-minute test. Robert Murnane does not believe this item is needed and urged that submitter to work with submitters of Block 8. Michael 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. 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. 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. Diane Lee noted that Block 8 is just clarifying what is needed for selection of appropriate standards. Robert Murnane indicated that he also called states referenced by Michael Keilty and they are using the Fundamental Considerations for field standards. Jim Willis (New York) believes this item is redundant, noted that as a Director, he already has the authority through Fundamental Consideration, and recommends withdrawal. John McGuire (New Jersey), Walt Remmert (Pennsylvania), James Cassidy (Massachusetts) and Lou Sakin (Holliston, Massachusetts) all recommended Withdrawal of this item.

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

At the 2023 NEWMA Annual Meeting, Michael Keilty stated he made modifications to this item regarding the MMQ after hearing comments from the body and would like to see this item listed as voting. Loren Minnich (NIST OWM) supports item as voting. Robert Murnane is satisfied with modification from submitter and supports voting.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Michael Keilty recalled that the CWMA recommended this as a Voting Item for the 2022 NCWM. In May CWMA voted and approved this item. Larger drafts than 1 minute can be used.

Robert Murnane stated that the purpose statement does not align with proposed change to N.3. Numerous meters are 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) suggested changes 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.

At the 2023 Annual Meeting, Michael Keilty noted that N.3.1 was not part of original item and a need to change the voting order for these items at the NCWM Annual meeting if possible. Michael Keilty provided a recommended voting order for the national meeting and addressed issues with the MMQ. Michael Keilty recommended that the item move forward with a voting status. He also noted that the API manual Chapter 4.5 talks about master meters. This would fall under that field provers have to be tested every five-years and portable every 3-years. API says field standard meters should be tested every year. Bob Murnane, Loren Minnich both supported the item as voting. In addition, John Hathaway (Murray Equipment) also supports as voting

Matt Jambor (Marathon) stated that terminals prefer SVPs over open neck provers. They would not use a field standard meter to calibrate their meters and is open to the idea.

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

HGM – Hydrogen Gas-Measuring Devices

HGM-23.1 D UR.3.8. Safety Requirement

Source: Quong and Associates, Inc.

Submitter's Purpose and Justification:

Add safety requirement for hydrogen gas measuring devices. The proper fueling of hydrogen vehicles is critical to ensure that the vehicle and high-pressure tank is not damaged. Unlike other gases, such as compressed natural gas, hydrogen heats as a vehicle is fueled due to the reverse Joule-Thompson effect. This means that the fueling rate and temperature of the hydrogen must be carefully controlled, or damage can occur to the vehicle hydrogen tanks. The hydrogen industry has done considerable work in developing standard fueling protocols in SAE.

> J2601 (**https://www.sae.org/standards/content/j2601_202005/**) and validation methods in ANSI/CSA HGV 4.3 (**https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/**) to ensure that the vehicles are fueledcorrectly and safely.
>
> The validation of SAE J2601 using ANSI/CSA HGV 4.3 has been performed on the 50+ hydrogen stations in California bythe 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 hydrogenfueling 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, includingstations 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 byARB is publicly available. (**https://h2tools.org/hystep-hydrogen-station-equipment-performance-device**)

The submitter provided the following links:

- SAE J2601: **https://www.sae.org/standards/content/j2601_202005/** (copyrighted)
- ANSI/CSA HGV 4.3 (**https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/**) (copyrighted)

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

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

- EVSE Pre_Rule Wkshop Shared Deck.pdf

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

NIST OWM Executive Summary for HGM-23.1 – UR.3.8. Safety Requirement

NIST OWM Recommendation:

- It has not been part of the weights and measures standards development process to include prescriptive safety requirements into handbook legal metrology standards.

- The dispenser's design features regardless of their function should not affect the metrological integrity of the equipment.

- Traditional fueling applications have established mechanisms to address the safety features of dispenser installations not typically within in the scope of the weights and measures authority.

- Groundwork is not outlined in the proposal detailing key elements that must be established for an SAE J2601 verification program and what standards if any apply to equipment in operation before the effective date.

Table 2. Summary of Recommendations
HGM-23.1 – UR.3.8. Safety Requirement

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM			
WWMA	Developing		
NEWMA	Developing		
SWMA	Developing		
CWMA	Developing		
NCWM	Developing		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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 testingdemonstrating conformance with the latest version of SAE J2601 Fuel Protocols for Light Duty Gaseous Hydrogen SurfaceVehicles, as determined by the latest version of ANSI/CSA HGV 4.3 "Test Methods for Hydrogen Fueling Parameter Evaluation."

[Nonretroactive as of January 1, 20XX]

NIST OWM Detailed Technical Analysis:

The proposal will essentially require weights and measures officials to assess compliance with an SAE and ANSI standards. The official will be required to verify the owner is operating dispensing equipment that holds fueling safety protocol certification to SAE J2601 which can involve the performance of the dispenser, its programing, communications capability, and the station's hydrogen storage system as well as a suitable test apparatus for use in the verification procedure. It has not been part of the weights and measures standards development process to include prescriptive safety requirements into handbook legal metrology standards. The dispenser's design features regardless of their function should not affect the metrological integrity of the equipment.

If it is just an inspection for possession of current documentation, that may be more palatable; however, that is not really clear from the proposal and weights and measures programs do not typically enforce safety standards. Will compliance with safety standards keep coming up as an issue with alternative fuel dispensing systems used in vehicle refueling applications? This is unlike traditional fueling applications which have established mechanisms to address the safety features of dispenser installations. How does each jurisdiction ensure that equipment has met safety standards without putting weights and measures programs in the position of having to verify the equipment complies with standards other than HB44, since that's not typically within the scope of their authority (other than a limited number of programs which do regulate safety requirements)?

Safety is always the first priority; however, has the groundwork been laid to provide all the key components to weights and measures jurisdictions to properly address existing and new installations of equipment. The safety community should be approached on lessons learned in similar applications and to determine all other options and possible opportunities to make stakeholders in the up-and-coming hydrogen marketplace aware of recommended practices for safe fueling protocols.

Summary of Discussions and Action:

At the 2023 NCWM Interim Meeting, Kevin Schnepp (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 that facilitates accurate and safe fueling. Supports item. Kevin Schnepp (California in response to Matt Curran's (Florida) comment, "it's a performance protocol as well," not just for safety.

Spencer Quong gave a presentation during open hearings. Heat generated from filling can cause damage. This is important to protect the consumer. Requests informational status, so the proposal can be continued to be developed.

Tina Butcher (NIST OWM) stated, typically NIST Handbook 44 does not include safety requirements. That generally rests with non-Weights and Measures agencies. She doesn't question the need but does question if NIST Handbook 44 is the right place for this. Matt Curran (Florida Dept of Agriculture and Consumer Services) echoed Tina Butcher's comments.

The Committee would like to see the metrological effect this has on the device. The Committee decided to keep this proposal as developing

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, there were no comments from the floor. The CWMA S&T Committee recommended this proposal as a Developing Item. Clarification regarding the term "verification" is needed.

At the 2023 CWMA Annual Meeting, there were no comments. The CWMA S&T Committee recommends this item remain Developing.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Kevin Schnepp (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 recommended that this item be assigned a Developing status with consideration to the concerns identified during open hearings.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Matt Curran questioned whether this was the proper venue for this item. Paul Floyd (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 this type of item is within the scope of weights and measures.

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

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Spencer Quong (submitter and representing Toyota Motors North America) explained the requirements for validation of fueling protocol through SAE. Spencer 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. 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. Jason Flint (New Jersey) 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 recommended that this item be given a Developing status.

At the 2023 NEWMA Annual Meeting, the Committee heard no comments on this item but recommended to the body that this item retain Developing status and the body concurred.

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

Submitter's Purpose and Justification:

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.

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 California Initial Statement of Reasons (ISOR) for adopting specifications and tolerances requirement for commercial EVSE, California 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, California DMS utilized 2015 DOE data stating that the average commercial Level 2 EVSE costs between $3,000 to$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**. 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 $92 M to upgrade the existing Level 2 station in the U.S. today and $74 M 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 means for tracking station service dates. California 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.

Item Under Consideration:

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.

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.

NIST OWM Detailed Technical Analysis:

As the weights and measures community continues to consider proposed new paragraphs A.1.1 and A.1.2 which would exempt EVSEs from all NIST HB 44 Section 3.40 requirements based on the dates these systems were placed into commercial use, NIST OWM would like to note the following concerns:

As worded the proposal is: (1) unclear on the exact type of use that entitles an EVSE to an exemption from all code requirements and also (2) in conflict with General Code paragraph G-A.6. Nonretroactive Requirements.

The proposal, if adopted, would mean an entire generation of devices will be permitted to operate for a 10-year period without having to comply with any HB 44 Section 3.40 requirements for indications, receipts, accuracy, security for metrological features, specific code markings, etc. for what may well be the lifetime of the device.

To allow such a blanket exemption does a disservice to the electric vehicle refueling industry and would be viewed as competitively unfair to traditional and other alternative vehicle fueling applications which are required to comply with similar requirements or EVSE manufacturers who are spending money to comply with current requirements.

The submitter needs to consider that, even if an effective date is added to an entire device-specific code, Section 1.10. General Code requirements will still apply.

For jurisdictions that don't automatically adopt the current version on NIST Handbook 44, this window of time during which noncompliant devices can continue to be installed will be even longer.

The USNWG EVF&S that developed the EVFS Code and modified the Timing Device Code (to recognize EVSEs) has been widely advertised and all stakeholders (including EVFS OEMs) encouraged to join. Many companies have been an integral part of the development of these requirements and have expended considerable funds to bring their equipment into compliance at a competitive disadvantage if a large group of competing devices were to be exempted from the requirements.

The proposal describes the marketplace as having "existing stations that often do not include an integrated meter" which might be an indication that available EVSEs placed into commercial use before the proposed enforcement date will have limited or no legal metrology components. In this case a notice is necessary for consumers that purchasing electricity from one site does not provide the same assurance of accuracy that is provided at another site.

If there are concerns about specific provisions in the code, these need to be addressed by making specific sections "nonretroactive" with sunset dates, not by exempting the device from the requirements of the specific code in entirety. Factored into any enforcement dates should be the fact that the EVFS codes have been available for over seven years (and was under development by regulators and industry for three years prior to that).

Throughout 2021 up through June 2022 NIST OWM has recommended the submitters revise their 2021 proposals to address concerns previously expressed by the USNWG EVF&S's EVFE Subgroup and weights and measures community prior to submission of any alternate proposals for a review of the EVFE Subgroup.

The submitters provided updates to the community in July 2021 about their work to revise the proposals in NCWM S&T Committee Agenda Items EVF-21.1 A.1. General and EVF-21.5 T.2. Load Test Tolerances. Their work was completed in early November 2021.

On November 20, 2021, NIST OWM provided input on the submitter's alternate proposal. This revised proposal modifies five NIST Handbook 44 Section 3.40 EVFS requirements (that address indicating elements, sealing, identification/marking, and tolerances). The submitters and NIST OWM met on December 7, 2021 to discuss NIST OWM's preliminary review and adjustments suggested for the alternate proposal. Subsequent revisions by the submitters of their alternate proposals were also made available to the EVFE Subgroup in January 2022 and April 2022. These alternate proposals do not include any modifications to paragraph A.1. General. The EVFE Subgroup's discussions have been

ongoing in their review of the submitters latest proposals which are intended to replace S&T Agenda Items EVF-21.1 and EVF-21.5. The EVFE has not reached a consensus on the submitters' latest proposals.

NIST OWM is aware of the submitters' November 15, 2022 email sent to the Committee where the submitters recommend withdrawing EVF 21.1 and EVF-21.5 given new proposal EVF-23.6 reflects feedback on these 2021 proposals and the significant changes to the proposals since August 2020 (as well as the EVSE code becoming permanent). The submitters are also supportive of designating EVF-23.6 as a voting item. At this stage, given the lengthy deliberations over the course of the past three years by the EVFE Subgroup on EVF-21.1 and other alternative proposals developed by the submitters, as well as the significant differences between the enforcement dates and conditions applicable to DC Systems in EVF-23.6 in contrast to and the Subgroup's June 2022 alternate proposal for DC tolerances and corresponding marking requirements to be applicable based simply on a 2024 installation date; nor the proposed conditions in EVF-21.1 for a blanket exemption from the entire code for ten years being replaced by EVF-23.6 where DC system's compliance involves certification/installation/multiple enforcement dates would any of these options be conducive to a straightforward and orderly implementation of the EVFS Code. Possibly the EVFE Subgroup's alternate proposal with some refinement might have been most viable option.

NIST OWM concurs with January 2023 action by the Committee and Submitter's recommendation that Agenda Item EVF-21.1 should be Withdrawn.

It is necessary to determine if recommendations for modifying any EVSE requirements adequately address the issues raised by the developers of the proposal, are they broadly written and flexible enough to be applied to a majority of the device configurations/models used in commercial applications while not being so prescriptive that they limit technology or are so selective to any single design so as to create a competitive advantage. Requirements should adhere to sound weights and measures principles.

The EVFE Subgroup who developed the EVFS Code adopted in 2015 and all subsequent submitters of proposals to modify any EVSE related codes and regulations in either NIST Handbook 130 or 44 should remember those basic components of the transaction (unit of measurement, price per unit, total sales amount, and their availability), their transparency, accessibility, and how they are used by the: 1) seller protecting their investment/business; 2) buyer getting what they pay for; and 3) regulator needing access to commercial equipment to verify measurements and the device's correctness when operating in the marketplace.

The purpose of these legal metrology requirements is to facilitate the use of electrical vehicle fueling systems used in commercial applications; help ensure clear and transparent transactions in these applications; and promote the use of equipment or practices that result in authentic and consistently reliable, accurate, and correct measurements and associated transaction information that are a genuine representation of the commodity being sold; and to thereby, encourage consumer acceptance and understanding of these fueling systems for commercial purposes.

Summary of Discussions and Actions:

During the NCWM 2021 Interim Meeting the Committee assigned Developing status for this item. The Committee suggested the submitters take into consideration the comments provided during open hearings and prepare a revised draft proposal to NIST OWM, the EVFE Subgroup, etc. in an effort to provide a

comprehensive proposal to NCWM membership. For more information or to provide comment, please contact:

Francesca Wahl (Tesla)
(650) 435-0422, **fwahl@tesla.com**

At the NCWM 2022 Annual Meeting, Francesca Wahl (Tesla) representing the submitters of this proposal indicated the developers of the agenda item are working to address problems encountered with the requirements by the upcoming standards development cycle and before the code gains permanent status. Francesca 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.

Kurt Floren (Los Angeles County, California) had a question regarding whether amendments to the code would be entertained prior to the code becoming permanent. A priority item (EVF-22.1) recommending the EVFS Code be upgraded to permanent status was approved late June 2022 and included as a Voting Item on the July 2022 S&T Committee's Agenda. There is already a Voting Item (EVF-20.1), this proposal (EVF-21.1), and a second unresolved proposal (EVF-21.5) as well as ongoing work and deliberations in the community to further refine specific tentative EVFS code requirements. The July 2022 adoption of the priority item resulted in amending NIST Handbook 44 Section 3.40 Electric Vehicle Fueling Systems – Tentative Code to: (1) change the code's status to permanent effective January 1, 2023 and (2) modify paragraphs S.2.7. Indications of Delivery, N.5.2.(b) Accuracy Testing; For DC systems, and T.2.1. EVSE Load Test Tolerances to include a statement that makes these three requirements applicable to DC systems on or after January 1, 2028. This agenda item (EVF-21.1) remained unchanged and carried over to the 2023 standards develop cycle under the development of the submitters.

Submitter's Update: The 11 Submitters' sent a November 15, 2022 email to the NCWM S&T Committee outlining their history with EVF-21.1 (a proposal for a 10 year EVSE code exemption) and EVF-21.5 (a proposal for DC systems installed before 2033 to be permitted 2.5 times wider tolerances and after 2033 a 1 percent/2 percent tolerance already applied to AC systems applies to all EVSEs), the items introduction into the 2021 cycle and the proposals achieving Developmental status and subsequent work to address input on these items. The submitters noted their unanticipated July 2022 change in the code's status to become enforceable in 2023 and acknowledged at that same time the NCWM also modified the code to make certain elements not enforceable until 2028 implying it was not possible today to enforce these elements. For the submitters these actions accelerated the need to incorporate the concepts in the proposals and other handbook modifications to ensure the EVFS code is ready for implementation. However, a new 2023 proposal EVF 23.6 (for DC systems installed prior to 2024 when bearing accuracy markings are permitted a 5 percent tolerance which sunsets in 2034 although all DC tolerances don't apply until 2028) replaces the need to continue maintaining EVF-21.1 and EVF-21.5 as Developing Items.

The submitters noted their diligence in their work and are appreciative of the feedback and guidance from the community. The submitters recommend withdrawing EVF 21.1 and EVF-21.5 given new proposal EVF-23.6 reflects feedback on these 2021 proposals and the significant changes to the proposals since August 2020 (to include the EVSE code becoming permanent). The submitters are also supportive of designating EVF-23.6 as a voting item. The submitters plan to speak to both recommendations during the January 2023 NCWM Interim Meeting and are happy to answer questions.

At the 2023 NCWM Interim Meeting, the Committee has withdrawn this item based on recommendations from the submitters, along with similar comments heard during open hearings supporting the withdrawal of this item

Regional Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Francesca Wahl indicated that Agenda Item EVF-23.6 is a resubmittal of this item, yet requested this proposal remain a Developing Item.

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

Western Weights and Measures Association

At the WWMA 2022 Annual Meeting, the following comments were received.

Francesca 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. Francesca 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 Francesca Wahl.

Kurt 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.

Kevin Schnepp (California Division of Measurement Standards) 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. Jose Arriaga (Orange County, California) commented that 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 agreed that a 10-year exemption is not justified, as there are currently devices available which meet handbook requirements. The Committee recommended that this item be Withdrawn.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Scheleese Goudy Goudy (Electrify America and submitter) requested that it be Withdrawn.

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

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Francesca Wahl commented that there is no status update from the group of submitters and requested to keep the item as developing. 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 the submitters developed multiple alternate proposals intended to replace this

item. Ms. Williams asks submitters to work with the EVSE Subgroup. John McGuire (New Jersey) stated that a 10-year exemption is too long and unnecessary and recommend withdrawal or Developing status. Jim Willis (New York) requested that this item be Withdrawn.

After hearing comments from the floor, the Committee does not believe this item has merit. The Committee agreed that a blanket 10-year exemption for devices is not appropriate and recommended that this item be Withdrawn.

EVF-21.5 W T.2. Load Test Tolerances

Source: ABB, BTCPower, Electrify America, Edison Electric Institute, EVConnect, EVgo, Greenlots, Rivian, Siemens, Tesla, Tritium

Submitter's Purpose and Justification:

To create separate metering requirements for DC EVSE due to significant technology differences and challenges between AC and DC systems.

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.

Item Under Consideration:

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

(1) Acceptance Tolerance: 2.5 %; and

(2) Maintenance Tolerance: 5.0 %

(b) Devices installed January 1, 2033 or later

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %

NIST OWM Detailed Technical Analysis:

Should the weights and measures community continue to consider proposed new paragraph T.2.2 which would widen the tolerances for DC systems "installed" prior to January 1, 2033, NIST OWM asks are there existing devices that can meet the current requirements? Justifications for proposing the relaxing of the tolerances to this degree, particularly without a sunset date (i.e., a retroactive date) are not being received from all manufacturers?

From a technical standpoint accuracy is fundamental to determining a basic property of a measuring system in its use to establish a fee. Manufacturers and at least one jurisdiction are evaluating the performance of DC equipment as of December 2022. If the existing HB 44 requirement for a 1 percent Acceptance and 2 percent Maintenance Tolerances for *all* systems are modified then OWM would be less reluctant to seeing the adoption of a phase-in date to meet the tighter tolerances that includes an

accompanying sunset date (i.e., a retroactive date). Those dates should be established from multiple factors looking at the overall impact which may not be well understood by many members of the community. OWM asks what concrete issues can be cited by the submitters to counter any opposing arguments for a phase in period for DC systems? It would be important to have statistics on the population of devices not in compliance with requirements as discussion moves forward on this proposal.

This is not a typical practice to be done on an unlimited basis. This would be more palatable from both a competitive and enforcement standpoint if there are specific technical issues, that necessitate and justify relaxing equipment tolerances on an industrywide basis. An additional concern is that companies are spending money to comply with the existing NIST HB section 3.40 tentative code yet are competing with a population of existing equipment. An additional question is: how big is that population exactly?

NIST OWM also would ask how many devices are out there that would be put into use and competing with AC devices, thus creating a competitive advantage for DC devices?

Lately multiple stakeholders in the community have either brought forward or indicated less reluctance in opposing a dual tolerance structure. There will be concerns about a dual tolerance structure if this proposal moves forward since it still does not include a corresponding marking or some other type of information requirement to alert consumers that purchasing electricity from one fueling device does not provide the same accuracy assurance as it does from another fueling device. Bottom line multiple tolerance tiers frustrate value comparisons. There is not a lot of data being made available on the accuracy of DC devices. Comments from the EVFE Subgroup representatives from industry and national laboratory indicate the current 1 % acceptance and 2 % maintenance tolerances are achievable by existing DC systems. NIST OWM was made aware in June 2022 that at least one jurisdiction is in possession of a DC test standard that has traceability, but that date has been extended several times. Several EVFE Subgroup members indicate there is a confidentiality issue that prevents release of any data.

Throughout 2021 up through mid-2022 NIST OWM has recommended the submitters revise their 2021 proposals to address concerns previously expressed by the USNWG EVF&S's EVFE Subgroup and weights and measures community prior to submission of any alternate proposals for a review of the EVFE Subgroup.

The submitters provided updates to the community in July 2021 about their work to revise the proposals in NCWM S&T Committee Agenda Items EVF-21.1 A.1. General and EVF-21.5 T.2. Load Test Tolerances. Their work was completed in early November 2021.

On November 20, 2021, NIST OWM provided input on the submitter's alternate proposal. This revised proposal modified five NIST Handbook 44 Section 3.40 EVFS requirements (that address indicating elements, sealing, identification/marking, and tolerances). The submitters and NIST OWM met on December 7, 2021 to discuss NIST OWM's preliminary review and adjustments suggested for the alternate proposal. Subsequent revisions by the submitters of their alternate proposals were also made available to the EVFE Subgroup in January 2022 and April 2022. The EVFE Subgroup's discussions have been ongoing in their review of the submitters proposals for expanding tolerances to 5 % for older equipment in commercial operation and EVSE marking requirements if a dual tier tolerance structure exists. The EVFE Subgroup was balloted June 17, 2022 on a proposed new 5 % tolerance for DC EVSEs installed prior to 2024 and a corresponding new requirement for marking the accuracy of pre-2024 equipment. The EVFE Subgroup will offer this proposal as an alternative to two new 2023 proposals (EVF-23.5 and EVF-23.6 both are proposals to require new accuracy markings and widen DC systems tolerances but warrant careful review of the conditions and enforcement dates in these proposals).

NIST OWM is aware of the submitters' November 15, 2022 email sent to the Committee where the submitters recommend withdrawing EVF 21.1 and EVF-21.5 given new proposal EVF-23.6 reflects feedback on these 2021 proposals and the significant changes to the proposals since August 2020 (as well as the EVSE code becoming permanent). The submitters are also supportive of designating EVF-23.6 as a voting item. At this stage, given the lengthy deliberations over the course of the past three years by the EVFE Subgroup on EVF-21.1 and other alternative proposals developed by the submitters, as well as the significant differences between the enforcement dates and conditions applicable to DC Systems in EVF-23.6 in contrast to and the Subgroup's June 2022 alternate proposal for DC tolerances and corresponding marking requirements to be applicable based simply on a 2024 installation date; nor the proposed conditions in EVF-21.1 for a blanket exemption from the entire code for ten years being replaced by EVF-23.6 where DC system's compliance involves certification/installation/multiple enforcement dates would any of these options be conducive to a straightforward and orderly implementation of the EVFS Code. Possibly the EVFE Subgroup's alternate proposal might have provided the submitters with the most viable option.

The purpose of legal metrology requirements is to facilitate the use of electrical vehicle fueling systems used in commercial applications; help ensure clear and transparent transactions in these applications; and promote the use of equipment or practices that result in authentic and consistently reliable, accurate, and correct measurements and associated transaction information that are a genuine representation of the commodity being sold; and to thereby, encourage consumer acceptance and understanding of these fueling systems for commercial purposes.

NIST OWM concurs with January 2023 action by the Committee and submitter's recommendation that Agenda Item EVF-21.5 should be Withdrawn.

Summary of Discussions and Actions:

During the NCWM 2021 Interim Meeting the Committee assigned Developing status for this item. For more information or to provide comment, please contact:

Asaf Nagler
ABB
202-639-4075, **asaf.nagler@us.abb.com**

At the 2022 NCWM Interim Meeting, during the Committee's work session this item retained its Developing status. The Committee suggested the submitters take into consideration the comments provided during open hearings. The Committee recommended the submitter work with NIST OWM on the final draft of their 2022 alternate proposal for review and comments.

At the NCWM 2022 Annual Meeting a priority item (EVF-22.1) recommending the EVFS Code be upgraded to permanent status was approved late June 2022 to be included as a voting item on the July 2022 S&T Committee's Agenda. There was already a voting item (EVF-20.1), this proposal (EVF-21.5) and a second unresolved proposal (EVF-21.1) as well as work and deliberations in the community to further refine specific tentative EVFS code requirements. Adoption of the priority item did occur resulting in amendments to the NIST Handbook 44 Section 3.40 Electric Vehicle Fueling Systems – Tentative Code to: (1) change the code's status to permanent effective January 1, 2023 and (2) modify paragraphs S.2.7. Indications of Delivery, N.5.2.(b) Accuracy Testing; For DC systems, and T.2.1. EVSE Load Test Tolerances to include a statement that makes these three requirements applicable to DC systems on or after January 1, 2028. This agenda item (EVF-21.5) remained unchanged and carried over

to the 2023 standards develop cycle under the development of the submitters. This item should be updated to include the new statement that passed adoption July 2022 to reflect the retroactive enforcement date of January 1, 2028 for paragraph T.2.1, that will be applicable to DC systems.

Submitter's Update: the 11 Submitters' sent a November 15, 2022 email to the NCWM S&T Committee outlining their history with EVF-21.1 (a proposal for a 10 year EVSE code exemption) and EVF-21.5 (a proposal for DC systems installed before 2033 to be permitted 2.5 times wider tolerances and after 2033 a 1 percent/2 percent tolerance already applied to AC systems applies to all EVSEs), the items introduction into the 2021 cycle and the proposals achieving Developmental status and subsequent work to address input on these items. The submitters noted their unanticipated July 2022 change in the code's status to become enforceable in 2023 and acknowledged at that same time the NCWM also modified the code to make certain elements not enforceable until 2028 implying it was not possible today to enforce these elements. For the submitters these actions accelerated the need to incorporate the concepts in the proposals and other handbook modifications to ensure the EVFS code is ready for implementation. However, a new 2023 proposal EVF 23.6 (for DC systems installed prior to 2024 when bearing accuracy markings are permitted a 5 percent tolerance which sunsets in 2034 although all DC tolerances don't apply until 2028) replaces the need to continue maintaining EVF-21.1 and EVF-21.5 as Developing Items.

The submitters noted their diligence in their work and are appreciative of the feedback and guidance from the community. The submitters recommended withdrawing EVF 21.1 and EVF-21.5 given new proposal EVF-23.6 reflects feedback on these 2021 proposals and the significant changes to the proposals since August 2020 (to include the EVSE code becoming permanent). The submitters are also supportive of designating EVF-23.6 as a voting item. The submitters plan to speak to both recommendations during the January 2023 NCWM Interim Meeting and are happy to answer questions.

At the 2023 NCWM Interim Meeting, Kevin Schnepp (State of California, Division of Measurement Standards) supports a status of Withdrawn for the item. Francesca Wahl (Tesla) commented on behalf of the submitters and requested the item be assigned a status of Withdrawn. Jared Ballew (ChargePoint) supports a status of Withdrawn for the item.

The Committee has withdrawn this item based on the recommendations from the submitters, along with similar comments heard during open hearings supporting to withdraw this item.

Regional Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting Francesca Wahl stated that Item EVF-23.6 is a resubmittal of this item. Requested this remain Developing.

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

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Francesca 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. Francesca 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 Francesca Wahl.

Kevin Schnepp commented the item does not have merit, given the state of current technology and recommended the item be withdrawn. Kurt Floren (County of Los Angeles, California) agreed with Kevin Schnepp'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 recommended that this item be withdrawn.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Scheleese Goudy Goudy (Electrify America), the submitter of this item, requested that it be withdrawn.

The SWMA S&T Committee recommended this item be withdrawn.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Francesca Wahl (Tesla), on behalf of the submitters, indicated there has been no movement on this item and noted there are new proposals as part of the EVSE Subgroup. Keith Bradley (Electrify America) recommended this item be withdrawn. 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. Jason Flint (New Jersey) and Jim Willis (New York) 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.

EVF-23.1 V S.2.5.1. Money-Value Divisions Digital, S.8.(a) Minimum Measured Quantity, S.5.2. EVSE Identification and Marking Information, S.5.3.(d) Abbreviations and Symbols; Joule, N.1. No Load Test, T.5. No Load Test, N.2. Starting Load Test, T.6. Starting Load, Appendix D–megajoule (MJ)

Source: NIST USNWG EVF&S-EVFE Subgroup

Submitter's Purpose and Justification:

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.

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.

NIST OWM Executive Summary for EVF-23.1 – S.2.5.1. Money-Value Divisions Digital, S.8.(a) Minimum Measured Quantity, S.5.2. EVSE Identification and Marking Information, S.5.3.(d) Abbreviations and Symbols; Joule, N.1. No Load Test, T.5. No Load Test, N.2. Starting Load Test, T.6. Starting Load, Appendix D–megajoule (MJ)

NIST OWM Recommendation:

- NIST OWM agrees with this EVFE Subgroup's proposal that further refines the electrical vehicle fueling systems code requirements in NIST HB 44.
- NIST OWM also notes there is a related method of sale proposal on the L&R Committee Agenda (MOS-23.4) that updates the unit of measurement terminology for the EVSE application in NIST HB 130.
- NIST OWM concurs with the EVFE Subgroup's late fall 2022 proposed changes to the EVFS Code in S&T Agenda Item 23.1 to include:
  - further modification to paragraph S.2.5.1. Money-Value Divisions Digital to clarify that it is at the "end of the transaction when mathematical agreement shall occur.
  - proposed new modifications to:
    - paragraph S.5.2. EVSE Identification and Marking Information to ensure continuity across the EVFS Code in all references to the EVSE's current level; and
    - further amending paragraph S.5.3. Abbreviations and Symbols to recognize the term "kilowatt-hour"

NIST OWM Executive Summary for EVF-23.1 – S.2.5.1. Money-Value Divisions Digital, S.8.(a) Minimum Measured Quantity, S.5.2. EVSE Identification and Marking Information, S.5.3.(d) Abbreviations and Symbols; Joule, N.1. No Load Test, T.5. No Load Test, N.2. Starting Load Test, T.6. Starting Load, Appendix D–megajoule (MJ)

The additional modifications would read:

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.**0**1 kWh."

S.5.2. EVSE Identification and Marking Information.

(b) maximum ~~**current**~~ deliverable **amperes**;

S.5.3. Abbreviations and Symbols.

(d) ~~**J**~~kWh = ~~**joule**~~kilowatt hour.

Table 2. Summary of Recommendations
EVF-23.1 – S.2.5.1. Money-Value Divisions Digital, S.8.(a) Minimum Measured Quantity, S.5.2. EVSE Identification and Marking Information, S.5.3.(d) Abbreviations and Symbols; Joule, N.1. No Load Test, T.5. No Load Test, N.2. Starting Load Test, T.6. Starting Load, Appendix D–megajoule (MJ)

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Voting		
NEWMA	Developing		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry		1	26AUG2022 input on S.2.5.1.
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language

2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend Handbook 44, Electric Vehicle Fueling Systems Code Sections 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]**~~

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. During its December 8, 2022 meeting the group agreed to further amend the requirement in response industry concerns about systems' delays in relaying transaction information and for clarify that it is at the "end of the transaction" when mathematical agreement shall occur as shown below:

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.**0**1 kWh.

(Amended 202X)

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.

S.8. Minimum Measured Quantity (MMQ). – The minimum measured quantity shall satisfy the conditions of use of the measuring system as follows:

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)

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. Also, during its December 8, 2022 meeting the group agreed to amend paragraph S.5.2. EVSE Identification and Marking Information to ensure continuity across the EVFS Code in all references to the EVSE's current level and further amend paragraph S.5.3. Abbreviations and Symbols to recognize the term "kilowatt-hour" and its corresponding abbreviation and after reviewing a similar proposal in Agenda Item EVF-23.4. Consequently, also modify the relevant handbook requirements as follows:

S.5.2. EVSE Identification and Marking Information.

(b) maximum ~~**current**~~ deliverable **amperes**;

S.5.3. Abbreviations and Symbols.

~~**(d) J = joule.**~~

~~**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.

NIST OWM Detailed Technical Analysis:

NIST OWM acknowledges the EVFE Subgroup's proposal was developed to further refine the 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 and agrees with the proposal. NIST OWM also notes there is a related method of sale proposal on the L&R Committee Agenda (MOS-23.4) that updates the unit of measurement terminology for the EVSE application in NIST HB 130 Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality.

NIST OWM concurs with the EVFE Subgroup's late fall 2022 proposed changes to the EVFS Code in S&T Agenda Item 23.1 to include the alternate proposed modifications to paragraph S.2.5.1. Money-Value Divisions Digital. The EVFE Subgroup agreed at its December 8, 2022 meeting that further modification to paragraph S.2.5.1. was appropriate to clarify that it is at the "end of the transaction when mathematical agreement shall occur. NIST OWM agrees with the proposed new modifications to

paragraph S.5.2. EVSE Identification and Marking Information to ensure continuity across the EVFS Code in all references to the EVSE's current level and further amending paragraph S.5.3. Abbreviations and Symbols to recognize the term "kilowatt-hour" and its corresponding abbreviation which the EVFE Subgroup recommended after reviewing similar proposals in Agenda Item EVF-23.4. These additional modifications are shown below:

> **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.**0**1 kWh."

S.5.2. EVSE Identification and Marking Information.

(b) maximum ~~**current**~~ deliverable **amperes**;

S.5.3. Abbreviations and Symbols.

(d) ~~**J**~~**kWh** = ~~**joule**~~**kilowatt hour**.

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

- The SG asks the S&T Committee to replace its recommended changes to paragraph S.2.5.1. Money-Value Divisions Digital to further clarify the point in the process when mathematical agreement occurs with the following:

  > **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 the transaction** shall be based on quantities not exceeding ~~**0.5 MJ or**~~ 0.**0**1 kWh.
  >
  > **(Amended 202X)**

- The SG considered recommending a definition for the term "transaction" that would be specifically applicable to Section 3.40 possibly based on the definition published September 2022 in OIML G 22 the corresponding international EVSE guide. The SG did not reach a conclusion on a proposed definition; however, the SG may come back with a recommendation at some point in the future as part of a separate proposal. Two points to consider should the SG revisit the proposed definition is whether the term should apply to the 14 other NIST HB 44 codes where the term is also cited and further clarify whether it is the customer, the electric vehicle fueling system, or some other intelligence that provides acknowledgement of receipt of information relevant to the transaction process.

- The SG agrees with the proposed changes in S&T Agenda Item 23.4 to: (1) paragraph S.5.2.(b) EVSE Identification and Marking Requirements for clarity and consistency in the expression of current values across the EVFS Code and to properly identify the highest current value or level at which the manufacturer has specified for the operation of the EVSE, the EVFE SG supports identifying this marking information as the "maximum deliverable ampere" rather than the currently stated "maximum current deliverable", and (2) paragraph S.5.3.(d) Abbreviations and Symbols which removes the "joule" unit of measurement and its corresponding abbreviation and further modifies that subparagraph to include the "kilowatt-hour" as well as recognize that unit's abbreviation "kWh".

The EVFE SG believes it has addressed all questions about the interpretation and applicability of code requirements in this proposal and is not aware of any further requests that the group revisit requirements or definitions in Agenda Item EVF-23.1.

Summary of Discussions and Actions:

A letter dated August 26, 2022 from industry representing Electrify America was sent to the NCWM S&T Committee. Electrify America "offered a revision to this proposal that is narrowly tailored and necessary to avoid significant interference with the ordinary operation of electric vehicle chargers. Electrify America, LLC, is the country's largest open network of fast DC electric vehicle chargers operating over 3,000 chargers in most states. Electrify America has a serious concern about the proposed revision to paragraph S.2.5.1, "Money-Value Divisions Digital," where the total price computation must be based on quantities not exceeding 0.01 kWh. Measurements of energy delivery are carried out locally, but the price calculation is carried out by the centralized server and reported back, repeatedly through the transaction, for display to the customer. For a charger operating at 350 kW (a capability that is now quite common) to ensure that the total cost is updated with each 0.01 kWh would require an update every 50 milliseconds. Lags in communications (Internet service to the device) for fast chargers will be not uncommon to be more than 0.01 kWh late in updating the rolling cost display, even after operators incur the heavy bandwidth penalty to even attempt these updates. It would be impossible for even the swiftest humans to make a choice, and stop a charging session, based on a change in information occurring in 100 milliseconds. The system in which cost information is calculated and communicated by a central server uses the Open Charge Point Protocol (OCPP) the emerging industry standard. These central server calculations are important for chargers to be able to operate flexibly with multiple pricing structures.

Electrify America asks why this requirement should be imposed and was not aware that this 0.01-kWh issue was brought up and deliberated in the EVFE Subgroup promptly alerting NIST. As Electrify America understands the code, the obligation to present a running, continually-updated cost would come from the reference to paragraph G-S.5.5. Money-Values, Mathematical Agreement. So, proposal EVF-23.1 could be revised to separate the 0.01-kWh requirement, as follows:

> **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 **computed** price **of the energy sale, presented at the completion of a transaction**, computation **presented** shall be based on quantities not exceeding 0.5 MJ or 0.**0**1 kWh.

In this proposed revision, Electrify America used the term "total computed price" instead of "price computation" to remain consistent with existing paragraph S.2.6. EVSE Recorded Representation, which describes the information that must be provided at the end of the transaction. "The completion of a transaction" is also the same term that is used in paragraph S.2.6.

Electrify America asks the Committee to recommend this change. The remainder of EVF-23.1 is sensible and appropriate."

The following background information was excerpted from the abbreviated summary on Agenda Item 3.a of the EVFE Subgroup's October 6, 2022 virtual meeting. The following discussion by the EVFE Subgroup in an effort to address Electrify America's concerns regarding the group's proposed modification to paragraph S.2.5.1. Money-Value Divisions.

The group identified S&T Agenda Item EVF 23.1 as needing further modification to its proposed changes to paragraph S.2.5.1. Money-Value Divisions Digital to specify at what point in the delivery to apply this requirement. The EVFE Subgroup also agreed to recommend a new definition of "transaction" drawn from OIML Guide 22 Electrical Vehicle Supply Equipment be included in NIST Handbook 44 Appendix D – Definitions to further clarify what constitutes the purchase or transaction process.

The proposal to modify paragraph S.2.5.1. to no longer include the megajoule unit of measurement when expressing the electrical energy quantity value that is used to calculate the total price for refueling was developed in May 2022 by the EVFE Subgroup. An industry representative who agrees with the group's recommendation cautions the group on the second part of its proposal to reduce the maximum interval value permissible for quantities expressed in the kilowatt-hour (kWh) from 0.1 to 0.01. The proposed change was made in anticipation that the unit price of electrical energy for vehicle refueling would reach $1.00 per kWh or more. The group acknowledges that the maximum quantity value should be revisited to keep pace with the average national price per kilowatt hour for an EV charging session.

One industry member has concern that the recommended modification of the kWh value would result in the relay ("pinging") of information would result in a delay in the device's processing transaction information from what currently takes place in the system. Several in the group indicated that some delay might occur (e.g., a minimal number of milliseconds); however, with digital indications the consumer most likely would not detect the lag during refueling. Additionally, paragraph S.1.2. EVSE Indicating Elements specifies that an EVSE shall include an indicating element that continuously accumulates transaction information. During the processing of that information a very minimal lag might occur while the electrical energy delivery is taking place, but at the conclusion of the delivery there would be agreement between indications. Therefore, the EVSE Subgroup agreed further modification is necessary to paragraph S.2.5.1. Money-Value Divisions Digital for clarity and to specify this requirement applies "at the end of a transaction."

The EVFE Subgroup concluded that the interpretation of what process occurs to constitute a "transaction" is not defined in the handbook and therefore, a new definition of "transaction" which will be drawn from OIML Guide 22 Electrical Vehicle Supply Equipment should be included in NIST Handbook 44 Appendix D – Definitions. These latest alternate modification to the code and proposed new definition for Appendix D were distributed to the Subgroup membership on October 7th for input at the upcoming meeting on October 18th. At this time the group is not recommending other than the EVFS Code [3.40] be referenced in the proposed new definition.

At the 2023 NCWM 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 Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA 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) requested to remove the 0.01 kWh change and move everything else forward as Voting.

Craig VanBuren (Michigan) stated 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 recommended 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.**0**1 kWh.

(Amended 202X)

At the 2023 CWMA Annual Meeting, Loren Minnich (NIST OWM) supported the proposal which aligns with the L&R item to remove the unit "Joule". The proposal also clarifies that mathematical agreement has to occur at the end of the transaction. The EVFE Subgroup fully supports this item.

Scheleese Goudy supports as amended. Monica Martinez (Tesla) supports as amended and thanks the EVFE Subgroup.

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

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Scheleese Goudy 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.

Kevin Schnepp (California Division of Measurement Standards) commented: DMS can stand in support of the item and recommended that the 0.01 kWh issue be addressed.

Francesca Wahl seconded the comments regarding the 0.01 recommendation.

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 requested the submitter address the formatting of their proposal to meet NCWM standard editing requirements.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Scheleese Goudy submitted the updated wording, which is newly adopted by the NIST workgroup as of October 2022. She recommended 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.**0**1 kWh.

The SWMA S&T Committee recommended this item move forward as a Voting Item with the above wording.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Keith Bradley (Electrify America) explained that 0.1kWh for DC could be an issue due to communication speeds. Keith Bradley suggested modifying the language to "…total price computation at the end of the transaction". Juana Williams (NIST OWM) indicated that the EVSE Subgroup is making further modifications to this item. Francesca Wahl agreed with the language modification suggested by Keith Bradley. Lou Sakin (Holliston, Massachusetts) recommended that this item be Developing.

After hearing comments from the floor, the Committee believes the item has merit. The Committee recommended that the item be given a Developing status.

At the 2023 NEWMA Annual Meeting, Loren Minnich stated that OWM agrees with U.S. National Working Group proposal that was submitted to NCWM and noted there is a related method of sale in proposal MOS 23.4. James Cassidy (Massachusetts) and Jim Willis (New York) support the item.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

EVF-23.2 W S.2.7. Indication of Delivery

Source: Siemens Industry Inc. and Smart Infrastructure eMobility

Submitter's Purpose and Justification:

Provide consistent treatment of AC and DC chargers on the topic of Indication of Delivery.

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.

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.

NIST OWM Detailed Technical Analysis:

The effective date was placed under this specific paragraph that addresses indications and therefore applies only to this paragraph while there are multiple other code paragraphs that include requirements for indication of that same transaction information throughout the charging session. An important question for the community is that as the enforcement date draws closer will compliance be delayed further by extending the effective date or granting a permanent exemption to equipment.

Indications are the means by which transaction and other related information is read from the device itself, although a device may have additional auxiliary indicating elements for the convenience of the owner/operator as long as they are not confusing or misleading. Electric Vehicle Fueling Systems have the option of each device having its own integral display indication or multiple devices being interfaced to a single display capable of clearly providing each device's associated information. NIST Handbook 44 Section 1.10 General Code requirements under G.S.5. Indicating and Recording Elements and where applicable Section 5.55 Timing Devices Code also include indication requirements that apply to EVFSs.

Proposals which alter, further delay the enforcement date, or eliminate any requirement for making basic transaction information available should be analyzed from the standpoint of their effect on the consumer, operator, competing businesses, and regulatory authority. Consideration should be given to transparency, value comparison across competing installations, confidence in the marketplace, etc., given the projected expansion of commercial devices also competing with traditional and other alternative fueling applications in the marketplace. What if other vehicle refueling industries request a similar exemption?

It should be noted that the State of California has type approved AC systems based on their meeting indication requirement in the Electric Vehicle Fueling Systems Code.

There is limited justification for this proposal, and it appears that it follows on the heels of the NCWM's actions in July 2022 to delay the application for DC systems until 2028. This is a continuance of the case where consideration has not been given to similar work by multiple stakeholders from the weights and measures and electrical energy community on the USNWG EVFE SG over the past three years to reach a consensus that is clear, comprehensive, fair from a competitive standpoint, and takes place before submitting a proposal that effects the fundamental component of transparency, knowing what has been transacted whether buying or selling and being able to make value comparisons in the marketplace. Given that the earliest this proposal could become effective is 2024, and the rapidly expanding marketplace it is uncertain what point there is to implement the latest proposed modifications for AC systems in the paragraph. It's likely that once a device has been "approved" without an indication, there will be argument that it should then be grandfathered.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, Kevin Schnepp (CDFA DMS) recommends an assigned status of Withdrawn. Kevin Schnepp added there are over 14 EVSE devices that meet this display requirement and added there is no benefit to consumers in adopting this item. Steve Timar (New York Department of Agriculture and Markets) recommends an assigned status of Withdrawn. Jared Ballew (ChargePoint) believes the item does not have merit, as there are many AC EVSE devices installed that meet this display requirement. Jared Ballew recommends the item be assigned a Withdrawn status. Tina Butcher (NIST OWM) recommends the item be assigned a Withdrawn status.

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 Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Francesca Wahl (Tesla) indicated 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) recommended Developing status.

The CWMA S&T Committee recommended this as a Developing Item.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received. 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. Francesca Wahl agreed with Siemens.

Kevin Schnepp stated California already has this requirement for AC EVSE's. Kevin Schnepp 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.

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 recommended withdrawal of this item.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting. Hal Prince (Florida) stated that this has been addressed and the item should be withdrawn. Scheleese Goudy (Electrify America) stated that this would modify a brand-new proposal and should be withdrawn. The SWMA S&T Committee recommended this item be Withdrawn.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Francesca Wahl (Tesla) stated that she believes there is merit for discussion, but additional details would be helpful. Juana Williams (NIST OWM) pointed out there are AC systems that meet this requirement and are already type-approved in California. Jason Flint (New Jersey) and Jim Willis (New York) 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 recommended that this item be given a Developing status.

EVF-23.3 W S.2.7. Indication of Delivery

Source: Power Measurements LLC

Submitter's Purpose and Justification:

Reduce the exemption for DC EVSE from 2028 to 2025.

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.

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**.

NIST OWM Detailed Technical Analysis:

Although the proposal modifies the 2028 effective date to become 2025, that effective date was placed under this specific paragraph that addresses indications and therefore applies only to this paragraph. There are multiple other code paragraphs that include requirements for indication of that same transaction information throughout the charging session. An important question for the community is that as the enforcement date draws closer will compliance be delayed further by extending the effective date or granting a permanent exemption to equipment.

Indications are the means by which transaction and other related information is read from the device itself, although a device may have additional auxiliary indicating elements for the convenience of the owner/operator as long as they are not confusing or misleading. Electric Vehicle Fueling Systems have the option of each device having its own integral display indication or multiple devices being interfaced to a single display capable of clearly providing each device's associated information. NIST Handbook 44 Section 1.10 General Code requirements under G.S.5. Indicating and Recording Elements and where applicable Section 5.55 Timing Devices Code also include indication requirements that apply to EVFSs.

Proposals which alter, further delay the enforcement date, or eliminate any requirement for making basic transaction information available should be analyzed from the standpoint of their effect on the consumer, operator, competing businesses, and regulatory authority. Consideration should be given to transparency, value comparison across competing installations, confidence in the marketplace, etc., given the projected expansion of commercial devices also competing with traditional and other alternative fueling applications in the marketplace. What if other vehicle refueling industries request a similar exemption?

Summary of Decisions and Actions:

At the 2023 NCWM Interim Meeting, 2023 Interim: Kevin Schnepp (CDFA DMS) recommends an Informational status, allowing for information gathering and discussion to address technological advances with the Committee and NCWM membership. Kevin Schnepp added that California has already experienced consumer complaints and is worth discussing further.

The Committee considered the comments heard during open hearings and has withdrawn this item.

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Francesca Wahl (Tesla) requested this be Withdrawn. No additional justification as to why the date should be changed. No supporting data.

Craig VanBuren (Michigan) also requested this be Withdrawn. 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.

Scheleese Goudy (Electrify America) requested this be Withdrawn.

The CWMA S&T Committee recommended this item be Withdrawn.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received. Francesca Wahl 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. Scheleese Goudy agreed with TESLA.

Kevin Schnepp (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. 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 recommended that this item be assigned a Voting status.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting. Hal Prince (Florida) stated that this has been addressed and the item should be withdrawn. Scheleese Goudy stated that this item would modify a brand-new proposal and it should be withdrawn. The SWMA S&T Committee recommended this item be withdrawn.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, Juana Williams (NIST OWM) stated that the EVFE Subgroup has no recommendation at this time. Francesca Wahl 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. Keith Bradley (Electrify America), Marc Paquette (Vermont), James Cassidy (Massachusetts), and Jim Willis (New York) all agreed with the statements of Francesca 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 no provide reasoning to roll back the date to 2025. The Committee is recommending that this item be withdrawn.

EVF-23.4 D S.5. Markings, and N.5. Test of an EVSE System

Source: Power Measurements LLC

Submitter's Purpose and Justification:

Update the details of the recommended tests in HB44 3.40 to better conform to current practice and Publication 14 instructions.

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,

iii. 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.

NIST OWM Executive Summary for EVF-23.4 S.5. – Markings and N.5. Test of an EVSE System.

NIST OWM Recommendation:

- The proposed modifications to subparagraph S.5.2. (b) to specify EVSEs must be marked with the "maximum deliverable amperes" will clarify the appropriate terminology for specifying the amperage load rating for the equipment's operation and to be marked on the device.

- At this time the "joule" unit of measurement is not used for expressing electrical energy quantity values in commercial EVSE applications. For continuity across EVSE NIST Handbook codes and regulations the term and its abbreviation (J) should also be removed from subparagraph S.5.3.(d). The kilowatt-hour unit of measurement and its corresponding abbreviation should be recognized in the EVFS Code.

- Observe this proposal removes any reference to the feature used to determine the MDA percentage level achieved during accuracy tests and establishes a new MDA range for performing the light load test and when a vehicle is the test load for verifying EVFSs; whereas

NIST OWM Executive Summary for EVF-23.4 S.5. – Markings and N.5. Test of an EVSE System.

other proposals recommend the establishment of a new laboratory test in addition to field test procedures.

- There does not seem to be a general consensus on the minimum test criteria to apply to AC and DC systems. There may be test criteria that cannot be applied in both the laboratory and in the field because there are factors the examiner cannot control or adequately correct for. Tests should be conducted over the range of operating conditions for which the device is designed.

- The 2023 proposal creates a new separate test requirement specifically for laboratory evaluations; therefore a 2028 exemption would also be new text that requires being underscored to clearly designate the 2028 effective date as new language.

- The 2028 effective date is confusing, is the intent that no testing at an approved brick and motor facility nor type evaluations can be carried out until January 1, 2028?

- A slight change is recommended for the agenda item's title to include missing paragraphs **S.5.2.(b) EVSE Identification and Marking Requirements and S.5.3.(d) Abbreviations and Symbols; joule** and striking ~~**S.5. Markings**~~ to clarify these units of measurement are a part of this proposal. This would also assist the community in distinguishing this item from multiple other 2023 proposals that address EVFS marking requirements.

- The EVFE Subgroup's Test Procedures Subcommittee is currently tasked with working through a recently modified version of the test procedures addressed in Item EVF 23.4. This latest modified version of the test procedures is the result of the collaborative effort of the submitters of both proposals. Based on the Test Procedures Subcommittee findings the Subgroup has targeted the upcoming standards development cycle to develop and provide input on both EVF-23.4 and EVF-23.7.

Table 2. Summary of Recommendations
EVF-23.4 – S.5. Markings and N.5. Test of an EVSE System.

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	Developing		
SWMA	Withdrawn		
CWMA	Developing		
NCWM	Developing		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held

4 Not submitted on agenda
5 No recommendation or not considered

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 ofSection 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 accesspanel).

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.~~1~~2. 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 t~~T~~he following testing is deemed sufficient for a field validation.

(a) For AC EVSE

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

(2) A point between 45 % and 55 % of the maximum deliverable amperes; and

(3) A point between 70 % and 100 % of the maximum deliverable amperes.

(b) For DC EVSE

A point at less than 30 A

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.~~2~~1. 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 test**s** ~~**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**~~

NIST OWM Detailed Technical Analysis:

The submitter's proposed modifications to subparagraph S.5.2. (b) EVSE Identification and Marking Requirements will clarify throughout the EVFS code the appropriate terminology for specifying the amperage load the EVSE's manufacturer has rated the equipment at for its operation and as a required marking on the device.

The unit of measurement "joule" is not presently in use for expressing electrical energy quantity values in commercial EVSE applications. Therefore, to ensure continuity across all relevant EVSE NIST Handbook codes and regulations the term "joule," to include its abbreviation (J), should *not* be included in subparagraph S.5.3.(d) or any other legal metrology requirements at this time. The kilowatt-hour unit of measurement and its corresponding abbreviation should be recognized in the EVFS Code.

Although the community has more knowledge on the operations of EVFSs, test equipment, and installation sites there does not seem to be a general consensus on the minimum test criteria to apply to

AC and DC systems. Variability in test processes and procedures arise from factors that are inherent in the device under test, in the test itself, or in test equipment. There may be test criteria that cannot be applied in both the laboratory and in the field because there are factors the examiner cannot control or adequately correct for. Tests should be conducted over the range of operating conditions for which the device is designed.

The 2028 exemption included in the DC system test procedure as part of the July 2022 priority item amended paragraph N.5.2 a general set of test procedures. S&T Agenda Item EVF-23.4, a 2023 proposal, adds a separate set of test procedures for type evaluation that did not previously exist and would be a substantive change to the 2023 edition of the handbook. The 2023 proposal creates a new separate test requirement specifically for laboratory evaluations; therefore a 2028 exemption, if appropriate, would also be new text that requires being underscored to clearly designate the 2028 effective date as new language.

The 2028 effective date is confusing, is the intent that no testing at an approved brick and motor facility nor type evaluations can be carried out until January 1, 2028?

A slight change is recommended for the agenda item's title to include missing paragraphs **S.5.2.(b) EVSE Identification and Marking Requirements and S.5.3.(d) Abbreviations and Symbols** and striking ~~**S.5. Markings**~~ to clarify the appropriate terminology for the EVSE current level and unit of measurement are also under consideration in this proposal. This would also assist the community in distinguishing this item from multiple other 2023 proposals that address other types of EVFS marking information.

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

- The SG agrees with the proposed changes to: (1) paragraph S.5.2.(b) EVSE Identification and Marking Requirements for clarity and consistency in the expression of current values across the EVFS Code and to properly identify the highest current value or level at which the manufacturer has specified for the operation of the EVSE, the EVFE SG supports identifying this marking information as the "maximum deliverable ampere" rather than the currently stated "maximum current deliverable", and (2) paragraph S.5.3.(d) Abbreviations and Symbols which removes the "joule" unit of measurement and its corresponding abbreviation and further modifies that subparagraph to include the "kilowatt-hour" as well as recognize that unit's abbreviation "kWh".

- The SG agrees with the proposed changes to N.5.1. Performance Verification in the Field and N.5.2. Accuracy Testing in concept, but the SG is not in concurrence with specific recommendations in the proposal. The SG would like to share the following points from its discussions of these items.

    - Some members of the SG would like to take a closer look at the test points.

    - The SG would like to ask the SG's Test Procedures Subcommittee to take a look at the criteria and provide feedback to the SG and the S&T Committee before the item moves ahead.

    - There are concerns about the limitations of available test standards and how the proposed test criteria might impact this.

- Regarding N.5.2. Accuracy Testing (Field) subparagraph (2)(i), the SG has concerns about testing to less than 10 % of maximum current or maximum deliverable amperes which could be significantly below typical levels of operation.

- There were some questions about whether type evaluation criteria should be included in Handbook 44.

- Specifying field test criteria that only apply if a device holds type evaluation certification. Exactly what test criteria apply to devices that do not have a certificate? Must those devices first undergo the proposed more stringent test criteria specified to be performed under laboratory conditions?

Several proposals developed by the EVFE Subgroup membership to modify NIST Handbook 44 Section 3.40 paragraphs N.5.1. Performance Verification in the Field and N.5.2. Accuracy Testing have been under discussion by the EVFE Subgroup since May 2022. The EVFE Subgroup has not yet reached a consensus on a comprehensive set of modifications to the current test procedure requirements in the 2023 edition of NIST Handbook 44. The handbook N. Notes paragraphs (1) identify the minimum testing that applies in the official test of a device and (2) are used by the type evaluation program technical sector or work group as the basis for the key parts of the device test criteria checklist these technical committees will develop. These proposals to modify EVSE handbook requirements have evolved over the past two years as a result of lessons learned about EVSE operations in a variety of installation sites, the increased capacity of charging equipment since the codes inception, and the application of code requirements during type evaluation and to commercial operations for the past seven years. The EVFE Subgroup has also over the past five years reviewed all proposals to modify EVSE handbook requirements appearing on the NCWM S&T and L&R Committees Agendas to include 2023 Developing Items EVF-23.4 & EVF-23.7. Both agenda items contain proposals to modify paragraphs N.5.1. and N.5.2. These two agenda items were not developed by the EVFE Subgroup although the submitters of both proposals are active members of the Subgroup.

The EVFE Subgroup's Test Procedures Subcommittee is currently tasked with working through a recently modified version of the test procedures addressed in Item EVF 23.4. This latest modified version of the test procedures is the result of the collaborative effort of the submitters of both proposals. Based on the Test Procedures Subcommittee findings the Subgroup has targeted the upcoming standards development cycle to develop and provide input on both EVF-23.4 and EVF-23.7.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, Kevin Schnepp (CDFA DMS) recommended a developing status, recognizing the item has merit but needs more development. Kevin Schnepp recommends working with the NIST USNWG EVFE Subgroup on item development. 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. Francesca Wahl (Tesla) commented the item needs further development and recommended the submitter work with the NIST USNWG EVFE Subgroup on developing the item. 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.

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 Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Scheleese Goudy (Electrify America) stated the 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): Requested developing. Send to the NIST USNWG for consideration.

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

At the 2023 CWMA Annual Meeting, Scheleese Goudy noted the Submitter and submitter of EVF-23.7 are working to submit a single joint proposal. A general consensus on concerns has been reached. SG meeting will be convened to discuss technical aspects of joint proposal

Monica Martinez (Tesla) indicated a draft combination of 23.4 and 23.7 still being reviewed for technical accuracy

The CWMA S&T Committee recommends this item remain Developing.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Scheleese Goudy stated Electrify America opposes this proposal. Scheleese Goudy suggested the 30 amps is too small and too low for the 10 % accuracy testing. Scheleese Goudy recommended a Withdrawal status.

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

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

Kevin Schnepp (California Division of Measurement Standards) commented there is some concern about the language for specifications and tolerances. Kevin Schnepp recommended this item be assigned to a work group. Kevin Schnepp 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 recommended 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 recommended that this item be blocked with item EVF-23.7. The WWMA S&T Committee recommended the new blocked items be assigned a Developing status.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting. Scheleese Goudy stated that the test current is too low and recommended withdrawal. Matt Curran (Florida) stated that line 17 on page 238 should read N.5.1. The SWMA S&T Committee recommended that this item be withdrawn.

Northeastern Weights and Measures Association

At the 2022 NCWM Interim Meeting, 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 recommended this item be given a Developing status.

At the 2023 NEWMA Annual Meeting, William Hardy (Power Measurements, LLC) gave a short presentation. When this proposal was submitted, there were not many DC chargers around and 50kw was considered high power. Currently, 3 megawatt chargers are available and soon 10 megawatt will be available. International standards are catching up with rapid progress of the industry. The USNWG has been working extremely hard to keep HB44 up to date. The submitters of this proposal and EVF-23.7 wish to get the items in the handbook prior to 2025. Bill Hardy was looking for support from NEWMA to find a path to address this sooner than 2025. Scheleese Goudy stated that the submitters have been working to find a solution between EVF-23.4 and EVF-23.7 and will have an update soon. Alicia Artessa (Tesla) stated that Tesla supports development with the USNWG and working with submitters of 23.7. James Cassidy (Massachusetts) asked if there is a consensus to ask for an emergency item from NCWM BOD and that we need to figure out how to test the devices and with what parameters. Devices are being installed but how are we supposed to test them. James Cassidy asked if there is any type of documentation that when installed, shows what specifications the installers are using and if the device passes. Loren Minnich (NIST-OWM) stated that OWM agrees that the USNWG should be consulted on 23.4 and 23.7. NIST is currently developing testing guidance documents and trying to address minimum test procedures. NCWM Chair Albuquerque stated that the two items are still in developing status and if the submitter is trying to elevate to voting before the Annual meeting, at minimum there should be a consensus between the submitters of both items prior to requesting an emergency item. Ms. Cheryl Ayer (New Hampshire) concurs with moving this item forward. Perry Lawton (TESCO) is in agreement with moving forward to at least get a definition of what a field test is so they can develop test equipment. Jim Willis (New York) sees an uphill battle to change this to voting status for the Annual meeting.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a developing status and not request that the NCWM S&T Chair consider this a priority item, and the body concurred.

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

Submitter's Purpose and Justification:

Update the tolerances for DC EVSE and change the effective date to January 1, 2024. Make the new tolerance retroactive effective January 1, 2025.

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.

Item Under Consideration:

Amend Handbook 44, Electric Vehicle Fueling Systems as follows:

S.5.1. 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)

(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 andthe 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 theDC 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)

NIST OWM Detailed Technical Analysis:

Moving forward with adoption before fully vetting proposals to modify fundamental requirements such as accuracy, transparency, or that ensure fair competition which are the foundation of every weighing and measuring device code can have unforeseen consequences. To delay or eliminate these basic guidelines (tools needed for this new device application) encourages nonuniformity (from state to state) which can be disruptive and impact the level of confidence in the marketplace. Proposals should be evaluated based on their impact on all stakeholders in the community. Time and again the community has moved to take corrective action on discovering an oversight that resulted from either the modification of existing or adoption of a new legal metrology requirement. In the interim prior to a code's publication or the first type evaluation, jurisdictions maintain their regulatory authority over new commercial device applications and emerging technological advances in weighing and measuring equipment through provisions offer alternative means of achieving a provisional status of compliance that encourages commerce is not overburdensome while still allowing for their program's oversight. Some do admit this path can be a more complex process but when well thought out it works. So, there are options such as General Code provisions, the Fundamental Considerations, and provisional status for devices for stakeholders during that interim period until all components of the weights and measures infrastructure are in place.

The proposal outlined in agenda item EVF-23.5 is not exactly the same as an alternative proposal agreed to in a June 2022 ballot of the EVFE Subgroup. In the case of the EVFE Subgroup, the wider tolerance of 5 % for DC systems installed before 2024 was identified by several OEMs as achievable, and the less than ideal existence of dual tolerances in the marketplace would be addressed by marking the accuracy achievable by devices which met only the wider tolerance. Granted some refining of the requirement text would be necessary the group's alternate proposal addressed many concerns expressed by both OEMs and regulators when the Subgroup's discussions on this topic first began in 2020.

NIST OWM is aware of a letter from the State Weights and Measures Directors of Colorado, Michigan, Florida, Vermont and industry representative from Electrify America, Tesla, and EVGo. If as the co-authors of the letter indicate that jurisdictions have not up through October 2022 regulated these systems, then all work to modify the code to appropriately address the marketplace and provide a comprehensive uniform set of tools/requirements needed by regulators and equipment manufacturers (EVSE and test apparatus) can be accomplished. And this includes expediting changes to any oversights or other gaps in the requirements.

Since the proposed accuracy marking applies only to systems capable of meeting the wider 5 percent tolerance, thus not applicable to all systems, and is separate information from the required marking of electrical energy levels and temperature range for the operation of the equipment, we therefore recommend the "Notice" be included as a separate new subparagraph S.5.2.1.

NIST OWM encourages the community's participation in the USNWG which began work in 2012 as a forum for stakeholders and other interested parties in establishing legal metrology standards (also the weights and measures infrastructure) for electrical energy measurements. That effort resulted in NIST

HB 44 3.40 EVFS Code's adoption in 2015. The four paragraphs that appear in multiple 2023 proposals address (1) dual EVSE tolerances (2.0 percent or 5.0 percent [DC EVSEs]); (2) new EVSE markings required for the wider tolerance in the marketplace (proposed new 5.0 percent accuracy for DC systems); and (3) corresponding accuracy test procedures are part of the EVFE SG's meeting discussions. The EVFE Subgroup's work continues up through today having met October 6, 18, and December 8, 2022 to address proposals under consideration for the 2023 cycle. It should be noted that the EVFE SG has worked to further refine the code as more is learned about these systems and since January 2020 met 16 times to consider the proposals the group submitted to the S&T Committee as well as those developed or under development outside of its forum to provide their input. The EVFE SG will provide a clear statement of its exact position on agenda proposals when it reaches a consensus and provides this information in writing (as shown below). The EVFE SG reached a consensus in July 2022 which the group agreed to move forward to recommend a wider tolerance of 5 percent only for DC systems installed before 2024 that must bear accuracy markings while maintaining for AC systems a 1 percent Acceptance Tolerance/2 percent Maintenance Tolerance and the tighter tolerance would also apply to post 2024 DC systems.

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

- The SG agreed to forward the results of its June 2022 ballot (in which it proposed changes to the tolerances and the addition of marking requirements) to the S&T Committee and recommended the Committee consider these recommendations as it considers Items EVF-23.5 and EVF-23.6.

- In a June 2022 ballot, the SG agreed to recommend the following changes to the tolerances and marking requirements in Section 3.40. The SG asks that the Committee consider the SG's recommendations presented below as it deliberates on S&T Agenda Items EVF-23.5 and EVF-23.6 which include proposed changes to these same handbook code paragraphs. The changes agreed to by the SG in its June 2022 ballot are shown below.

    - Additionally, some device users on the SG indicated that there remains a desire to recognize and then maintain a 5 % tolerance for DC legacy (i.e., installed prior to 2024) equipment.

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~~shall be as follows**:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

(Amended 202X)

T.2.2. EVSE Accuracy Test Tolerances for DC Systems. – The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For DC systems installed prior to 2024 and that bear the notice specified in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024, acceptance and maintenance tolerances are: 5.0 %.

(b) For DC systems installed 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 Prior to 2024 tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

(Added 202X)

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and indelibly 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. - DC EVSEs installed prior to 2024 shall be marked with the following:

NOTICE:

"This charger operates at a tolerance of ± 5 percent versus newer chargers which operate at a maximum tolerance of ± 2 percent."

This marking shall be conspicuously, legibly, and indelibly marked, 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 % and a maintenance tolerance of 2 %.

(Added 202X)

(Amended 2021)

Summary of Discussions and Actions:

A letter dated October 18, 2022 from the State Weights and Measures Directors of Colorado, Michigan, Florida, Vermont, and industry representatives from Electrify America, Tesla, and EVGo was sent to the NCWM S&T Committee. The co-authors of the letter remind the Committee that it accepted their July 2022 recommendations for exempting DC systems from "accuracy tolerances and testing until 2028" citing this as a "solution that enables regulators to inspect and test to the accuracy of chargers for which appropriate testing equipment in available." Further indicating that an "inspector or service agent cannot certify a DC fast charger because what is needed is equipment that they can bring to a site of a range up to 350 kW and 600 amps or more and that has NIST-traceable calibration for the energy delivered." Also,

the letter states the "NCWM should not reduce the exemption that it adopted in July 2022 until the Committee has evidence test equipment is reasonably available."

At the 2023 NCWM Interim Meeting, 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. Hal 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. Mahesh Albuquerque (Colorado Division of Oil and Safety) agreed with Hal Prince's comments, expressing his preference for item EVF-23.6. Keith Bradley (Electrify America) referred to the letter submitted and recommends withdraw of the item. Keith Bradley commented on the 5 % tolerance proposed does not included legacy devices. He added there is no available equipment to test these devices. Francesca Wahl (Tesla) agreed with Keith Bradley's comments and recommends withdraw of the item. Francesca Wahl added the need for clarification on the dates in the item. Francesca Wahl added the 2028 was based on the lack of test equipment to test DC EVSEs.

Kevin Schnepp (CDFA DMS) suggested that the submitters of this item, EVF-23.5, and EVF-23.6 work together to develop a single proposal and agrees with Tina Butcher (NIST OWM) to amend language to address accuracy and marking requirements. Perry Lawton (TESCO) commented on TESCO's capability to test DC EVSEs with certified equipment. Perry Lawton added the TESCO TS 400 testing standard is ready to test DC EVs. Tina Butcher 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. Tina Butcher added the two dates of 2025 and 2028 should be clarified.

The Committee considered the comments heard during open hearings and decided to Withdraw this item. The Committee moved forward with EVF-23.6 as a Voting item.

Regional Association Reporting:

Central Weights and Measures Association

At the 2022 NCWM Interim Meeting, Francesca Wahl (Tesla) requested it be withdrawn. 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) and Scheleese Goudy (Electrify America) requested it be Withdrawn.

The CWMA S&T Committee recommended this item be Withdrawn.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received. Francesca 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. Francesca Wahl proposed this item be combined and harmonized with EVF-23.6. Francesca Wahl recommended a Withdrawal status. Scheleese Goudy commented Electrify America agrees with TESLA's comments. Chris King (Siemens) 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

recommended the submitters work with the USNWG to develop one proposal by combining language from EVF-23.6.

The WWMA S&T Committee recommended that this item be blocked with item EVF-23.6. The WWMA S&T Committee recommended the new blocked items be assigned a Developing status.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting. Hal Prince (Florida) stated that this issue has been addressed and that this item should be withdrawn. Scheleese Goudy stated that this item should be withdrawn.

The SWMA S&T Committee recommended that this item be withdrawn.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Keith Bradley and Francesca Wahl requested that this item be withdrawn. Juana Williams (NIST OWM) commented that the EVFE Subgroup has not had the time to vet this item and requested that it be developing. Marc Paquette (Vermont) noted that there are currently no traceable standards to test DC devices and requested a developing status. Lou Sakin (Holliston, Massachusetts), John McGuire (New Jersey), and Walt Remmert (Pennsylvania) agreed with Marc Paquette's'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.

EVF-23.6 V S.5.2. EVSE Identification and Marking Requirements and T.2. Tolerances

Source: Florida Department of Agriculture and ConsumerServices; Electrify America; Tesla; EVGo, Siemens

Submitter's Purpose and Justification:

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 devicesinstalled 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 subjectto 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 thenthose chargers would be subject to the 1 %/2 % tolerance. The proposal includes language to establish this treatment.

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.

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 bemarked as 5 % devices; but if they are not marked that way, they would of course be subject to the 1 % / 2 % level as for new chargers.

B. The basic justification

DC and AC chargers are fundamentally different–in technology, in customer use, and in metering capabilities. AC charging technology, the older form, delivers energy in the same form—voltages and currents oscillating at 60 Hertz (in the United States) as utilities have provided it for a century. Because a vehicle has to convert AC energy to DC for charging the battery, AC charging stations operate at no more than 19.7 kW, and most no more than 6-7 kW. These charging rates will add 24-80 miles of range in an hour of charging a typical car, and consequently AC charging involves extended sessions—the median time that a customer uses an AC station is 22 hours.[1] 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 ultimate needs it. Using voltages of 400 to 950 volts dc and currents up to 500 amps dc (higher levels are coming in the future for applications like charging heavy trucks), they are able to deliver 50kW, 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.[2]

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

[1] Idaho National Laboratory, "Plugged In: How Americans Charge Their Electric Vehicles," p.14, **https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf**.

[2] 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.

operate at 60 Hertz, within ranges of 69 to 480 volts and 0.5 to 30 amps (sufficient to cover typical AC chargers).[3] DC metering technology, by contrast, has been "in research and development."[4] 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.[5] Meanwhile, NIST calibration services for DC watt-hour meters are non-standard, and are available only up to 240 volts and 5 amps[6]—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 to make that assessment, given the lack of NIST-traceable measurement apparatus to test fast DC chargers in the field.

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

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

1. In 2019, California adopted a regulation that put a modified version of Section 3.40. into force for new devices. DC chargers installed before January 2023 are subject to no weights and measuresstandards at all until 2033. DC chargers installed after January 2023 (and before January 2033) are subject to a maintenance tolerance of 5.0 % (and acceptance tolerance of 2.5 %). Consequently, in California, which represents roughly 30 % of the currently-existing base of DC chargers, the maintenance tolerance will be 5.0 % for the coming decade. A maintenance tolerance of 5.0 % for legacy chargers in section 3.40 will be stricter overall than the California regulation (because it will apply to all legacy chargers, whereas the California standard applies only to post-2023 chargers) but will align with the numerical tolerance used in California. Although a 5.0 % tolerance is among the larger tolerances used in Handbook 44, it is not unprecedented. And the fact that newchargers in California will be subject to that standard will mean EV charging customers have substantial experience with that chargers at that tolerance, and the 5.0 % tolerance we propose would be the same transactional experience as customers in California (the largest EV charging market in the country) receive. It bears mention, too, that as Measurement Canada prepares to implement standards for AC chargers, the tolerance (acceptance and maintenance) will be 3.0%, not the 1 % acceptance in Handbook 44. The cost of a typical charging session is $15 to $20. A 5.0% maintenance standard would mean

[3] **https://shop.nist.gov/ccrz__ProductDetails?sku=56110S&cclcl=en_US**.

[4] Cal. Dept of Food & Agriculture, Final Statement of Reasons on Electric Vehicle Fueling Systems, p.23 (Nov. 1, 2019).

[5] Id.

[6] **https://shop.nist.gov/ccrz__ProductDetails?sku=56110S&cclcl=en_US**

a variation, beyond that, of an additional plus *or minus* 40 cents. As with any tolerance, that variation could at any given charger be for or against either side to the transaction.

2. The industry submitters have studied carefully their existing chargers, measurement devices and existing models now available. They believe the 5 % maintenance tolerance is achievable at a manageable cost in the future, because it will generally not require extensive reconfiguring of cabinets and the installation of four-wire cables.

3. The cost of bringing legacy chargers into line with the 1 % / 2 % standard would be extreme. Although equipment is not available to test DC fast chargers in the field, some operators have found in tests of existing devices that they can be brought to a 5 % tolerance but cannot meet the 1 % / 2 % standard without replacing the meters or implementing an entirely new measurement system, which means a physical reconfiguration at each station and/or replacing the cables for delivering the energy to vehicles. Section 3.40. standards are based on the energy delivered at the connector to the car; in other words, a charger must account for losses in the cables. The most straightforward way to account for losses is to measure the voltage at the vehicle connector; that means the cable must have two additional high-voltage leads, to carry that voltage back to the meter[7]. In California's Initial Statement of Reasons (ISOR) for adopting specifications and tolerances requirement for commercial EVSE, California estimated that it costs approximately $20,000 to retrofit an existing DC charger.[8] We understand that cost to represent the cost (parts and labor) to replace the charging cable, and possibly to replace the meter if that task is simple. This cost may be a significant underestimate for some models of charger, because replacing the meter may not always be possible without physical reconfiguration of the space within the charger. Which charger models would require that sort of reconfiguration, and what proportion of the installed base they represent, is impossible to know without a detailed model-by-model study and detailed model-by-model installation data across manufacturers. The upper end of cost would be simply the cost of replacing a charger, which many operators would find preferable to physical reconfiguration of charger internals anyway. The 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.[9] 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).[10] 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"

[7] 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.

[8] **https://www.cdfa.ca.gov/dms/pdfs/regulations/EVSE_ISOR.pdf.**

[9] 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**.

[10] Id. at 4 tab. 4.

DCchargers.[11] 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.[12]

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 revisedproducts. 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 thosechargers also takes time. The January 2024 date is appropriate for expecting new chargers to incorporate meters that were available a few years before that date.

6. The proposal focuses on installation before January 2024, rather than using the concept of retroactive/non-retroactive that is more common in Handbook 44, because non-retroactive is ordinarily based on when a device is placed in service. Many states do not yet regulate EV chargers and consequently have no placed-in-service process. In these states, "placed in service" would not be a well-defined concept, and regulators might not have good ways to determine when a device was placed in service. Installation is a reasonably well-defined process, and it should be possible to 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.

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[11] According to the AFDC's station locator database, there are 6,580 DC stations with 22,767 chargers. The AFDC also reports that the number of DC ports grew 29% year-on-year to the second quarter of 2021. **https://afdc.energy.gov/files/u/publication/electric_vehicle_charging_infrastructure_trends_second_quarter_2021.pdf**. With growth at this rate, about 6,600 additional DCFC stations will be installed in 2022 and 2023, leading to a total of about 36,000 DC chargers that would be "pre-2024" chargers under the proposal.

[12] 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.

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 timeframe is unreasonably soon to do that, given the cost estimates above. California estimated that chargers have an effective 10-year lifespan.[13] 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.[14] Notably, the effect is significantly more stringent than in the California regulation. Under California's rule, a charger installed before 2023 is subject to no standards for 10 years, and then becomes subject to standards in 2033; a replacement of the charger in 2032 would be subject to the 5.0 % maintenance tolerance. A charger installed in 2023 (and that hypothetical 2032 installation) would be subject to the 5.0 % tolerance indefinitely, with no end point. Our proposal, by contrast, would make a pre-2024 charger subject to the 5.0% tolerance once the 2028 compliance dates kicks in but only until 2034, at which point the charger would have to be retrofitted, replaced, or otherwise brought to the 1 % / 2% tolerance.

C. Potential objections

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

Some have also commented that there should not be parallel accuracy classes for a given application. But this approach is not unprecedented. In 1986, NCWM required new scales to be marked with an accuracy class. Pre-1986 scales could remain unmarked, and those unmarked scales were subject to various accuracy tolerances (depending on application) that ranged up to 5.0 %, compared to the largest tolerance for any marked scale at 2.0 %. For grain moisture meters, Handbook 44 has completely separate sections for pre-1998 and post-1998 devices, with some different tolerance specifications for older and newer devices. For both scales and grain moisture meters, there was no sunset date; the older devices have been allowed to continue in use for as long as they operated. We do not suggest that the circumstances with EV chargers are the same. Each of those past examples was based on justifications particular to that situation. Nonetheless, these examples show that it has been done to maintain parallel tolerances for a given application. In addition, there are already parallel, differing tolerances for EV chargers. If the proposal is not adopted, pre-2023 chargers in California will have no tolerance at all until 2033; post-2023 chargers will have a 5.0% 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.

[13] Cal. Department of Food & Agriculture, Final Statement of Reasons, p.6.

[14] California. Code of Regulations § 4002.11; Rev. Code Wash. § 19.94.190(6).

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

This proposal arrives without the formal approval of the U.S. National Work Group subgroup 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. The current proposal has that feature and thus addresses the only concern expressed by the sole "no" vote.

NIST OWM Executive Summary for EVF-23.6 – S.5.2. EVSE Identification and Marking Requirements and T.2. Tolerances

NIST OWM Recommendation:

- Items EVF-23.5 and EVF-23.6 both propose changes to marking and accuracy requirements in NIST Handbook 44.
- OWM has given thought to how we might assist the Committee and the Community in addressing these items and arriving at a single proposal that would meet the needs of the submitters of both items and other stakeholders.
- OWM believes this proposal (Item EVF-23.6) and the alternative recommended in Item EVF 23.5 both require more work and vetting as suggested by two of the four regional associations.
- We believe this work would most appropriately be done in the USNWG SG as recommended during the WWMA meeting and recommend the Committee designate these items as Developing and ask the SG for assistance in vetting the proposals.
- Should the Committee believe there is an urgent need to move one of these proposals forward, OWM encourages the Committee to use the proposed language in Item EVF-23.5 as a starting point to ensure clarity and understanding of the final language.
    - Having well-defined tolerances with clear and understandable effective dates is essential.
    - Defining tolerances in the specific device codes is also preferable to the alternative of having jurisdictions use the provisions of the General Code to implement tolerances suitable for the application since this has the potential for non-uniform application across the country.

NIST OWM Executive Summary for EVF-23.6 – S.5.2. EVSE Identification and Marking Requirements and T.2. Tolerances

- Regarding Item EVF-23.6, OWM offers the following specific technical concerns and comments.

- OWM questions the reference to the phrase "certified to…." In the proposed EVF-23.6 paragraph S.2.5.1. Marking.

  - If the intent is to note the marking is not required for devices capable of meeting the 1 % Acceptance and 2% Maintenance tolerance, then the language should clearly state this.

- OWM concurs that the markings need to be "conspicuously and legibly displayed." Prior versions of similar language considered by the EVFE Subgroup also included the term "indelible" in recognition that the General Code requires all markings to be of a permanent nature. OWM recommends including the term "permanent" to align with the language used in the General Code.

- There are several dates referenced in proposed EVF-23.6 paragraph T.2.2. Tolerances that conflict and OWM believes will create confusion for those implementing the proposed requirements.

- The statement adopted by the NCWM in July 2022 exempting DC devices from any tolerance requirements until 2028 remains in the proposal, yet there is a date of 2024 in both the proposed paragraph T.2.2.(a) and paragraph T.2.2.(b) which specifies requirements for DC devices installed prior to 2024. This is confusing and widens the gap: (1) in time delays in the application of tolerances in what will be a dual tolerance marketplace for DC systems (2) that encourages nonuniformity in equipment performance and (3) in the timely marking of information for consumer awareness.

- Proposed paragraph T.2.2.(a) references a sunset date of 2034, yet there is still a statement referring to a 2028 date, creating a conflict. Additionally, the 2034 date is 6 years after the 2028 date that was adopted by the NCWM in July 2022. The rationale for extending the sunset date is not clear. OWM also notes that a date of 2034 is eighteen years after the tentative code was first adopted by the NCWM.

- The rationale for the following statement in paragraph T.2.2.(b) is not clear and OWM believes this statement needs to be struck from the proposed new paragraph T.2.2.(b):

  - "or that do not bear the notice specified in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024 tolerances are"

- Proposed accuracy markings need to be separate from the markings of electrical energy levels and required temperature ranges, therefore OWM agrees the "Notice" be included as a separate, new subparagraph S.5.2.1.

- As shared in its comments in Item EVF-23.5, OWM believes the proposed changes in Item EVF-23.5 are much clearer in language, format, and application and are closer to language agreed to by the USNWG SG in June 2022 than are the proposed changes in Item EVF-23.6.

NIST OWM Executive Summary for EVF-23.6 – S.5.2. EVSE Identification and Marking Requirements and T.2. Tolerances

- The NIST USNWG EVFE Subgroup reached a consensus through a June 2022 ballot in which the group agreed to move forward to recommend a wider tolerance of 5 percent only for DC systems installed before 2024 that must bear accuracy markings while maintaining for AC systems a 1 percent Acceptance Tolerance/2 percent Maintenance Tolerance and the tighter tolerance would also apply to post 2024 DC systems.

- The language from the June 2022 ballot is included in OWM's detailed analysis below and in Item EVF-23.5.

- As noted in its comments on Item EVF-23.5, OWM is aware of comments indicating EVF-23.5 may not meet the needs of all stakeholders as presently written and OWM believes additional changes would be needed to that item. However, the proposed changes in Item EVF-23.5 are much clearer in language, format, and application and are closer to language previously agreed to by the USNWG SG in June 2022 than are the proposed changes in Item EVF-23.6.

- There are differences between the language recommended in that June 2022 SG ballot and that proposed in Item EVF-23.6. The language adopted in the June 2022 ballot:

  - Permits DC devices installed before 2024 to have a wider tolerance if they were clearly marked to designate their accuracy.

  - Includes a wider tolerance of 5 % for DC systems installed before 2024 when accuracy is marked, which several OEMs identified as achievable. Note: The SG's language does not include an exemption for DC systems from accuracy tolerances up through 2028 to sunset in 2034.

  - Acknowledges the less-than-ideal existence of dual tolerances in the marketplace would be addressed by marking systems to indicate when 5 percent is their achievable accuracy; and

  - Recognizes the EVFE Subgroup would further refine the requirement's text.

- OWM is also aware of a Florida, Electrify America, Tesla, EVGo, and Siemens' October 15, 2022, letter sent to the S&T Committee regarding EVF-23.6 and a June balloted proposal of the USNWG EVFE Subgroup (SG). OWM submitted the following clarifications regarding this letter to the S&T Committee.

  - NIST OWM, as convenors of the EVFE SG, sent a response to the Committee indicating that although the results of the Subgroup's June 2022 ballot indicate the group's support for modifications to tolerances and marking requirements this should not be construed as supporting the specific changes proposed in EVF-23.6.

  - There are some key differences between the Subgroup's June balloted proposal and EVF-23.6. Specifically, the Subgroup's proposal does not include two different retroactive dates and differs in the magnitude of the tolerances and specific conditions under which they would apply, the permissible format required for markings (which are not indelible, do the submitters have a label or electronic only in mind?) and reference to certification. The

NIST OWM Executive Summary for EVF-23.6 – S.5.2. EVSE Identification and Marking Requirements and T.2. Tolerances

convenors of the Subgroup will continue to provide written and verbal input as explicitly directed by the group.

- Below are some additional comments for the Committee and other stakeholders to consider in reviewing Items EVF-23.5 and EVF-23.6.
- Adoption should occur only after fully vetting proposals to modify fundamental requirements such as those that impact accuracy, transparency, or that ensure fair competition to:
  - avoid unforeseen consequences;
  - ensure stakeholders have the tools needed for this new device application;
  - discourage nonuniformity which can have a disruptive influence on the marketplace; and
  - take corrective action on discovering any gaps/oversight in modifications to the seven-year-old legal metrology requirements.
- NIST OWM encourages the community's participation in the USNWG EVFE Subgroup which began its work in 2012 and whose work resulted in NIST HB 44 3.40. EVFS Code's adoption in 2015. The Subgroup is reviewing the four paragraphs that appear in multiple 2023 proposals that address: (1) dual EVSE tolerances (2.0 percent or 5.0 percent [DC EVSEs]); (2) new EVSE markings required for the wider tolerance in the marketplace; and (3) corresponding accuracy test procedures.
- The EVFE Subgroup last met on December 8, 2022, to address proposals under consideration for the 2023 cycle and will provide a clear statement in writing of its exact position on agenda items.
- Where commercial equipment is known to operate at dual tolerances the proposed marking and performance requirements should be retroactive.

Table 2. Summary of Recommendations
EVF-23.6 – S.5.2. EVSE Identification and Marking Requirements., and T.2. Tolerances.

	Status Recommendation	Note*	Comments
Submitter	Voting		October 15, 2022 and May 8, 2023 letters of support
OWM			October 20, 2022 letter of clarification on points made in the Submitter's 15OCT2023 letter to the Committee and on the June and December 2022 findings of the USNWG EVFE Subgroup
WWMA	Developing		
NEWMA	Voting	1	Recommended a 2028 effective date for only proposed paragraph T.2.2. DC tolerances

SWMA	Voting		
CWMA	Voting	1	Propose further modification of paragraph S.2.5.1. to recognize use of the indications to display accuracy markings
NCWM	Voting		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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. 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) (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) (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.

NIST OWM Detailed Technical Analysis:

The proposal outlined in agenda item EVF-23.6 is not exactly the same as an alternative proposal agreed to in a June 2022 ballot of the EVFE Subgroup. In the case of the EVFE Subgroup, the wider tolerance of 5 % for DC systems installed before 2024 was identified by several OEMs as achievable, and the less than ideal existence of dual tolerances in the marketplace would be addressed by marking the accuracy achievable by devices which met only the wider tolerance. Granted some refining of the requirement text would be necessary the group's alternate proposal addressed many concerns expressed by both OEMs and regulators when the Subgroup's discussions on this topic first began in 2020.

NIST OWM is aware of an October 15, 2022 letter from Florida and industry representatives from Electrify America, Tesla, EVGo, and Siemens sent to the NCWM S&T Committee. The co-authors of the letter summarized the EVF-23.6 proposal recommendations. The co-authors stated their beliefs about their comparison of EVF-23.6 to the Subgroup membership's June 2022 balloted proposal and the subgroup's position on EVF-23.6. On October 20th NIST OWM as convenors of the USNWG EVFE Subgroup sent to the NCWM S&T Committee a written response to the October 15th letter to clarify references made that imply the EVFE Subgroup's approval or support of S&T Agenda Item EVF-23.6. Though the results of the Subgroup's June 2022 ballot indicate the group's support for modifications to tolerances and marking requirements this should not be construed as supporting the specific changes proposed in EVF-23.6. There are some key differences between the Subgroup's June balloted proposal and EVF-23.6. Specifically, the Subgroup's proposal does ***not*** include two different retroactive dates and differs in the magnitude of the tolerances and specific conditions under which they would apply, the permissible format required for markings, and reference to certification. The convenors also clarified that

the Subgroup will provide written and verbal input as explicitly directed by the group (shown below under the subgroup heading).

The proposal in EVF-23.6 to include a new paragraph T.2.2. to address DC systems tolerances as worded permits a 5 percent tolerance for EVSEs installed pre- or post- 2024 on the condition this accuracy is declared in a "NOTICE"; however, if not bearing a notice then the expectation is that regardless of the installation date a DC system will still be permitted 5 percent accuracy. Device tolerances should not henge on the presence of a temporary label (i.e., the "Notice" for accuracy does not have to be indelible). Equipment has been permitted multiple accuracy classes; however, those devices bear an accuracy class marking permanently at all times and that determination is made during type evaluation of the device. In many device codes there is only a single accuracy class.

Newly proposed subparagraph T.2.2.(a) specifies a 2034 sunset date for equipment with a 5 percent accuracy this is almost two decades after the EVFS Code was published and becomes the second enforcement date included in the tolerance specification. The DC tolerance requirement also includes a 2028 enforcement date proposed in July 2022 and then adopted in July 2022 as part of a priority item. That 2028 date appears as the current handbook edition as an applicable enforcement date in Agenda Item EVF-23.6. This proposal attempts to address DC systems tolerances when they are exempt from handbook test tolerances until 2028.

Agenda Item EVF-23.6 proposed new paragraph S.5.2.1., an accuracy marking requirement for DC systems installed before 2024, is not applicable if the EVSE is "certified." Typically, references in the code to "certified" equipment are there to address requirements applicable to either test standards such as certified test weights or a reference scale, which are typically verified just prior to use and meet a performance level higher than that of the commercial device under test, or the device has undergone type evaluation and been issued a certificate. What would be the instructions for achieving this status given DC systems are not certified?

Moving forward with adoption before fully vetting proposals to modify fundamental requirements such as accuracy, transparency, or that ensure fair competition which are the foundation of every weighing and measuring device code can have unforeseen consequences. To delay or eliminate these basic guidelines (tools needed for this new device application) encourages nonuniformity (from state to state) which can be disruptive and impact the level of confidence in the marketplace. Proposals should be evaluated based on their impact on all stakeholders in the community. Time and again the community has moved to take corrective action on discovering an oversight that resulted from either the modification of existing or adoption of a new legal metrology requirement.

NIST OWM encourages the community's participation in the USNWG which began work in 2012 as a forum for stakeholders and other interested parties in establishing legal metrology standards (also the weights and measures infrastructure) for electrical energy measurements. That effort resulted in NIST HB 44 3.40 EVFS Code's adoption in 2015. The four paragraphs that appear in multiple 2023 proposals address (1) dual EVSE tolerances (2.0 percent or 5.0 percent [DC EVSEs]); (2) new EVSE markings required for the wider tolerance in the marketplace (proposed new 5.0 percent accuracy for DC systems); and (3) corresponding accuracy test procedures are part of the EVFE SG's meeting discussions. The EVFE Subgroup's work continues up through today having met October 6, 18, and December 8, 2022 to address proposals under consideration for the 2023 cycle. It should be noted that the EVFE SG has worked to further refine the code as more is learned about these systems and since January 2020 met 16 times to consider the proposals the group submitted to the S&T Committee as well as those developed or under development outside of its forum to provide the group's input. The EVFE SG will provide a clear statement of its exact position on agenda proposals when it reaches a consensus and provides this

information in writing (as shown below). The EVFE SG reached a consensus in July 2022 which the group agreed to move forward to recommend a wider tolerance of 5 percent only for DC systems installed before 2024 that must bear accuracy markings while maintaining for AC systems a 1 percent Acceptance Tolerance/2 percent Maintenance Tolerance and the tighter tolerance would also apply to post 2024 DC systems.

Where commercial equipment is known to operate at dual tolerances the proposed marking and performance requirements should be retroactive. NIST OWM concurs with the NEWMA recommendation to make the proposal applicable to coincide with the 2024 date for the installation and commercial use for systems specified in EVF-23.6 and in light of the EVSE code's adoption almost a decade ago in 2015.

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

- The EVFESG agreed to forward the results of its June 2022 ballot (in which it proposed changes to the tolerances and the addition of marking requirements) to the S&T Committee and recommend the Committee consider these recommendations as it considers Items EVF-23.5 and EVF-23.6.

- In a June 2022 ballot, the SG agreed to recommend the following changes to the tolerances and marking requirements in Section 3.40. The SG asks that the Committee consider the SG's recommendations presented below as it deliberates on S&T Agenda Items EVF-23.5 and EVF-23.6 which include proposed changes to these same handbook code paragraphs. The changes agreed to by the SG in its June 2022 ballot are shown below.

    - Additionally, some device users on the SG indicated that there remains a desire to recognize and then maintain a 5% tolerance for DC legacy (i.e., installed prior to 2024) equipment.

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~~shall be as follows**:

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.
(Amended 202X)

T.2.2. EVSE Accuracy Test Tolerances for DC Systems. – The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For DC systems installed prior to 2024 and that bear the notice specified in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024, acceptance and maintenance tolerances are: 5.0 %.

(b) For DC systems installed 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 Prior to 2024 tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

(Added 202X)

S.5.2. EVSE Identification and Marking Requirements. – In addition to all the marking requirements of Section 1.10. General Code, paragraph G-S.1. Identification, each EVSE shall have the following information conspicuously, legibly, and indelibly 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. – DC EVSEs installed prior to 2024 shall be marked with the following:

NOTICE:

"This charger operates at a tolerance of +/- 5 percent versus newer chargers which operate at a maximum tolerance of +/- 2 percent."

This marking shall be conspicuously, legibly, and indelibly marked, 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 % and a maintenance tolerance of 2 %.

(Added 202X)

(Amended 2021)

Summary of Discussions and Actions:

The Submitters most recently sent a letter dated May 8, 2023 to remind the Committee about a previous letter dated October 15, 2022 from the State Weights and Measures Director of Florida and industry representatives from Electrify America, Tesla, EVGo, and Siemens sent to the NCWM S&T Committee. The co-authors of the letter summarized the EVF-23.6 proposal's recommendation for a 5 percent tolerance for DC systems installed before 2024 when so marked, if installed after 2024 or lacking the 5 percent markings, those DC systems would be subject to 1 percent/2 percent tolerance. The Submitters noted the October 4, 2022 announcement by NIST of a general consensus on a June 2022 balloted proposal of the USNWG EVFE Subgroup (the ballot was an attachment to the submitters' October 15th letter). However, the submitters did not report the results of that ballot and it should be noted that the EVFE Subgroup did not meet the threshold required to approve the June 2022 ballot. The Submitters' response to the EVFE Subgroup member opposing the June 2022 proposal was to include a new 2034 expiration on the 5 percent tolerance as part of the proposal in item EVF-23.6. The submitters stated their beliefs about their comparison of EVF-23.6 to the Subgroup membership's June 2022 balloted proposal and the Subgroup's 2022 position on EVF-23.6.

A letter dated October 20, 2022 from the NIST OWM as convenors of the USNWG EVFE Subgroup was sent to the NCWM S&T Committee in response to the October 15th letter co-authored by Florida, Electrify America, Tesla, EVGo, and Siemens. The letter was sent to clarify references made in the October 15th letter that imply the EVFE Subgroup's approval or support of S&T Agenda Item EVF-23.6. Though the results of the Subgroup's June 2022 ballot indicate the group's support for modifications to tolerances and marking requirements this should not be construed as supporting the specific changes proposed in EVF-23.6. There are some key differences between the Subgroup's June balloted proposal and EVF-23.6. Specifically, the Subgroup's 2022 proposal did ***not*** include two different retroactive dates and differed in the magnitude of the tolerances and specific conditions under which they would apply, the permissible format required for markings, and reference to certification. The convenors of the Subgroup will continue to provide written and verbal input as explicitly directed by the group.

In Conclusion: May 2023 deliberations of the EVFE SG resulted in a vote approving the proposal, followed by a letter indicating the group's of support of the proposal being sent to the NCWM S&T Committee. The EVFE Subgroup met on December 8, 2022, input based on the group's discussions of S&T Item EVF-23.6 are provided above in the section of this analysis under the heading U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG). However, during the EVFE Subgroup March 2, 2023 meeting during its discussions on all S&T Agenda EVSE related proposals the Subgroup did vote to approve Item EVF-23.6 with six Public Sector and seven Private Sector votes resulting in 12 Approving and one Opposing (Private Sector) the Committee's March 2023 version of EVF-23.6. The Subgroup acknowledged the Committee's providing additional information in the accuracy notice statement to clarify the limits of the performance of unmarked DC systems is at a "maximum" tolerance of up to ± 2 percent. At the conclusion of its March 6th meeting and discussions the EVFE Subgroup considered further modifications to proposed new paragraph S.5.2.1. to recognize accuracy markings in digital format. A ballot on a digitally formatted accuracy marking resulted in six Votes [three Public/three Private] to Approve and six Votes [two Public/two Private] in opposition which did not meet the threshold for the Subgroup's approving further modification of EVF-23.6 at this time.

Summary of Discussions and Actions:

At the 2023 NCWM 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 and CDFA DMS to include:

- Further modifications by the Committee to proposed new paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024 included:

  - eliminating the exemption for marking accuracy levels for EVSEs that hold an unspecified certification by removing the text "unless it is certified to the tolerances of T.2.2(b)" from the paragraph:

  - specifying in the accuracy notice statement that the EVSEs marked 5 percent tolerance are in contrast all "other" unmarked systems operating at more stringent tolerances which resulted in the removal of any reference to "newer" charging equipment

  - providing more information on the accuracy limits of DC EVSEs that meet the 2 percent tolerance by specifying these systems operate at a "maximum" tolerance of up to ± 2 percent

Additionally, the Committee modified the conditions for displaying the accuracy markings in paragraph S.5.2. EVSE Identification and Marking Requirements by removing the term ”indelibly”-and specifying this information must be “permanently” marked.

In proposed new paragraph S.5.2.1. and paragraph T.2.2. EVSE Load Accuracy Test Tolerances for DC Systems the Committee further clarified that this set of requirements apply to DC systems installed prior to January 1, 2024 and when the equipment has been “placed into service” prior to January 1, 2024.

Regional Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Scheleese Goudy (Electrify America) remarked a 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) recommended the proposal move forward as Voting. Possible change: P 244, line 39. which “may” operate.

The CWMA S&T Committee believed this item is fully developed and recommended 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)

T.2. Test Tolerances.

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

(a) Acceptance Tolerance: 1.0 %; and

(b) Maintenance Tolerance: 2.0 %.

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

(b) For DC systems installed 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 Prior to 2024 tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

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

At the 2023 CWMA Annual Meeting, Scheleese Goudy (Tesla) stated the EVFE Subgroup approved this change and had no objection to digital display. The 2028 exemption was just voted and approved at NCWM. If moved to 2024, there is no adequate test equipment to test DC chargers. A recent demonstration of a tester did not function correctly for DC testing. If the exemption date moves up, states would have to write policies to exempt devices?

Jared Ballew (ChargePoint) indicated the original intent was to display the notice digitally or physically. And has concern that current wording does not make it clear that digital display of the notice is acceptable. Retrofitting existing equipment with physical markings would be cost prohibitive. And then the same when the notice is removed in the future. He does not support proposal without the clear allowance for digital display. No problem with moving the date to 2024, they've known this tolerance expectation for years. But agrees that the availability of (lack of) test equipment, would cause a problem.

Loren Minnich (NIST OWM) indicated NIST OWM would recommend that the S&T Committee provide guidance on the intent and implementation of three enforcement dates in proposed new paragraph T.2.2. EVSE Load Accuracy Test Tolerances for DC Systems to ensure regulators, the service industry, EVSE and test equipment manufacturers, and operators can smoothly transition equipment into commercial use and eventually meet the tighter tolerance. This is more important because the exemption granted for "All

DC EVSE“ tolerances until January 1, 2028 remains in code paragraph T.2. creating a four-year gap that impacts the proposed new dual tolerance system (i.e., the straightforward application of two separate tolerances from a pre2024 and post 2024 generation of equipment standpoint). The 2028 enforcement date is a sharp contrast to the enforcement dates prescribed in the submitters' first statement on their purpose for the proposal of creating "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)." The tracking of equipment is critical and may require more work because locations are obscure and not attended (requiring more investigative work to communicate with the operator and billing agent) also since placed in service policies vary from jurisdiction to jurisdiction.

At the NEWMA Regional Meeting a proposal was made and adopted to recommend the January 1, 2028 date be amended to January 1, 2024. If accepted by the NCWM S&T Committee the earlier date could eliminate the potential confusion in the implementation of this requirement. This would allow each jurisdiction the discretion to implement these accuracy requirements as test equipment becomes available to place devices into service. This would eliminate the current exemption from any tolerances for DC systems and would provide industry with firm requirements on which to base test equipment capabilities and EVSE devices capable of meeting these requirements. There would still be two sets of tolerances based on the date of installation, prior to January 1, 2024 and after January 1, 2024 depending on equipment capability or markings as described in paragraph S.5.2.1. Marking of Accuracy Limits, DC EVSEs Installed Prior to 2024.

Monica Martinez (Tesla) supports voting. Important to address new technology. Support the idea of digitally and agree as long as voting in July is preserved. The 2028 exemption is the same that was voted on at NCWM. No evidence that anything has changed to warrant the exemption date being moved (testing equipment still not available).

Craig VanBuren does not support changing date from 2028. Supports digital allowance <u>if</u> it says the notice must be displayed prior to the transaction.

The Committee recommends this item remain voting status with the following change to S.5.2.1. (S&T – 353, Lines 4 and 5:

> This marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used to display this notice, provided the notice is presented to the customer prior to the beginning of the transaction.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Scheleese Goudy (Electrify America) commented on the metering technology for DC chargers are now becoming available as technology develops. Scheleese Goudy proposed previously installed devices will not be able to meet the 1 and 2 % tolerances. Scheleese Goudy commented the tolerances are being developed with separate tolerances for legacy devices that can't meet the proposed requirements. Scheleese 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. Scheleese Goudy stated the changes to the item incorporated the change to include a 10-year sunset of legacy devices. Scheleese Goudy commented devices would be marked for the public and inspectors with the required tolerances. Scheleese Goudy recommended Voting status.

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

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

Chris King (Siemens) 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 recommended the submitters work with the USNWG to develop one proposal by combining language from EVF -23.5.

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

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Hal Prince (Florida) spoke in favor of this item being a satisfactory compromise.

Paul Floyd (Louisiana) stated that he would rather not have devices with warning labels for accuracy.

Scheleese Goudy recommended this move forward as a Voting Item.

John Stokes (South Carolina) stated that he supported the use of warning labels for these devices and supported this item.

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

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, Keith Bradley (Electrify America) recognizes that when the code was originally adopted there was questions about DC meters being able to meet a 1 % and 2 % tolerance. This item is to make sure devices are properly marked for the consumer as installed before 2024 and 5 % tolerance. If devices are not marked this way, the 1 % and 2% tolerances would apply. Installed devices would have the larger tolerance until 2034, then revert. Francesca Wahl recommends Voting status. Juana Williams (NIST OWM) noted that there is a letter from NIST to indicate that a status update on this item is forthcoming and has info to address marking and tolerances for DC systems. In a June meeting by the EVSE Subgroup, there was no 2028 retroactive date being considered and the proposal they reviewed included different sets of tolerances and marking requirements based on install date. Jason Flint (New Jersey) requested that this item be given a Developing status as there is too much debate and too many questions. Jason Flint suggested that the submitters of EVF-23.5 and EVF-23.6 work together to develop further.

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

At the 2023 NEWMA Annual Meeting, Scheleese Goudy provided a letter from the submitters and supports as voting. Alicia Artessa (Tesla) supports as voting. Jared Ballew did not support the item as currently drafted, only with minor modification to S.2.5.1, as follows: "This marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used to display this notice, provided the notice is presented to the customer prior to the beginning of the transaction."

He believes the original intent of the proposal was that the notice would be available digitally. Loren Minnich (NIST-OWM) indicated that the NCWM S&T Committee should provide guidance on 3 different dates listed in the proposal. Scheleese Goudy supports ChargePoint's proposal of modifying the language in S.2.5.1.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a voting status with no changes. However, during discussion, Lou Sakin (Hopkinton, Massachusetts) requested that the date pertaining to DC EVSE be changed from 2028 to 2024. Lou Sakin stated that at the time the EVSE code became permanent in Jul 2022, testing equipment was not readily available to DC chargers, however, it has been demonstrated that the equipment is now available and enforcement agencies should have the ability to use it to enforce the tolerances. A suggestion was made by Ethan Bogren (Westchester County, New York) to change the date to 2025. Scheleese Goudy disagrees that the technology is not available yet and does not support changing the date. Support for changing the date to 2024 was heard from Lou Sakin, James Cassidy (Massachusetts), Walt Remmert (Pennsylvania), Jim Willis (New York), Ms. Cheryl Ayer (New Hampshire), and Jared Ballew (ChargePoint).

After hearing discussion, the body voted to recommend to the NCWM S&T Committee to maintain a voting status with the following further changes to the current last sentence in T.2. Load Test Tolerances which applies to DC EVSEs to read:

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

EVF-23.7 D N.1. No Load Test, N.2. Starting Load Test, N.5.2. Accuracy Testing, and Appendix D: Definitions – maximum deliverable amperes

Source: Electrify America

Submitter's Purpose and Justification:

The proposal would have the testing conducted at the contemplated 10 %. Because it is unlikely that tests would actually be at precisely 10 %, the proposal would allow testing in a small range slightly above 10 %.

The accuracy tests in Section 3.40 contemplate testing an EV charger at two points, one at relatively low current and power, and the other at relatively high current and power. The low point was evidently intended to be at 10 % of a charger's maximum current. It is likely that charger manufacturers have designed chargers with that 10 % in mind as the "low" point of accuracy tests. But the code does not

actually state that testing should be *at* 10 %. It says testing can be at a current *less than* 10 %. This formulation is problematic because it encompasses any current less than 10 %. Zero is less than 10 %, and 0.1 A is less than 10 % even though it is less than the amount at which the code requires a charger to first register a load. Even currents larger than these, but less than 10 %, would be unnecessarily difficult for an accuracy test. The problem is that low currents are an area where accuracy is particularly difficult. For example, one common metering configuration is to measure the current being delivered by means of a shunt resistor, which generates a voltage from the high current passing through it. These resistors necessarily have very low resistances because they are necessarily dissipating power in accordance with the resistance. A typical resistor in an EV charger metering setup might be 100 micro-ohms. For a 500 amps full-scale current in a DC charger, that resistor would be dissipating 25 watts of power - thus, a much larger resistor is not a practical option. At, say, 10 amps of delivered current, the voltage generated across the resistor would be 1 millivolt. A 1 % measurement of that 1 millivolt would be 10 microvolts. At that level, a range of noise sources become quite significant, such as thermal EMF in the resistor itself and induced EMFs from the presence within the charger cabinet of voltages up to 480 volts ac or 950 volts dc, as well as any offsets or noise in the circuitry measuring the transduced voltage. The net result is that it is very challenging to achieve high accuracy at low currents in a device designed to handle and measure high currents. For reasons like these, the draft international (OIML) standard specifies that an accuracy test should be conducted *at* a given minimum current, rather than (like current Handbook 44) at any current *up to* that minimum.

Meanwhile, low currents are the levels least significant for transactional accuracy. At low current, a charger is delivering energy at a relatively low rate. As a practical matter, an EV will charge at the maximum rate possible in the circumstances. As the battery reaches a higher state of charge, it will draw less power from the EV, but only a small proportion of the overall energy will be delivered at low rates, precisely because the rates are low. Suppose as a simplified example, an EV charges for 30 minutes at 300 amps and 30 minutes at 15 amps (at a voltage of 400 volts). The EV will have received 60 kWh in the first part of the session, and only 3 kWh in the second part. The low-current period of charging contributes relatively little to the accuracy/inaccuracy of the overall transaction.

Thus, it is important for Handbook 44 to set a minimum current for accuracy tests. Because the point of 10 % of the maximum deliverable amperes is already in the code and has probably been used as a design basis for chargers, the proposal would keep that as the low-current point. The overall concept would be for testing to occur *at* 10 % of maximum deliverable amperes, rather than at *up to* 10 %. But it is impractical to specify a single point. An inspection that does not achieve a test at precisely the 10 % should not, as a consequence, be an invalid inspection. To make this practical, the proposal would have the low-end test occur in a range of currents, namely 10 % to 20% of the charger's maximum.

The code presents a similar problem for DC chargers tested using EVs as loads. The code allows an EV to be used as the load, rather than using a controlled load that draws the loads specified in the code. But the code provides no specifications about how to use an EV in this sort of test. So, it is possible that a tester could use an EV that is, say, at 95% state of charge in the battery, and that would arrive at the charger and draw very low levels of current (sometimes called a "trickle charge"). For the reasons discussed above, that sort of test would not be a productive test of the meaningful accuracy of the charger. The code should set a minimum current for an EV-based test to be usable. The proposal would have that minimum be 30% of the charger's maximum. It is set at more than 10 % because the EV-based test uses a single test point, which should therefore be somewhere in the middle of the charger's range.

The proposal would also add a definition of "maximum deliverable amperes." This quantity is the same as used in the existing code as the basis for the 10 % figure, but it is not currently defined. The definition would state that maximum deliverable amperes means the amount marked on the charger. (The code

already requires that amount to be marked.) This amount might be less than the manufacturer's specification for the potential maximum of the device, if for example the installation limits the charger to a particular amount, or the installer has selected a configuration with a lower maximum. But the maximum deliverable amount is a quantity that is fixed at installation and marked on the charger. The current code suggests that maximum deliverable amperes is the amount that the charger communicates to a vehicle or test apparatus. That approach is confusingly ambiguous, because the charger might for various reasons sometimes communicate a lower available current than its marked maximum. The proposal clarifies that for accuracy tests based on a percentage of maximum current, the "maximum" being used is the maximum marked on the device.

These concepts have been discussed in the U.S. National Work Group's Subgroup on EV charging. There is general consensus in favor of the proposal, but there has not been a quorum to vote formally in favor of it.

Finally, the proposal would eliminate the no-load and starting-load tests. These tests take unnecessary time, because an inspector has to wait to verify that a load of zero genuinely produces no response and a starting load of just 0.5 amps produces a response. Meanwhile, these tests are not meaningful for the transactional accuracy of an EV charger. In the process of establishing a handshake that the EV charger is connected to a vehicle, the charger might provide minute test amounts of current, so that a truly zero load is not pertinent to any real transaction; and these minute test currents may well 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.

NIST OWM Executive Summary for EVF-23.7 – N.1. No Load Test, N.2. Starting Load Test N.5.2. Accuracy Testing, and Appendix D: Definitions– maximum deliverable amperes

NIST OWM Recommendation:

- Test procedures are not solely written to the operational characteristics or particular design of one test apparatus. Test procedures should encompass operational conditions over the course of the entire transactions in the marketplace. Test points should fall within the rated minimum up through the maximum operational ranges specified by the manufacturer for the EVFS under normal conditions of commercial use.

- Observe this proposal removes any reference to the feature used to determine the MDA percentage level achieved during accuracy tests and establishes a new MDA range for performing the light load test and when a vehicle is the test load for verifying EVFSs; whereas other proposals recommend the establishment of a new laboratory test in addition to field test procedures.

NIST OWM Executive Summary for EVF-23.7 – N.1. No Load Test, N.2. Starting Load Test N.5.2. Accuracy Testing, and Appendix D: Definitions– maximum deliverable amperes

- The EVFS test standard must be fit for purpose or appropriate and suitable (this might be demonstrated by data) in its design, capacity, and accuracy; and would allow for replication of the manner in which the EVSE is used in commerce. The test standard used to verify an EVSE must also meet the NIST HB 44 Appendix A Fundamental Considerations for a test apparatus.

- Therefore, with a decade of experience with EVFSs having gone through type evaluation (i.e., CADMS) and test equipment designed to verify both AC and DC systems and the laboratory community closing in on filling the last gaps in the weights and measures infrastructure for EVFSs; it is important and necessary that all stakeholders (EVSE/test equipment manufacturers, type examiners, and regulators) reach a consensus on test procedures.

- Is this a proposal to renumber paragraph N.5. Accuracy Testing to become N.5.2.1.? The proposal does not show paragraph N.5.2 in entirety, is the submitter proposing to remove the 2028 enforcement date?

- For clarity the "meaning portion" of a definition should not include the term or parts of the term it is defining nor cite one of the many code paragraphs where the term is used because the appearance can be the term is unique to that sole paragraph. Therefore, the term's definition should include reference to the EVFS Code in brackets (i.e., [3.40] at the end of the definition rather cite a single code requirement or paragraph. The EVFS is a permanent code and definitions applicable to the code should be included in Appendix D—Definitions.

- The proposal removes the No Load Test and Starting Load Test but does not do the same for the tolerances applicable to these tests in paragraphs T.5. and T.6, respectively.

- The EVFE Subgroup's Test Procedures Subcommittee is currently tasked with working through a recently modified version of the test procedures addressed in Item EVF 23.4. This latest modified version of the test procedures is the result of the collaborative effort of the submitters of both proposals. Based on the Test Procedures Subcommittee findings the Subgroup has targeted the upcoming standards development cycle to develop and provide input on both EVF-23.4 and EVF-23.7.

Table 2. Summary of Recommendations
EVF-23.7 – N.1. No Load Test, N.2. Starting Load Test, N.5.2. Accuracy Testing, and Appendix D: Definitions – maximum deliverable amperes

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	Developing		
SWMA	Voting		
CWMA	Developing		

NCWM	Developing		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend Handbook 44 Electric Vehicle Fueling Systems Code as follows:

~~**N.1. No Load Test. A no load test may be conducted on an EVSE measuring system by applying rated voltage tothe 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-ampereload.**~~

…

N.5.2.1. Accuracy Testing. – The testing methodology compares the total energy delivered in a transaction andthe 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 fromthe DC EVSE to the test standard**~~ for a total energy delivered of at least twice the minimum measuredquantity (MMQ).

(2) Accuracy test of the EVSE system at a load of ~~**not more than**~~ 10 % ~~**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.

NIST OWM Detailed Technical Analysis:

There are other proposals on the S&T Committee agenda to modify the minimum light load and full load test procedures for AC and DC systems addressed in paragraph N.5.2. Accuracy Testing under consideration in the 2023 cycle. One reoccurring recommendation is for a separate new set of test procedures for type evaluation performed under laboratory conditions that did not previously exist and would be a substantive change to the 2023 edition of the HB 44. However, this proposal removes any reference to the feature used to determine the MDA percentage level achieved during accuracy tests and establishes a new MDA range for performing the light load test and when a vehicle is the test load for verifying EVFSs.

Test procedures are not solely written to the operational characteristics or particular design of one test apparatus. Test procedures should encompass operational conditions over the course of the entire transactions in the marketplace. Test points should fall within the rated minimum up through the maximum operational ranges specified by the manufacturer for the EVFS under normal conditions of commercial use. The USNWG developed the handbook AC and DC systems' light load test and full load test procedures in part because they appeared to be the most likely conditions under which equipment would be used during a charging session and based on existing test procedures and knowledge about watt-hour type electric meters. Watthour type electric meters were the only electrical energy device regulated by a U.S. weights and measures in the 2012 timeframe. For each gap in the EVSE infrastructure there have been stakeholders indicating a solution is possible. The community was advised to wait for completion of performance criteria for DC meters which became available in March 2021 in ANSI C 12.32-2021 American National Standard for Electricity Meters for the Measurement of DC Energy and would be an important reference document for DC type electricity metering in EVFSs. Therefore, with a decade of experience with EVFSs having gone through type evaluation (i.e., CADMS) and test equipment designed to verify both AC and DC systems and the laboratory community closing in on filling the last gaps in the weights and measures infrastructure for EVFSs it is important and necessary that all stakeholders (EVSE/test equipment manufacturers, type examiners, and regulators) reach a consensus on test procedures.

The EVFS test standard must be fit for purpose or appropriate and suitable (this might be demonstrated by data) in its design, capacity, and accuracy; and would allow for replication of the manner in which the EVSE is used in commerce. The test standard used to verify an EVSE must also meet the NIST HB 44 Appendix A Fundamental Considerations for a test apparatus.

The term "maximum deliverable amperes" or abbreviated as "MDA" would be defined as "the highest current value or highest level of current or highest total current capacity at which the manufacturer has designed the EVFS to operate and meet accuracy." Note: choose one of the three lead statements as the

most appropriate description of the current level in the beginning of this alternative new definition. The current level at the installation site and for test equipment shall be suitable for the MDA rating of the EVFS. The term "maximum deliverable amperes" is cited in multiple requirements in the EVFS Code and is relevant to test conditions and is also required marking information on the EVFS. For clarity the "meaning portion" of a definition should not include the term or parts of the term it is defining nor cite one of the many code paragraphs where the term is used because the appearance can be the term is unique to that sole paragraph. Therefore, the term's definition should include reference to the EVFS Code in brackets (i.e., [3.40] at the end of the definition rather cite a single code requirement or paragraph. The EVFS is a permanent code and definitions applicable to the code should be included in Appendix D – Definitions.

Is this a proposal to renumber paragraph N.5. Accuracy Testing to become N.5.2.1.? The proposal does not show paragraph N.5.2 in entirety, is the submitter proposing to remove the 2028 enforcement date?

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

Several proposals developed by the EVFE Subgroup membership to modify NIST Handbook 44 Section 3.40 paragraphs N.5.1. Performance Verification in the Field and N.5.2. Accuracy Testing have been under discussion by the EVFE Subgroup since May 2022. The EVFE Subgroup has not yet reached a consensus on a comprehensive set of modifications to the current test procedure requirements in the 2023 edition of NIST Handbook 44. The handbook N. Notes paragraphs (1) identify the minimum testing that applies in the official test of a device and (2) are used by the type evaluation program technical sector or work group as the basis for the key parts of the device test criteria checklist these technical committees will develop. These proposals to modify EVSE handbook requirements have evolved over the past two years as a result of lessons learned about EVSE operations in a variety of installation sites, the increased capacity of charging equipment since the codes inception, and the application of code requirements during type evaluation and to commercial operations for the past seven years. The EVFE Subgroup has also over the past five years reviewed all proposals to modify EVSE handbook requirements appearing on the NCWM S&T and L&R Committees Agendas to include 2023 Developing Items EVF-23.4 & EVF-23.7. Both agenda items contain proposals to modify paragraphs N.5.1. and N.5.2. These two agenda items were not developed by the EVFE Subgroup although the submitters of both proposals are active members of the Subgroup.

The EVFE Subgroup's Test Procedures Subcommittee is currently tasked with working through a recently modified version of the test procedures addressed in Item EVF 23.4. This latest modified version of the test procedures is the result of the collaborative effort of the submitters of both proposals. Based on the Test Procedures Subcommittee findings the Subgroup has targeted the upcoming standards development cycle to develop and provide input on both EVF-23.4 and EVF-23.7.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, Ed Williams (Ventura County, 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. Keith Bradley (Electrify America) commented it is difficult to test EVSE devices at low current and has the least impact to the commercial transaction. Keith Bradley stated it is more appropriate to have a range and recommended striking language in Pub. 15, page S&T-287, lines 6-7. Keith Bradley added this item is needed to address low limit testing. Kevin Schnepp (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. 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 this item with EVF-23.4 and to work with NIST USNWG EVFE Subgroup for item development.

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 Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Scheleese Goudy (Electrify America) remarked that the 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) recommended this move forward as voting.

Loren Minich (Kansas) stated that page 252 Line 10, remove the "of" before the range.

Craig VanBuren (Michigan) agreed and remarked this is Ready for voting with recommended changes.

The CWMA S&T Committee believes this item is fully developed and recommended 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 DC EVSE 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.

At the 2023 CWMA Annual Meeting, Scheleese Goudy submitter of this proposal and Item 23.7 are working to submit a single joint proposal. A general consensus on concerns has been reached. SG meeting will be convened to discuss technical aspects of joint proposal. Monica Martinez (Tesla) reports that a draft combination of Items 23.4 and 23.7 still being reviewed for technical accuracy.

The CWMA S&T Committee believes this item is fully developed and recommends voting status. However, the regional recommendation to the NCWM was that the proposal be a Developing Item on the NCWM agenda.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Scheleese 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. Scheleese Goudy commented these tests make inspectors wait and are not meaningful for the accuracy of an EV charger. Scheleese Goudy commented there was a broad consensus at the USNWG but no official vote was taken by the Work Group. Scheleese Goudy recommended a Voting status.

Chris King commented Siemens targets a 10 % accuracy test. Chris King commented Siemens is in favor of the change.

Francesca Wahl seconded the comments by Electrify America and Siemens. Francesca Wahl recommended a Voting status.

Kevin Schnepp (California Division of Measurement Standards) commented in full support of recommendations to strike the no load and starting load tests. Kevin Schnepp commented he doesn't think there is consensus from the Work Group. Kevin Schnepp recommended that this item be discussed with the U.S. National Working Group to make sure that it is highly agreed upon. Kevin Schnepp proposed if two vehicles are charging at once it cuts the 10 % in half. Kevin Schnepp commented in favor the range between 10 and 20%. Kevin Schnepp 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 recommended the submitters work with the USNWG to develop one proposal by combining language from EVF-23.4.

The WWMA S&T Committee recommended that this item be blocked with item EVF-23.4. The WWMA S&T Committee recommended the new blocked items be assigned a Developing status.

Southern Weights and Measures Association

The following comments were received during the 2022 SWMA Annual Meeting:

Hal Prince (Florida) supported this as a Voting Item. Scheleese Goudy recommended this item move forward as a Voting Item.

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

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Keith Bradley (Electrify America) stated that the core problem is testing at low currents. Keith Bradley believes that "10 % to 20 %" is better than "up to 10 %" as no currently installed charger will be able to do less than 10 %. Currently, the NIST HB doesn't qualify what the test procedure is for testing device using an EV. Juana Williams (NIST OWM) indicated that the removal of "no load test" and "starting load test" is consistent with other proposals viewed by the EVFE Subgroup. Ms. Williams 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. Ms. Williams also noted that a definition being tied to marking requirement is not typically done. Keith Bradley 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. Jason Flint (New Jersey) 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.

At the 2023 NEWMA Annual Meeting, Ms. Artessa supported the low end test values to ensure accuracy. After hearing comments from the floor, the Committee recommended to the body that this item maintain a developing status, and the body concurred.

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

Submitter's Purpose and Justification:

Reduce the tolerances for the air oven reference method.

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

Karl Cunningham
Illinois Department of Agriculture
217-785-8301, **karl.cunningham@illinois.gov**

AMS, FGIS request samples and list of grains 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 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 Charlie 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.

NIST OWM Executive Summary for GMA-19.1 – Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Method for All Grains and Oil Seeds.

NIST OWM Recommendation: NIST OWM supports the collection of data to verify that the proposed reduction in tolerances is appropriate for all grains and supports as a Developing status.

- During the NTEP Grain Analyzer (GA) Sector 2019 meeting, the Sector reviewed data from Arkansas for Long Grain Rough Rice (LGRR) and other grains. The data showed that the proposal to tighten the acceptance and maintenance tolerance may not be appropriate for all grain types. The original data presented and used as a basis for the proposal applied to corn and soybeans. After reviewing the data, the Sector decided to collect inspection data from across the country. An industry representative offered to assist with data analysis and along with the NIST representative will work in producing the inspection data needed for the analysis. A request for State participation will be sent to State weight and measures. The Sector requests that this remain a Developing Item as they move forward in evaluating additional data.

- North Carolina submitted the requested grain data for review. Field meter inspection data from the state of North Carolina for years 2017 to 2019 was examined and comprised over 3300 records each usually averaged 3 commodity drops on UGMA and Non-UGMA meter types. While only one state's data cannot be considered representative of all the other states, the results provide indications of trouble with decreased tolerances on both UGMA and Non-UGMA meter types.

- Additional data is expected from other States participating in the grain data submission.

Table 2. Summary of Recommendations
GMA-19.1–Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Method for All Grains and Oil Seeds.

	Status Recommendation	Note*	Comments
Submitter	Developing		
OWM	Developing		
WWMA	Withdraw		
NEWMA	Developing		
SWMA	Developing		
CWMA	Developing		
NCWM	Developing		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

Amend Handbook 44, Grain Moister Meter Code 5.56 (a) as follows:

T.2.1. Air Oven Reference Method. – Maintenance and acceptance tolerances shall be as shown in Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance.

(Amended 2001)

Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method

~~Type of Grain, Class, or Seed~~	~~Tolerance~~	~~Minimum Tolerance~~
~~Corn, oats, rice, sorghum, sunflower~~	~~0.05 of the percent moisture content~~	~~0.8 % in moisture content~~
~~All other cereal grains and oil seeds~~	~~0.04 of the percent moisture content~~	~~0.7 % in moisture content~~

Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method for All Grains and Oil Seeds

Tolerance	Minimum Tolerance
0.03 of the percent moisture content	0.5 % in moisture content

(Amended 2001 **and 20XX**)

NIST OWM Detailed Technical Analysis:

During the NTEP Grain Analyzer (GA) Sector 2019 meeting, the Sector reviewed data from Arkansas for Long Grain Rough Rice (LGRR) and other grains. The data showed that the proposal to tighten the acceptance and maintenance tolerance may not be appropriate for all grain types. The original data presented and used as a basis for the proposal applied to corn and soybeans. After reviewing the data, the Sector decided to collect inspection data from across the country. An industry representative offered to assist with data analysis and along with the NIST representative will work in producing the inspection data needed for the analysis. A request for State participation will be sent to State weight and measures. The Sector requests that this remain a Developing Item as they move forward in evaluating additional data.

At the 2020 Interim Meeting the S&T Committee agreed to retain this item as Developing in anticipation of additional data that is being collected to assess the proposed tolerances and the appropriateness of the change to tolerances for other grain types. The NIST Technical Advisor is working with the Grain Analyzer Sector and States to collect additional data on the proposed changes to the tolerances with plans to present data at the next NTEP GA Sector Meeting in August 2021. NIST OWM agrees with the S&T Committee that this item should be given a Developing status until additional data is examined.

Diane Lee (NIST) is working with the Sector to collect data on Unified Grain Moisture Algorithm (UGMA) grain moisture meters and non-UGMA grain moisture meters. North Carolina, Arizona, Illinois, and Iowa agreed to provide 2017-2019 inspection data on field meters. The participating States

were requested to submit data by December 1, 2021. One state will be unable to participate, and North Carolina has submitted their data.

During the 2022 Grain Analyzer Sector Meeting the Sector reviewed data from North Carolina. Regarding potential changes to "Handbook 44" tolerances for Grain Moisture Meters, field meter inspection data from the state of North Carolina for years 2017 to 2019 was examined. Only the one state provided data, but that comprised over 3300 records each usually averaging 3 commodity drops on UGMA and Non-UGMA meter types. While only one state's data cannot be considered representative of all the other states, the results here provide indications of trouble with decreased tolerances on both UGMA and Non-UGMA meter types. The following provide a percentage of device that exceeded the current tolerance compared to the percentage of meters that would exceed the proposed tolerance.

	Exceed current tolerance (UGMA)	**Exceed current tolerance (Non-UGMA)**	**Exceed proposed tolerance (UGMA)**	**Exceed proposed tolerance (Non-UGMA)**
Count	10	18	54	263
Records	1146	2208	1146	2208
Fraction	0.87%	0.82%	4.71 %	11.91 %

The Sector has requested additional data from other States to gain a better perspective on the impact of lowering the tolerances for grain moisture meters.

History

The GA Sector originally forwarded this proposal to the regional weights and measures associations with a proposed Voting status. All regional weights and measures associations agreed to forward the proposal as a voting item on the 2019 NCWM Interim Agenda and the Sector appreciates their review and support. 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. OWM agrees with the Grain Analyzer (GA) Sector's revised decision to change the status of this item to Developing.

This proposal to change the air-oven method tolerances was developed during the 2018 GA Sector meeting. During the 2018 GA Sector Meeting, Dr. Charlie Hurburgh provided the Sector with an analysis of data for 2-corn and 1-soybeans samples which included the average error for UGMA grain moisture meter technology and the average error of 2 MHz grain moisture meter technology from Iowa State weights and measures inspection data for years 2014-2017. Based on the Sectors review of the data, discussion of new tolerances, and the ability of the technologies to meet the new tolerances the Sector agreed to change the tolerances based on the data provided.

During additional discussion of what tolerances to apply to other grains, it was proposed that the same tolerances could apply to all grains, because corn is one of the more difficult grains to test and would likely have one of the largest variations when testing. No objections from States or meter manufacturers were provided during the discussion and voting to forward the item to the State regional weights and measures associations. Following the Sector meeting one State noted that there may be an issue with applying the tolerance to some grain types, specifically long grain rough rice. The GA Sector's technical advisor requested that the State forward field data to review the grain moisture meter results for LGRR and other grains. After review of the data with the proposed tolerances it was determined that a high meter failure rate could result with a change to the tolerances for some grain types.

After the Sector's Technical Advisor discussed the findings with the NTEP laboratory and the Sector members that originally proposed the tolerance change, they agreed with proposing a Developing status for this item, the Sector was officially balloted and also agreed to change the originally proposed Voting status to Developing to allow the Sector time to review additional data and make changes to its original proposal.

Summary of Discussions and Actions:

At the NCWM 2022 Interim Meeting, the Committee heard comments from Diane Lee (NIST OWM) who noted that additional data is needed to assess the proposed tolerances. Diane Lee added that states would be submitting more data. Diane Lee requested that this item remain Developing. During the Committee's work session, the Committee agreed to a Developing status for this item.

At the NCWM 2022 Annual Meeting open hearings Tina Butcher (NIST OWM) provided updates on the Grain Analyzer Sector's proposal to reduce the tolerance for grain moisture meters. She informed the S&T Committee that the Grain Analyzer Sector had originally reviewed data for corn and soybeans. After the proposal for changes to the tolerances were submitted to the NCWM, information was received that reducing the tolerance may be problematic for other grains. As such the Grain Analyzer Sector is collecting additional data on other grain types and request a Developing status and additional time to collect the data.

At the 2022 NCWM Annual Meeting Committee meeting, the Committee agreed to a Developing status for this item.

At the 2023 NCWM Interim Meeting, the S&T Committee heard comments from the floor during open hearings. Tina Butcher (NIST OWM) commented that COVID has put a hamper on the collection of data that is needed for the study and requested the item remain Developing. The Committee left the item Developing.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting no comments were heard on this item:

No additional data or update was received by the Committee. The WWMA S&T Committee recommended withdrawal and encouraged the submitter to reintroduce the item when sufficient data is available.

Southern Weights and Measures Association

During the 2022 SWMA Annual Meeting open hearing the Committee heard no comments.

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

Northeastern Weights and Measures Association

During the 2022 NEWMA Interim Meeting, Diane Lee 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. Diane Lee requests more time so more states can submit data.

The Committee is recommending that this item retain a Developing status.

During the 2023 NEWMA Annual Meeting, the Committee heard no comments on this item but recommended to the body that this item retain a developing status. The body concurred.

Central Weights and Measures Association

During the 2022 CWMA Interim Meeting Open Hearings, Doug Musick (Kansas) recommended that item remain developing, while waiting on additional data. Ivan Hankins (Iowa) stated that 0.5% tolerance is fair and should move forward to Voting.

The CWMA S&T Committee recommended this remains a Developing Item to allow time to collect additional data.

During the 2023 CWMA Annual Meeting, Loren Minnich (NIST OWM) noted that the Grain Analyzer Sector is still waiting on data for certain types of grain to verify tolerances are achievable and that NIST supports a Developing status .

The CWMA S&T Committee recommends this item remain Developing.

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

Submitter's Purpose and Justification:

Clarify what is meant by the term Meter to Like-Type Meter in the Grain Moisture Meter Code 5.56(a).

During the 2017 Grain Analyzer Sector meeting there was a discussion on Meter to like-type meter testing and the definition of a like-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 requested Voting status.

NIST OWM Executive Summary for GMA-23.1 – 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
NIST OWM Recommendation: NIST supports this item as Voting. With the modifications that were made at the 2023 NCWM Interim Meeting.

Table 2. Summary of Recommendations
GMA-23.1 – 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

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

(**Note**: The Item Under Consideration was modified at the 2023 NCWM Interim Meeting.)

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 ~~**type**~~ **model 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)

NIST OWM Detailed Technical Analysis:

NIST supports the editorial changes that were made to the item under consideration at the 2023 NCWM Interim Meeting:

- The title of the item was changed to include the word "type" to be consistent with the term used in NIST HB 44. The title and references in the item include the phrase "Meter to Like-Type Meter" rather than "Meter to Like-Meter, and

- Modifications were made to the note in T.2.2. as follows:

  NOTE: Like-type as described in paragraph N.1.3. ~~**See definition for like-type meter in N.1.3.**~~
  (Added 20XX)

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting no comments were heard on this item. The WWMA S&T Committee believes that this item has merit and recommended this item remain Developing to allow for input and adjustments. The WWMA S&T Committee also requested the submitter address the formatting of their proposal to meet NCWM standard editing requirements.

Southern Weights and Measures Association

No comments were received on this item during the 2022 SWMA Annual Meeting. The SWMA S&T Committee recommended this item move forward as a Voting Item.

Northeastern Weights and Measures Association

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.

At the 2023 NEWMA Annual Meeting, Loren Minnich (NIST OWM) supported this as a Voting item. The intent is to provide clarification as to what constitutes a like-type meter when comparing a meter to a meter.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

Loren Minnich (Kansas) stated that this clarifies which meter can be used in this application. He supports this item as Voting. Ivan Hankins (Iowa) supported as Voting.

The CWMA S&T Committee believes this item is fully developed and recommended Voting status.

At the 2023 CWMA Annual Meeting, Loren Minnich (NIST OWM) supported the item as voting and that it provides clarity defining that meter to like type meter is in the same model family to NTEP CC.

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

MDM – Multiple Dimension Measuring Devices

MDM-22.1 W S.1.7. Minimum Measurement.

Source: Parceltool P/L

Submitter's Purpose and Justification:

Exempt mobile tape based MDMD devices from the 12D minimum measurement.

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.

Table 2. Summary of Recommendations
MDM-22.1 – S.1.7. Minimum Measurement.

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Withdrawn		
WWMA	Withdrawn		
NEWMA	Withdrawn		
SWMA	Withdrawn		
CWMA	Withdrawn		
NCWM	Withdrawn		

	Letters of Support	Letters of Opposition	Comments
Industry	1	1	Letter of support: Letter from CubeTape (08-10-2021) Letter of opposition: Letter from Richard Suiter (06-27-2022)
Manufacturers		1	Letter of opposition: Letter from Mettler-Toledo (10-18-2022)
Retailers and Consumers			
Trade Association			

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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**)

NIST OWM Detailed Technical Analysis:

Note: The following was copied from OWM's 2022 NCWM Annual Meeting analysis and remains unchanged for the 2023 NCWM Interim Meeting:

This very same proposal appeared in the S&T Committee's 2019 agenda (as S&T Item MDM-2) and was withdrawn by the Committee in 2019. Additionally, the first two paragraphs included in the Committee's current agenda beneath the heading "Original Justification," are the very same two paragraphs contained in the Committee's 2019 Interim Meeting Agenda in the Background Discussion section of the item. That is, there is no additional information provided in the justification section of this item in the Committee's current agenda to explain the reason for resubmission or why the Committee should reconsider its earlier action to withdraw the item in 2019. OWM notes too that the NCWM MDMD work group also reviewed the MDM-2 proposal during its spring 2019 meeting and recommended the item be withdrawn.

We have reviewed our comments and recommendations provided to the 2019 S&T Committee for S&T Item MDM2 and still find them relevant today. Consequently, we submit them again (shown in the box below to include a few minor changes that we've made) to the Committee as our analysis for the item "MDM-22.1" in the Committee's current agenda.

OWM recognizes there is a potential for introducing excessive error in measurements when they are performed using a process or instrument that does not provide a sufficient level of resolution in the measurement. Minimum measurement requirements are established in NIST Handbook 44 device codes based on the premise, "rounding of digital values and the allowable error in a device from the application of tolerance creates the potential for large errors at small measurements." This effect decreases proportionately as the measurement size is increased along with the number of increments used in the measurement. To put this principle into perspective as it relates to multiple dimension measuring devices (MDMDs), NIST Handbook 44 maintenance and acceptance tolerances applicable to MDMDs are plus or minus 1 division (See paragraph T.3. Tolerance Values). Considering this tolerance in perspective with this proposal, a 1-division error within a 12division measurement (i.e., the minimum measurement currently permitted in accordance with paragraph S.1.7.) represents over 8 percent of the measurement value ($1 \div 12 = 0.083 \simeq 8.3$ %). If the measurement were to include 50 divisions (or increments), that same 1-division error represents only 2 percent of the measurement value ($1 \div 50 = 0.020$ or 2 %).

Compounding the potential for even greater error is the fact that MDMDs are generally used to measure hexahedron-shaped objects by determining values for length, width, and height, and then multiplying these values together to determine the cubic volume occupied by the object. Since there are three measurements needed to determine the volume, the error effect of using a device to make small measurements is multiplied threefold. For example, a 1-division plus error at a 12-division measurement

of length, width, and height would result in over a 27 percent error in the volume measurement of the object being measured as illustrated in the table below.

Axis	Measurement (+ 1 d error)	Actual
Length	13 d	12 d
Width	13 d	12 d
Height	13 d	12 d
Volume	2197 x-unit^3	1728 x-unit^3
Difference: Measurement minus Actual	2197 x-unit^3 – 1728 x-unit^3 = 469 x-unit^3	
Percent error calculation	(469 x-unit^3 ÷ 1728 x-unit^3) x 100 = 27.1 %	

Thus, given the potential that this proposal has for creating such very large measurement errors and the monetary impact those errors can have on commercial transactions, OWM does not believe this item should be advanced.

In addition, OWM also points out the following concerns relating to this item:

- A guiding principle in the development of HB 44 requirements is that the same requirements should apply to devices used in the same application, regardless of technology or design. The proposed change in this item violates the principle by proposing there be an exemption to one of the requirements in the MDMD code for a particular type of MDMD.

- The background/discussion pertaining to this item includes the statement that it is not unusual for measurements to be made of less than 12 divisions. If this is in fact the case, those using these devices commercially to take such measurements are violating the minimum measurement requirement in HB 44. OWM would hope that the submitter of this item, knowing this to be true, would take necessary steps to educate users so that accurate measurements can be ensured. OWM believes that there may also be a problem caused by the use of a device with too large a division size for use in measuring small objects rendering that device unsuitable for the purpose intended. Another potential problem may be created when two devices with different division values are needed due to the wide linear range of the different axes needing to be measured.

- The background/discussion portion of this item also indicates an accepted practice for this type of device is for the measurement to be rounded up to the nearest whole division. OWM notes such rounding conflicts with the instructions provided on the Federal Express and United States Postal Service websites for determining DIM weight, that specify the measurements are to be rounded to the nearest inch.

The current 12 d minimum measurement specified in HB 44 is uniform with the same in OIML R 129. Thus, a change to HB 44 requirement would cause conflict with OIML requirements.

OWM's Comments and Recommendation for Item MDM-22.1 Copied from its 2019 Analysis of MDM-2

Summary of Discussions and Actions:

During Committee open hearings at the 2022 NCWM Interim Meeting, Richard Harshman (NIST OWM) reported this very same proposal had appeared in the S&T Committee's 2019 agenda (as S&T Item MDM-2) and was withdrawn by the Committee in 2019. Additionally, the first two paragraphs included in the Committee's current agenda beneath the heading "Original Justification," are the very same two paragraphs contained in the Committee's 2019 Interim Meeting Agenda in the Background Discussion section of the item. That is, there is no additional information provided in the justification section of this item in the Committee's current agenda to explain the reason for resubmission or why the Committee should reconsider its earlier action to withdraw the item in 2019. Richard Harshman noted too that the NCWM MDMD work group also reviewed the MDM-2 proposal during its spring 2019 meeting and recommended the item be withdrawn. For these reasons, OWM recommends the item be withdrawn.

Darrell Flocken (NCWM) acknowledged he too was aware that the proposal is identical to the one that the Committee had withdrawn in 2019. He noted, however, that he had been contacted by a representative of the submitter and that this person had advised him the submitter desired to further pursue adoption of the proposal. Darrell Flocken indicated he expected new information to be made available to Committee from the submitter to provide better justification for it.

During the Committee's work session members of the Committee agreed to maintain the item on the Committee's agenda as a Developing Item to allow the submitter an opportunity to provide additional information that could justify the proposed changes.

Regional Association Reporting:

Western Weights and Measures Association

During the 2021 Annual Meeting Open Hearings, Russell Vires (Mettler Toledo) is opposed to the change proposed here. No reason to eliminate the minimum measurement.

The WWMA S&T Committee recommended that this item be assigned a Developmental status. The Committee recommended that the submitter provide data to support why the devices are unable to meet the 12-division requirement. The Committee also recommended that the submitter consult the MDMD Working Group.

During open hearings, no comments were heard on this item. No additional data or update was received by the Committee.

The WWMA S&T Committee recommended that this item be withdrawn.

Southern Weights and Measures Association

At the 2021Annual Meeting Open Hearings, Russ Vires (Mettler Toledo) requested that this item be withdrawn because the justification was invalid.

This Committee recommended this item be Withdrawn due to having no justification provided for the change.

At the 2022 SWMA Annual Meeting, Matt Curran (Florida) stated that this item was not needed.

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

Northeastern Weights and Measures Association

During the 2021 NEWMA Interim Meeting Open Hearings the following comments were heard.

Richard Harshman (NIST OWM) commented that this is a new item and members of NIST OWM's LMDP have not had opportunity to review/consider it. There's little information provided in the background/discussion of this item. If the device has digital indication, by rounding all values up as is specified in the background/discussion, the device would fail to comply with HB 44 paragraph G-S.5.2.2.(c).

Lou Sakin (Hopkinton/Northbridge, Massachusetts) commented that this item is in-need of further development.

The NEWMA S&T Committee recommended that this item be given Developing Status.

During the 2022 NEWMA Annual Meeting Open Hearings the following comments were heard:

Russ Vires (SMA) rose to oppose the item. He commented that the justification provided by the submitter does not identify issue that is to be resolved. Russ Vires suggested that the submitter work with MDM Work Group for a solution and referenced the Work Group meets in May and will be discussing this proposal.

After hearing comments from the floor, the Committee recognized the need to further develop this item and recommended the item retain Developing status.

During the 2022 NEWMA Interim Meeting Open Hearings, Diane Lee (NIST OWM) noted that this item has been on the agenda before and NIST OWM recommended withdrawing.

Jason Flint (New Jersey) 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.

At the 2023 NEWMA Annual Meeting, the item was not discussed.

Central Weights and Measures Association

At the 2021 CWMA Interim Meeting Open Hearing the Committee heard no comments from the floor. CWMA S&T Committee has no recommendation for this item.

During the 2022 CWMA Annual Meeting Open Hearings, the Committee received the following comments:

Russ Vires (SMA) opposed this item. The justification provided by the submitter does not adequately identify the issue this item is attempting to resolve, and why mobile tape-based MDMD devices should be exempted compared to all other MDMD devices. The SMA recommended that the submitter work with the MDMD Work Group to develop a suitable solution to this issue.

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

During the 2022 CWMA Interim Meeting Open Hearing, Loren Minnich (Kansas) recommended this be withdrawn. The CWMA S&T Committee recommended this item be withdrawn.

At the 2023 CWMA Annual Meeting, the item was not discussed.

Scale Manufacturers Association (SMA)

During the 2021 SMA Fall Meeting the SMA opposed this item. The justification provided by the submitter does not adequately identify the issue this item is attempting to resolve, and why mobile tape-based MDMD devices should be exempted compared to other MDMD devices. The SMA recommended that the submitter work with the MDMD Work Group to develop a suitable solution to this issue.

During the 2022 SMA Spring Meeting the SMA opposed this item. The rationale was the same as during the 2021 Fall Meeting.

During the 2021 SMA Fall Meeting the SMA opposed this item. The rationale was the same as during the 2021 Fall Meeting and the 2022 Spring Meeting. The SMA recommended that the submitter work with the MDMD Work Group to develop a suitable solution to this issue, otherwise remove it.

At the 2023 SMA Spring Meeting they did not take any position on the item.

OTH – Other Items

OTH-16.1 V Electric Watthour Meters Code under Development

Source: NIST Office of Weights and Measures

Submitter's Purpose and Justification:

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 in the USNWG's Watthour Type Electric Meters Subgroup (SG) 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.

Those interested in participating in this work please contact:

Subgroup Chair, Lisa Warfield (NIST OWM)
Email (**lisa.warfield@nist.gov**) or phone (301) 975-3308

Subgroup Technical Advisor, Juana Williams (NIST OWM)
Email (**juana.williams@nist.gov**) or phone (301) 975-3989

NIST OWM Executive Summary for OTH-16.1 – Electric Watthour Meters Code Under Development
• The "Source" should read NIST U.S. National Work Group (USNWG) Electric Watthour Meters Subgroup (EWH SG) • The title of this Item should read "Non-Utility Electricity-Measuring Systems (NUEMS) – Tentative Code " • Most members supported the proposed language as it currently appears in the 2023 S&T Agenda (Pub. 16), although regulatory members of the SG disagreed with the proposed language. • In addition, the regulatory members provided a detailed list to the EWH SG of their concerns. These concerns are noted in the letter that NCWM received from the California Agricultural Commissioners and Sealers Association (CACASA) (dtd. June 29, 2023) and posted under the NCWM S&T Supporting document website. • The EHW SG attempted to address the regulators and CACASA concerns. They made headway in addressing those concerns and they appear in the Crosswalk below. • The Crosswalk below, provides updates of items that appear in the 2023 S&T Annual Agenda (Pub. 16). They represent changes the EWH SG voted on to move forward to the S&T Committee for consideration. Due to limited time, the EWH SG was not able to address all the items, and the work continues.

Crosswalk

Electric Watthour Subgroup submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watthour Meters Tentative Code

Paragraph as it appears on S&T 2023 Annual Agenda (Pub. 16):	**Changes represented in bold strikethrough or underscore and followed by a clean version**
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.4. Type Evaluation.** – The National Type Evaluation Program (NTEP) will accept for type evaluation only those measuring systems that have received safety certification by a nationally recognized testing laboratory (**also referred to as "**NRTL**"**) and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code. **Clean version:** **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

Crosswalk

Electric Watthour Subgroup submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watthour Meters Tentative Code

Paragraph as it appears on S&T 2023 Annual Agenda (Pub. 16):	Changes represented in bold strikethrough or underscore and followed by a clean version
	testing laboratory (also referred to as "NRTL") and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code.
S.1.3.2. Test Output. – Each NUEMS within a system shall have either: (1) a location for the reading of the accumulated value; (2) a pulse output (visible and/or infrared pulse), an electrical pulse output in the form of a closure (relay or electronic such as an open drain field effect transistor (FET)) which provides a pulse at an interval of K_t Watt-Hours per pulse; or (3) other means for viewing accumulated values. The value of K_t shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any specified test condition.	**S.1.3.2. Test Output. – ~~Each~~ A** NUEMS **~~within a system~~** shall have either: (1) a **~~location for the reading of the accumulated value~~a rotating disk indicator**; (2) **~~an electrical~~** pulse output (visible **~~and/~~**or infrared **~~pulse~~**), **or (3)** an electrical pulse **~~output (~~**in the form of a closure **~~(~~**relay or electronic **means),** which provides a pulse a**~~t an interval of~~ with** K_t **or K_h**Watt-Hours per pulse**~~; or (3) other means for viewing accumulated values~~**. The value of K_t **or K_h** shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any **~~specified~~ specific** test **~~condition~~**. **Clean version:** **S.1.3.2. Test Output. –** A NUEMS shall have either: (1) a rotating disk indicator; (2) a pulse output (visible or infrared), or (3) an electrical pulse (in the form of a closure relay or an electronic means), which provides a pulse with K_t or K_h Watt-Hours per pulse. The value of K_t or K_h shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any specific test.
S.1.3.6. NUEMS With External Sensors Located Remotely from the Pulse Output or Display. – For NUEMS with external sensors located remotely from either the pulse output or display which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the Pulse Output or Display, means shall be provided to allow either the pulse output or display to be remotely used.	**S.1.3.6. NUEMS With External Sensors Located Remotely from the ~~Pulse~~ Test Output ~~or Display~~.** – For NUEMS with external sensors located remotely from **~~either~~** the **~~pulse~~ test** output **~~or display~~** which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the **~~Pulse~~ Test** Output **~~or Display~~**, means shall be provided to allow **~~either~~** the **~~pulse~~ test** output **~~or display~~** to be remotely used. **Clean Version** **S.1.3.6. NUEMS With External Sensors Located Remotely from the Test Output.** – For NUEMS with external sensors located remotely from the test output which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the Test Output, means shall be provided to allow the test output to be remotely used.

Crosswalk

Electric Watthour Subgroup submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watthour Meters Tentative Code

Paragraph as it appears on S&T 2023 Annual Agenda (Pub. 16):	Changes represented in bold strikethrough or underscore and followed by a clean version

Add into Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS

	Physical Marking	Electronic
***Sensor True Ratio* (12) *Nonretroactive as of January 1, 2024*.**	**O**	**D**
K_h or K_t (**~~12~~13**)	**O**	**D**
Bi-directional (**~~13~~14**)	**O**	**D**
Temperature Range if narrower than −20 °C to + 50 °C (− 4 °F to + 122 °F) (**~~14~~15**)	**O**	**D**

Add into Table S.3.2.3.b. Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS

12. True Ratio.

~~True Ratio.~~ The True Ratio, in primary amperes or volts to secondary amperes or volts shall be physically marked on a meter unless it is contained in either electronic or printed documentation. This is to be expressed as xxxA:yyyA; or xxxA:yyyV; or xxxV:yyyV. The number of digits is the number needed to express the values.

Examples of sensor ratio markings include:
200A:5A
400A:0.3V
480V:120V

T.2. No-Load Test. – For NUEMS with a K_t/K_h output, the NUEMS shall not emit more than one K_t/K_h 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.2. No-Load Test.** – **~~For~~ A** NUEMS **~~with a K_t/K_h output, the NUEMS~~** shall not emit more than one **~~K_t/K_h~~ test** pulse **output**. **~~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.~~** **Clean Version** **T.2. No-Load Test.** – A NUEMS shall not emit more than one test pulse output.
N.3. Minimum Test Duration. – Full and light load tests shall require at least a one-minute test and at least one watthour test constant.	**N.3. NUEMS Minimum Test Duration.** – **A NUEMS f~~F~~ull load test shall consist of a minimum of 10 watthour test constants** and **a** light load test**~~s~~** shall **~~require at least a one-minute test and at least~~ consist of a minimum of** one watthour test constant.

Crosswalk **Electric Watthour Subgroup submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watthour Meters Tentative Code**	
Paragraph as it appears on S&T 2023 Annual Agenda (Pub. 16):	**Changes represented in bold strikethrough or underscore and followed by a clean version**
	Clean Version **N.3. NUEMS Minimum Test Duration.** – A NUEMS full load test shall consist of a minimum of 10 watthour test constants and a light load test shall consist of a minimum of one watthour test constant.
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.	**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. **Clean Version** **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 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.
Appendix D. Definitions	
	bidirectional. – A NUEMS equipped to register the accumulation of energy in both directions (i.e., for delivered and received energy): **A bidirectional NUEMS shall fall into at least one of the following categories:** (a) **Single register or net meter that displays the difference between the delivered and received energy; or**

Crosswalk Electric Watthour Subgroup submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watthour Meters Tentative Code	
Paragraph as it appears on S&T 2023 Annual Agenda (Pub. 16):	**Changes represented in bold strikethrough or underscore and followed by a clean version**
	(b) **Separate register(s) for delivered or received energy. [3.XX]**
	external sensor. – Any voltage sensor or current sensor not located inside of the meter body NUEMS itself and not inside the sealed enclosure containing the NUEMS. [3.XX]
	internal sensor. – Any voltage sensor or current sensor located inside of the meter body NUEMS itself or inside the sealed enclosure containing the NUEMS. [3.XX]
	non-integral. – Used to describe external sensors that can be disconnected from the meter body. [3.XX]

Table 2. Summary of Recommendations
OTH-16.1 – Electric Watthour Meters Code under Development

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	Developing		
SWMA	Developing		
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association			
California Agricultural Commissioners and Sealers Association (CACASA)		1	CACASA - June 29, 2023 letter listing points to be resolved

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

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

Table of Contents

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.

S.1.1.2. Digital Indications. – An indication shall include the display of a number for all places that are displayed to the right of the decimal point and at least one place to the left. Otherwise, leading zeros are not required.

S.1.2. Nominal Capacity. – *A device shall have a minimum capacity indication of five digits of resolution. [Nonretroactive as of January 1, 20XX]*

S.1.3. NUEMS Indications.

S.1.3.1. Primary Indicating Element. – Each NUEMS shall be equipped with a primary indicating element that includes a display visible and accessible after installation which clearly indicates the number of kilowatt-hours measured by the NUEMS.

S.1.3.2. Test Output. – Each NUEMS within a system shall have either: (1) a location for the reading of the accumulated value; (2) a pulse output (visible and/or infrared pulse), an electrical pulse output in the form of a closure (relay or electronic such as an open drain field effect transistor (FET)) which provides a pulse at an interval of K_t Watt-Hours per pulse; or (3) other means for viewing accumulated values. The value of K_t shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any specified test condition.

S.1.3.3. Segments. – A segmented digital indicating element shall have an easily accessible provision for checking that all segments are operational.

S.1.3.4. **Real-time Indicating Element.** – If the indicating element is not on continuously, it shall be accumulated continuously so that real-time measurement is indicated during activation.

S.1.3.5. Multiple NUEMS, Single Indicating Element. – A primary indicating, or combination indicating-recording element coupled to two or more NUEMS shall be provided with a means to easily, clearly, and definitely display information from a selected NUEMS and shall automatically indicate which NUEMS is associated with the currently displayed information.

S.1.3.6. NEUMS With External Sensors Located Remotely from the Pulse Output or Display. – For NUEMS with external sensors located remotely from either the pulse output or display which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the Pulse Output or Display, means shall be provided to allow either the pulse output or display to be remotely used.

S.1.3.7. NUEMS With a Register Ratio. For NUEMS with a register ratio, the register ratio shall be indicated on the front of the registers that are not an integral part of the NUEMS nameplate. Means shall be provided for the tenant to read the register.

S.2. Design of Measuring Elements and Measuring Systems.

S.2.1. Metrological Components. – A NUEMS shall be designed and constructed so that metrological components are adequately protected from environmental conditions likely to be detrimental to accuracy based on the specified installation locations for the NUEMS.

S.2.2. Provision for Sealing. – Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that undetected access to metrologically significant mechanisms and parameters is prevented. Specifically, after sealing no adjustment or change may be made to:

(a) any measuring element;

(b) any metrological parameter that affects the metrological integrity of the device or system; and

(c) any wiring connection which affects the measurement.

When applicable, any adjusting mechanism shall be readily accessible for purposes of affixing a security seal. Audit trails shall use the format set forth in Table S.2.3. Categories of Device and Methods of Sealing.

Table S.2.3.
Categories of Device and Methods of Sealing

Categories of Device	Method of Sealing
Category 1: No remote configuration capability.	Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 2: Remote configuration capability, but access is controlled by physical hardware. The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.	**(1)** The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information.
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). The device shall clearly indicate that it is in the remote configuration mode and record such message or shall not accumulate kWh while in this mode.	An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (**Note:** Does not require 1000 changes to be stored for each parameter.)

S.2.4. NUEMS Watthour Registration Retention. – The NUEMS shall retain the total accumulated watthour registration and shall not be affected by electrical, mechanical or temperature variations, radio-frequency interference, power failure, or any other environmental influences to the extent that accuracy is impaired. This also applies to other billable quantities.

S.3. Markings. – The following identification and marking requirements are in addition to the requirements of Section 1.10 General Code, paragraph G-S.1. Identification.

S.3.1. Location of Marking Information. – The marking information may be placed either internally or externally (as specified in paragraphs S.3.2. Device Identification and Marking Requirements and S.3.3. 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.

Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS		
	Physical Marking	**Electronic Display*, ** **
Manufacturer or Distributor name, initials, or trademark (1)	**R**	**D**
Model Prefix (2)	**O**	**D**
Model (3)	**R**	**D**
Serial Number Prefix (4)	**O**	**D**
Serial Number (5)	**R**	**D**
NTEP CC Number with Prefix (6)	**R**	**D**
NUEMS Voltage Input Rating (7) Nonretroactive as of January 1, 2024.	**O**	**D**
Voltage Sensor Rating (8) *Nonretroactive as of January 1, 2024.*	**O**	**D**
Voltage Sensor Ratio (9) *Nonretroactive as of January 1, 2024.*	**O**	**D**
NUEMS Current Input (10) *Nonretroactive as of January 1, 2024.*	**O**	**D**
Sensor Primary Current Rating (11) *Nonretroactive as of January 1, 2024.*	**O**	**D**
K_h or K_t (12)	**O**	**D**
Bi-directional (13)	**O**	**D**
Temperature Range if narrower than −20 °C to + 50 °C (− 4 °F to + 122 °F) (14)	**O**	**D**
R Required to be marked on the NUEMS **O** Required to be marked on the NUEMS only if information is not available on a display **D** Alternate when information is not marked physically on the NUEMS. If device identification and marking is provided on an electronic display**,** then all fields must be provided.		

[*]"Electronic Display" includes, but is not limited to, displays of the required marking information through a NUEMS display, a mobile device, or other electronic means as specified by the manufacturer and retrievable through the NUEMS. This may include providing access directly from the meter to a webpage. If the information is provided via a mechanism other than the NUEMS display, the mechanism must be provided by the device owner/operator as specified in UR.2.4.10. Devices for Viewing Marking Information Provided Via an Electronic Display, External Sensor (ES) NUEMS.

[**]Instructions on how to view required markings shall be marked on the device or provided in the NTEP CC.

General:

- Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.2.2.b. Descriptors for Table S.3.2.3.a. Device Identification and Marking Requirements of External Sensor (ES) NUEMS.
- For requirements and details on application, see Table S.3.2.3.b. Descriptors for Device Identification and Marking Requirements of External Sensor (ES) NUEMS.

Table S.3.2.3.b.
Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS

1. Manufacturer's Identification. Marked per General Code paragraph G-S.1. Identification.
2. Manufacturer's Model Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the 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).
3. Manufacturer's Model Identifier. Marked per General Code paragraph G-S.1. Identification.
4. Serial Number Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the 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).
5. Serial Number. Also see General Code paragraph G-S.1. Identification.
6. NTEP Certificate of Conformance Number and Prefix. NUEMS electronics that has been evaluated by NTEP and has its own NTEP CC shall be marked per General Code paragraph G-S.1. Identification.
7. NUEMS Voltage Input Rating (V_{nom}). The nominal voltage input(s) for the voltage channel of the NUEMS electronics (e.g., 120VAC, 600VAC, 120-480VAC, etc.). Multiple forms of the term such as "Rated Voltage," "Max Voltage," and "Reference Voltage" are permitted.
8. Voltage Sensor (V_{nom}). The nominal input at the voltage sensor. If a voltage sensor is not used this marking is not required. If a voltage sensor is used, a multiplier can be used in place of V_{nom} and voltage sensor ratio.
9. Voltage Sensor Ratio. Ratio of sensor primary voltage to sensor output voltage. If a voltage sensor is not used this marking is not required. If a voltage sensor is used, a multiplier can be used in place of V_{nom} and voltage sensor ratio.
10. NUEMS Current Input (Input I_{nom} or I_{max}). 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.
11. Sensor Primary Current Rating (Sensor I_{nom}). The nominal current input through the sensor.
12. Kh or Kt. Watthour test constant.
13. Bi-Directional. Marking via a "Separate Document" is permissible only if instructions for accessing that information is described in an accompanying NTEP Certificate of Conformance.

14. Temperature Range if Narrower Than − 20 °C to + 50 °C (- 4 °F to + 122 °F): If the device is rated for use over a range that is narrower than and within − 20 °C to + 50 °C (- 4 °F to + 122 °F), this must be physically and/or electronically marked.

S.3.3. Device Identification and Marking Requirements – External Sensors. – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each external sensor that is non-integral with the 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.

Table S.3.3a.
Device Identification and Marking Requirements - External Sensors

	Physical Marking on Sensor	**Electronic Display**	**Separate Document** (Hard Copy or Electronic)
Manufacturer name, initials, trademark (1)	**R**	**D**	**D**
Model Prefix (2)	**O**	**D**	**D**
Model (3)	**R**	**D**	**D**
Serial Number Prefix "S/N" (4)	**O ‡**	**D ‡**	**D ‡**
Serial Number (5)	**O ‡**	**D ‡**	**D ‡**
NTEP CC Prefix and Number (6)	**O †**	**D †**	**D †**
True Ratio (7)	**O**	**D**	**D**
Maximum Primary Current (8)	**O**	**D**	**D**
Rated Frequency (Hz) (9)	**O**	**D**	**D**
Maximum Safety Voltage Rating (10)	**O**	**D**	**D**
Polarity (11)	**O**	**D**	**D**

R Required to be marked on the device
O Required to be marked on the device if information is not available on a display or in printed form
D Required when data is displayed on an electronic display or printed document
‡ Required only when a specific sensor must be matched to a specific meter input to meet accuracy specifications
† Required only when a sensor has separate approval from the metering system as a whole.

Notes:

- Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.3.b. Descriptors for External Sensor Marking Requirements.
- For requirements and details on application, see Table S.3.3.b. Descriptors for External Sensor Marking Requirements.
- "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.

Summary:
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.

Table S.3.3.b. **Descriptors for Device Identification and Marking Requirements - External Sensors**
1. Manufacturer's Identification. Marked per General Code paragraph G-S.1. Identification.
2. Manufacturer's Model Prefix. The General Code paragraph G-S.1. Identification (b)(1) model prefix marking requirement for the sensor(s) may be met with a physical marking. Alternatively, the marking requirement may be satisfied through an electronic display 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).
3. Manufacturer's Model. Marked per General Code paragraph G-S.1. Identification.
4. Serial Number Prefix. For a NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the sensor(s), where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated sensor is not required to meet General Code paragraph G-S.1. Identification (c)(1).
5. Serial Number. Also see General Code paragraph G-S.1. Identification.
6. NTEP Certificate of Conformance Prefix and Number. 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.
7. True Ratio. 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. Examples of sensor ratio markings include: 200A:5A 400A:0.3V 480V:120V CT Turns Ratio 4:1 VT Ratio 4:1 An example of a sensor ratio designation which includes a unit-less ratio: 480V:120V = 4:1.
8. Maximum Primary Current. The maximum primary current at which the sensor can be safely and accurately operated.
9. Rated Frequency. A sensor shall be marked with its rated frequency if other than 40Hz to 400Hz.
10. Maximum Safe Operating Voltage. A sensor shall be marked with a Maximum Safe Operating Voltage if it is less than 600VAC. Examples of sensor maximum safe operating voltage ratings: • 250 Vac • 250 VAC • 50 V **Note:** The maximum safe operating voltage rating marking may not be higher than the voltage to which the device was verified during type evaluation.
11. Polarity Marking. 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 watthour 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 ± 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.

Table T.4.
Tolerances for NUEMS

	Tests Conducted at Unity Power Factor	**Tests Conducted at 0.5 Lagging Power Factor**
Acceptance Tolerances	1.0 %	2.0 %
Maintenance Tolerance	2.0 %	3.0 %

T.5. Repeatability. – When multiple load tests are conducted at the same load condition, the range of the load test results shall not exceed 25 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

UR. User Requirements

UR.1. Selection Requirements.

UR.1.1. Customer Indicating Element, Accessibility. – For systems in which the primary indicating element is not reasonably accessible to the customer, 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.

$$E(T) = \int_0^T v(t) \cdot i(t) \cdot dt \qquad \textit{Eq. 1}$$

Where T is much greater than the period of the AC line frequency.

alternating current (AC). – An electric current that reverses direction in a circuit at regular intervals. [3.XX]

ampere. – The practical unit of electric current. It is the quantity of current caused to flow by a potential difference of one volt through a resistance of one ohm. One ampere is equal to the flow of one coulomb of charge per second. One coulomb is the unit of electric charge equal in magnitude to the charge of 6.24 x 10^{18} electrons. [3.XX]

audit trail. – An electronic count and/or information record of the changes to the values of the calibration or configuration parameters of a device. [1.10, 2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]
(Added 1993)

B

balanced load. – Balanced load is used to indicate equal currents in all phases and relatively equal voltages between phases and between each phase and neutral (if one exists); with approximately equal watts in each phase of the load. [3.XX]

basic lightning impulse insulation level (BIL). – A specific insulation level expressed in kilovolts of the crest value of a standard lightning impulse. (Example: BIL = 10 Kv) [3.XX]

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)

event logger. – A form of audit trail containing a series of records where each record contains the number from the event counter corresponding to the change to a sealable parameter, the identification of the parameter that was changed, the time and date when the parameter was changed, and the new value of the parameter. [2.20, 2.21, 3.30, 3.37, 3.39, 3.XX, 5.54, 5.56(a), 5.56(b), 5.57]

(Added 1993)

F

form designation (FM). –An alphanumeric designation denoting the circuit arrangement for which the NUEMS is applicable and its specific terminal arrangement. The same designation is applicable to equivalent NUEMS for all manufacturers. (Example: FM 2S) [3.XX]

H

hertz (Hz). – Frequency or cycles per second. One cycle of an alternating current or voltage is one complete set of positive and negative values of the current or voltage. [3.XX]

K

kilowatt (kW). – A unit of power equal to 1,000 watts. [3.XX]

kilowatt-hour (kWh). – A unit of energy equal to 1,000 watthours. [3.XX]

L

line service. – The service terminals or conductors connecting the (NUEMS) to the power source. [3.XX]

load service. – The service terminals or conductors connecting the (NUEMS) to the electrical load (e.g., vehicle, tenant, etc.). [3.XX]

load, full. – A test condition with rated voltage, current at 100% of test amps level, and power factor of 1.0. [3.XX]

load, light. – A test condition with rated voltage, current at 10% of test amps level, and power factor of 1.0. [3.XX].

M

master meter, electric. – A (NUEMS) owned, maintained, and used for commercial billing purposes by the serving utility. All the electric energy served to a submetered service system is recorded by the master meter. [3.XX]

metrological components. – Elements or features of a measurement device or system that perform the measurement process or that may affect the final quantity determination or resulting price determinations. This includes accessories that can affect the validity of transactions based upon the measurement process. The measurement process includes determination of quantities; the transmission, processing, storage, or other corrections or adjustments of measurement data or values; and the indication or recording of measurement values or other derived values such as price or worth or charges. [3.XX]

N

non-utility electricity measuring system (NUEMS). – An electricity measuring system comprised of all the metrologically relevant components required to measure electrical energy, store the result, and report the result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured.

O

ohm. – The practical unit of electric resistance that allows one ampere of current to flow when the impressed potential is one volt. [3.XX]

P

percent error. – Percent error is calculated as follows:

percent error = (NUEMS reading – standard reading)/standard reading x 100
[3.XX]

power factor (PF). – The ratio of "active power" to "apparent power" in an AC circuit. It describes the efficient use of available power. [3.XX]

primary indicating or recording elements. – The term "primary" is applied to those principal indicating (visual) elements and recording elements that are designed to, or may, be used by the operator in the normal commercial use of a device. The term "primary" is applied to any element or elements that may be the determining factor in arriving at the sale representation when the device is used commercially. (Examples of primary elements are the visual indicators for meters or scales not equipped with ticket printers or other recording elements and both the visual indicators and the ticket printers or other recording elements for meters or scales so equipped.) The term "primary" is not applied to such auxiliary elements as, for example, the totalizing register or predetermined-stop mechanism on a meter or the means for producing a running record of successive weighing operations, these

elements being supplementary to those that are the determining factors in sales representations of individual deliveries or weights. (See "indicating element" and "recording element.") [1.10, 3.XX]

R

reactive power. – For sinusoidal quantities in a two-wire circuit, reactive power is the product of the voltage, the current, and the sine of the phase angle between them, using the current as the reference. [3.XX]

register ratio (R_r). – The number of revolutions of the gear meshing with the worm or pinion on the rotor shaft per complete rotation of the fastest (most sensitive) wheel or dial pointer. [3.XX]

remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device.[2.20, 2.21, 2.24, 3.30, 3.37, 3.39, 3.XX, 5.56(a)]

(Added 1993)

retail device. – A measuring device primarily used to measure product for the purpose of sale to the end user. [3.30, 3.32, 3.37, 3.39, 3.XX]

(Amended 1987 and 2004)

S

sensor ratio. – The stated ratio of the primary circuit current or voltage compared to the secondary circuit current or voltage. (Example: CSR = 200 : 0.1) [3.XX]

serving utility. – The utility distribution company that owns the master meter and sells electric energy to the owner of a submeter system. [3.XX]

starting load. – The minimum load above which the device will indicate energy flow continuously. [3.XX]

submeter. – A meter or meter system downstream of the electric master meter. [3.XX]

T

tenant. – The person or persons served electric energy from a non-utility electricity-measuring system (NUEMS). [3.XX]

test amperes (TA). – The full load current (amperage) specified by the device manufacturer for testing and calibration adjustment. (Example: TA 30). [3.XX]

thermal overload protector. – A circuit breaker or fuse that automatically limits the maximum current in a circuit. [3.XX]

U

unit price. – The price at which the product is being sold and expressed in whole units of measurement. [1.10, 3.30, 3.XX]

(Added 1992)

utility. – A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution facilities for delivery of electric energy for use primarily by the public. Included are investor-owned electric utilities,

municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few entities that are tariff based and corporately aligned with companies that own distribution facilities are also included.

A list of recognized utilities in the U.S. can be found at the U.S. Energy Information Administration (EIA) at: **https://www.eia.gov/electricity/data/eia861** [3.XX]

V

volt. – The practical unit of electromotive force. One volt will cause one ampere to flow when impressed across a resistance of one ohm. [3.XX]

W

watt. – The practical unit of electric power. In an alternating-current circuit (AC), the power in watts is volts times amperes multiplied by the circuit power factor. [3.XX]

watthour (Wh). – The practical unit of electric energy, which is expended in one hour when the average power consumed during the hour is one watt. [3.XX]

meter – self-contained. – A meter in which the terminals are arranged for connection to the circuit being measured without using external instrument transformers. [3.XX]

watthour constant (K_h). – The expression of the relationship between the energy applied to the meter and the output indication, expressed as "watthours per revolution" or "watthours per output indication." [3.XX]

watthour test constant (K_t). – The expression of the relationship between the energy applied to the meter and the output indication, expressed as "watthours per output indication," when the meter is in test mode [3.XX]

NIST OWM Detailed Technical Analysis:

The USNWG on Electric Vehicle Fueling & Submetering is divided into two subgroups; one to address electric vehicle fueling and one to address utility-type watt hour meters. This item addresses work being done by the latter subgroup, the "Electric Watthour Meter Subgroup (EWH SG).

Since 2016, the EWH SG has been developing a proposed NIST Handbook 44 code for EWH-type meters. This item has been on the S&T Committee's agenda since 2016 as a Developing Item to allow the USNWG to inform the weights and measures community of progress on the draft code.

The EWH SG appreciates the Committee's willingness to maintain the item on the agenda as a mechanism for and to encouraging input and participation from those interested in the draft code and associated work.

The EWH SG is pleased to submit a draft NIST HB44 code for "Non-Utility Electricity Measuring Systems" to the S&T Committee Chair on November 12, 2022 for consideration at the 2023 NCWM Interim Meeting. The EWH SG believes the draft code is ready for consideration as a voting item and asks the Committee to consider assigning this item "Voting" status.

At the 2023 NCWM Interim Meeting, Tina Butcher commented there are some areas of the code in which the Subgroup is continuing to develop some additional language; however, this work need not delay consideration of the Code.

The Subgroup would also like to call attention to some specific areas of the Code as noted below and is open to suggested changes by the Committee as comments are received on this item.

- Paragraph S.1.3.2. Test Output.
    - The Subgroup voted several times on the language in this paragraph and the majority of members supported this language. However, the regulatory members of the Subgroup disagreed with this language. Thus, the Subgroup would especially appreciate review and comments on this paragraph.
- Table S.3.2.3.b., Note 7:
    - The Subgroup is considering the development of an accompanying new User Requirement related to the marking of the service voltage. This would be presented as a future recommendation to the draft code.
- N.3. Minimum Test Duration:
    - The Subgroup is considering alternative language for this paragraph that would include more specificity regarding the full and light load tests. The Subgroup will offer any such recommendations for changes to the Committee to consider along with any other comments the Committee might receive from NCWM members.
- N.5.(a) Test of NUEMS:
    - The Subgroup is considering moving N.5.(a) out of the Notes section and moving it to a User Requirement (with corresponding changes to present it as a User Requirement) as follows and is interested in input on this suggestion:
        - UR.X.X. Each NUEMS submitted for testing shall have all necessary components assembled, connected, and configured as intended for use. Components may include, but are not limited to, meter, sensor(s), indicator(s), etc.

All the Regions reviewed this item at their 2022 fall Regional Association Meetings they have recommended a Developing status; however, this assessment was based on the prior version of the draft code and comments received up to that point.

Although the most recent draft of the code was not available until after the Fall 2022 Regional Association Meetings, the regions and others will have adequate opportunity to review and comment on the draft in the period between the 2023 NCWM Interim and Annual meetings.

Thus, the EWH SG believes that designating this item with a Voting status is still an appropriate course of action.

At the EWH SG meeting on April 25, 2023, the SG agreed to move forward the following changes to the definition in the code.

Bidirectional. – A NUEMS equipped to register the accumulation of energy in both directions (i.e., for delivered and received energy):

A bidirectional NUEMS shall fall into at least one of the following categories:

(a) Single register or net meter that displays the difference between the delivered and received energy; or

(b) Separate register(s) for delivered or received.

external sensors. – Any voltage or current sensors not located inside of the meter body NEUMS itself and not inside the sealed enclosure containing the NEUMS

internal sensors. – Any voltage or current sensors located inside of the meter body NEUMS itself or inside the sealed enclosure containing the NEUMS.

non-integral. – Used to describe external sensors that can be disconnected from the meter body.

At the EWH SG meeting on June 27, 2023, the SG agreed to move forward the following changes to the definition in the code.

S.1.3.2. Test Output. – ~~Each~~ A NUEMS ~~**within a system**~~ shall have either: (1) a ~~**location for the reading of the accumulated value**~~**a rotating disk indicator**; (2) ~~**an electrical**~~ pulse output (visible ~~**and/**~~or infrared ~~**pulse**~~), **or (3)** an electrical pulse ~~**output (**~~in the form of a closure ~~**(**~~relay or electronic **means),** which provides a pulse a~~**t an interval of**~~ **with** K_t **or** K_hWatt-Hours per pulse~~**; or (3) other means for viewing accumulated values**~~. The value of K_t **or** K_h shall be such that the NUEMS's accuracy can be tested in 5 minutes or less for any ~~**specified**~~ **specific** test ~~**condition**~~.

S.1.3.6. NUEMS With External Sensors Located Remotely from the ~~Pulse~~ Test Output ~~or Display~~. – For NUEMS with external sensors located remotely from ~~**either**~~ the ~~**pulse**~~ **test** output ~~**or display**~~ which can be installed as described in paragraph UR.2.4.8. External Sensors Located Remotely from the ~~**Pulse**~~ **Test** Output ~~**or Display**~~, means shall be provided to allow ~~**either**~~ the ~~**pulse**~~ **test** output ~~**or display**~~ to be remotely used.

12. True Ratio.

~~**True Ratio.**~~ **The True Ratio, in primary amperes or volts to secondary amperes or volts shall be physically marked on a meter unless it is contained in either electronic or printed documentation. This is to be expressed as xxxA:yyyA; or xxxA:yyyV; or xxxV:yyyV. The number of digits is the number needed to express the values.**

Examples of sensor ratio markings include:
200A:5A
400A:0.3V
480V:120V

T.2. No-Load Test. – ~~**For**~~ **A** NUEMS ~~**with a K_t/K_h output, the NUEMS**~~ shall not emit more than one ~~**K_t/K_h**~~ **test** pulse **output**. ~~**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.**~~

N.3. NUEMS Minimum Test Duration. – **A NUEMS f~~F~~ull load test shall consist of a minimum of 10 watthour test constants** and **a** light load test~~s~~ shall ~~**require at least a one-minute test and at least**~~ **consist of a minimum of** one watthour test constant.

Some additional areas that we would like to note to the S&T Committee:

- The "Source" should read NIST U.S. National Work Group (USNWG) Electric Watthour Meters Subgroup (EWH SG)

- The title of this Item should read "Non-Utility Electricity-Measuring Systems (NUEMS) – Tentative Code "

- Most members supported the proposed language as it currently appears in the 2023 S&T Agenda (Pub. 16), although regulatory members of the SG disagreed with the proposed language.

- In addition, the regulatory members provided a detailed list to the EWH SG of their concerns. These concerns are noted in the letter that NCWM received from the California Agricultural Commissioners and Sealers Association (CACASA) (dtd. June 29, 2023) and posted under the NCWM S&T Supporting document website.

- The EHW SG attempted to address the regulators and CACASA concerns. They made headway in addressing those concerns and they appear in the Crosswalk below.

- The Crosswalk below, provides updates of items that appear in the 2023 S&T Annual Agenda (Pub. 16). They represent changes the EWH SG voted on to move forward to the S&T Committee for consideration. Due to limited time, the EWH SG was not able to address all the items, and the work continues.

Summary of Discussions and Actions:

At the NCWM 2022 Interim Meeting, Matt Douglas (California – Division of Measurement Standards) stated that California supports the development of this item but has concerns about identity marking requirements being on a separate document. Also, the devices should be easy to test before and after instillation. This device should allow for electronic data logger. Ms. Williams commented that the subgroup had provided a draft code that is on the website. Ms. Williams requested comments be submitted to Tina Butcher (NIST OWM) or Ms. Warfield by March 22, 2022. Ms. Williams stated these comments will be used to provide and updated draft for the 2022-2023 submission cycle and the item remain in developing status. The Committee agreed that the item be given a Developing status.

At the NCWM 2022 Annual Meeting, the Committee heard an update from Tina Butcher highlighted the points in the Executive Summary to this item. Tina Butcher acknowledged this item has been on the agenda for several years, during which time the SG has been continually working to develop a draft code for submission to the NCWM for consideration. The SG shared a draft with the Committee in August 2021 and asked that it be posted to the NCWM website. The SG had identified specific sections of the draft code which was still being refined by the SG. The SG had asked that that those interested in this work review the remainder of the code and provide input that would allow the SG an opportunity to modify the draft to reflect their comments prior to submitting a final recommendation to the NCWM.

Tina Butcher reported that the SG is diligently continuing to work on this item, holding eighteen meetings in 2021 and seven meetings in 2022. She thanked those who provided comments during the regional and national meetings, noting in particular the Committee heard from California Division of Measurement Standards who noted that additional work is needed on the marking requirements. She noted that California and others have raised questions about the provision that would allow required markings to appear on a separate document and asked for clarifications on how this would work. Other concerns raised included making sure that testing capabilities are readily achievable both before and after installation and refining requirements for audit trail requirements to ensure that hard copies of any event loggers are available to the inspector. The SG appreciates this input and is working to resolve the remaining areas of concern identified and hopes to present a draft to the NCWM in the coming fall.

The Committee agreed to retain this item on its agenda with a Developing status while the SG continues its work.

At the NCWM 2023 Interim Meeting, Tina Butcher commented that the USNWG on Electric Watthour Meters Subgroup believes that the draft code is ready for consideration as a voting item. Tina Butcher asked for continued feedback from the weights and measures community. During the Committee work session, the Committee agreed that the item is fully developed and has merit and assigned the item a Voting status.

Regional Association Reporting:

Western Weights and Measures Association

At the 2022 WWMA Annual Meeting no comments were heard on this item. The WWMA S&T Committee recommended that this item should remain Developing to allow the USNWG to continue development of the model code.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Ms. Warfield stated the workgroup planned to have an item in NCWM Publication 15 before the 2023 NCWM Interim Meeting.

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

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting Ms. Warfield 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. After hearing comments from the floor, the Committee recognized the need to further develop this item and recommended the item retain Developing status.

At the 2023 NEWMA Annual Meeting, the Committee heard no comments on this item but recommended to the body that this item retain a Developing status. The body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting no comments were heard from the floor. The CWMA S&T Committee recommended this as a Developing Item.

At the 2023 CWMA Annual Meeting, no comments were heard from the floor. The CWMA S&T Committee recommended this as a Voting Item.

Item Block 1 (B1) Minimum Draft Size When Using a Field Standard Meter

B1: LMD-23.1 V N.3.5. Wholesale Devices
B1: VTM-23.1 V N.3. Test Drafts
B1: MLK-23.1 V N.3. Test Drafts

Source: Endress+Hauser Flow USA, Inc.

Submitter's Purpose and Justification:

Define the minimum test draft size when using a field standard meter.

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

NIST OWM Executive Summary for Item Block 1 (B1) – Minimum Draft Size When Using a Field Standard Meter

NIST OWM Recommendation: NIST supports the proposed change to N.3.5 (B1: LMD-23.1) with adjustments to the item under consideration as shown in Block 1, Table 1. Analysis of Items – LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2. NIST also supports items B1: VTM-23.1 and B1: MLK-23.1 with adjustments to the item under consideration as shown in Block 1, Table 2. Analysis of Items B1: VTM-23.1 and B1: MLK-23.1. This proposal helps to broaden the original intent of the paragraph. We believe the requirements for test drafts were written around the most common test methods at that time. Future requirements for test drafts may be better addressed in the General Code with additional guidance in the Fundamental Considerations or another guidance document.

- One of the items in Block 1 (B1: LMD-23.1) is one of three items (LMD-23.4, B1: LMD-23.1 and B5: LMD-23.2) that propose changes to LMD code paragraph N.3.5. All items are on the agenda as voting items. As currently written, they are in conflict with each other and if all are adopted there will be different changes adopted to the same paragraph. To prevent this, the item under consideration must be adjusted for these items so that each proposal reflects an appropriate change to the paragraph. See Block 1, Table 1. Analysis of Items – LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2below with options for changes to these items on the agenda.

- B1: VTM-23.1 and B1: MLK-23.1 conflict in structure. See Block 1, Table 2. Analysis of Items B1: VTM-23.1 and B1: MLK-23.1with options for changes to these items on the agenda.

- Technology will continue to change and evolve, and we will need to respond to the number of changes, such as the different standards that will be in use, and the factors associated with different technologies. We will need to ensure an appropriate test draft is selected so that the errors of test method and device under test do not contribute greatly to the test of the device. Coupled with what is already in the fundamental considerations for responsibility for selecting a test standard and what is being proposed in Items Gen-23.1 and Block 8, we believe a solution may be to add a general code requirement with additional guidance in the fundamental consideration or EPOs for Test draft and consider removing Test Draft from the individual codes and addressing it in the general code in test notes as a suitability requirement.

Table 2. Summary of Recommendations
Item Block 1 (B1) – Minimum Draft Size When Using a Field Standard Meter

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		w/ suggested changes

WWMA	Withdraw		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM	Voting		

	Letters of Support	Letters of Opposition	Comments
Industry			As of 6/15/2023 Comments are available on the NCWM website to an older item Block 1 not this Block 1
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

B1: LMD-23.1 V N.3.5. Wholesale Devices

(**Note:** The Item Under Consideration was changed following the 2023 NCW< Interim Meeting)

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. [Nonretroactive as of January 1, 20XX]

(Added 20XX)

B1: VTM-23.1 V N.3. Test Drafts

(**Note:** The Item Under Consideration was changed following the 2023 NCWM Interim Meeting)

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. [Nonretroactive as of January 1, 20XX]

(Added 20XX)

B1: MLK-23.1 V N.3. Test Drafts

(**Note:** The Item Under Consideration was changed following the 2023 NCWM Interim Meeting)

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. [Nonretroactive as of January 1, 20XX]

(Added 20XX)

NIST OWM Detailed Technical Analysis:

NIST supports the proposed change to N.3.5 (B1: LMD-23.1) with adjustments to the Item Under Consideration as shown in Block 1, Table 1. Analysis of Items – LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2.

NIST also supports items B1: VTM-23.1 and B1: MLK-23.1 with adjustments to the Item Under Consideration as shown in Block 1, Table 2. Analysis of Items B1: VTM-23.1 and B1: MLK-23.1. This proposal helps to broaden the original intent of the paragraph. We believe the requirements for test drafts were written around the most common test methods at that time. Future requirements for test drafts may be better addressed in the General Code with additional guidance in the Fundamental Considerations or another guidance document.

One of the items in Block 1 (B1: LMD-23.1) is one of three items (LMD-23.4, B1: LMD-23.1 and B5: LMD-23.2) that propose changes to LMD code paragraph N.3.5. All items are on the agenda as voting items. As currently written, the items are in conflict with each other and if all are adopted there will be different changes adopted to the same paragraph. To prevent this, the Item Under Consideration must be adjusted for these items so that each proposal reflects an appropriate change to the paragraph. See Block 1, Table.1 Analysis of Item – LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2 with options for changes to these items on the agenda.

B1: VTM-23.1 and B1: MLK-23.1 conflict in structure. See Block 1, Table 2. Analysis of Items B1: VTM-23.1 and B1: MLK-23.1 with options for changes to these items on the agenda.

Block 1, Table 1. Analysis of Items – LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2

Item Under Consideration (as presented in Pub. 16)
LMD-23.4 V N.3.5. Wholesale Devices. **Source:** American Petroleum Institute **Purpose:** 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)

B1: LMD-23.1 V N.3.5. Wholesale Devices.

Source: Endress+Hauser Flow USA, Inc.
Purpose: Define the minimum test draft size when using a field standard meter.
Item Under Consideration: Amend Handbook 44, Liquid Measuring Devices Code 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)

B5: LMD-23.2 V N.3.5. Wholesale Devices

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.

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)**~~.

Items in Conflict
LMD-23.4, B1: LMD-23.1, and B5: LMD-23.2.

LMD-23.4 moves the language in **N.3.5. Wholesale Devices** from that paragraph to a new paragraph, **N.3.5.1. Test Drafts,** with amended language.

B1: LMD-23.1 N.3.5. Wholesale Devices does not include the language for N.3.5 wholesale device

B5: LMD-23.2 amends **N.3.5. Wholesale Devices** with the same language that **LMD-23.4 moves to N.3.5.1. Test Drafts**.

Conflict: Adoption of all three in their current form, depending on the order in which they are voted on, would either override the language in an item adopted during the same voting session, then duplicate the language in/create similar language in both **N.3.5. Wholesale Devices** and new paragraph **N.3.1. Test Drafts.**

The new paragraph could look like this:

N.3.5. Wholesale Devices. –The delivered quantity shall be equal to at least the amount delivered by the device in one minute at its maximum discharge rate

N.3.5.1. Test Drafts. – The delivered quantity shall be equal to at least the amount delivered by the device in one minute at its maximum discharge rate.

(Added 20XX)

N.3.5.2. 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.*
[Nonretroactive as of January 1, 20XX]

(Added 20XX*)*

N.3.5.3. 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)

Suggested Resolution:

1. Keep all three items separate from a Consent Calendar if one is put forth for consideration.

2. Vote on **LMD-23.2 (B5)** first. If adopted, it would not change **N.3.5. Wholesale Devices** and would add ***N.3.5.X. Field Standard Meter Test.*** as a sub-paragraph. If not adopted there's no effect on the other items

3. Vote on **LMD-23.4** second. If adopted, it would move the language in **N.3.5. Wholesale Devices** to sub-paragraph **N.3.5.1. Test Drafts.** with the amended language as proposed in **LMD-23.1** and would add a new sub-paragraph which would be designated as **N.3.5.2. Small Volume Prover Test. T**he item in **LMD-23.2** would then be designated ***N.3.5.3. Field Standard Meter Test.*** **LMD-23.1** could then be withdrawn by the Committee as the language it proposed would now be included in **N.3.5.1. Test Drafts.**

4. If **LMD-23.4** is not adopted, **LMD-23.1** could then be voted on.

Block 1, Table 2. Analysis of Items B1: VTM-23.1 and B1: MLK-23.1

Item Under Consideration (as presented in Pub. 16)

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]

Items in Conflict
B1: VTM-23.1 and B1: MLK-23.1

B1: VTM-23.1 – Test Draft in HB 44 is currently address in N.3. The proposal shows the test draft without the language that is currently in the handbook for paragraph N.3. Also, it is not clear as to whether or not the S&T committee intend to also strike the same text in the test draft paragraph for VTM that is shown in the Milk Meter Test Draft paragraph.

B1: MLK-23.1. – Test Draft in HB 44 is currently address in N.3. The proposal shows a sub-paragraph for test draft N.3.1., was added with the same language that is currently in N.3 and includes the edits proposed to other test draft paragraph proposals. Also as written the language in the test draft paragraph is different from the current language in the handbook so appropriate strikeouts of old text must be shown.

Suggested Resolution:

B1: VTM-23.1 – Add the N.3. Test Draft paragraph to the item under consideration with the same changes made to the milk meter test draft paragraph N.3.1. as follows:

N.3. Test Drafts. – ~~**Test drafts**~~ **The delivered quantity** ~~**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)**~~.
(Amended 1989 **and 20XX**)

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

B1: MLK-23.1. – Move N.3.1 paragraph to N.3 as follows:

N.3. Test Drafts. – ~~**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)**~~.
(Amended 1989 **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.
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

Summary of Discussions and Actions:

At the 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 regarding this item and assigned it a Voting status.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting 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.

Robert Murnane (Seraphin Test Measure Company) stated that 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 recommended that this item be withdrawn with the recommendation that the submitter combine their efforts with the submitters of Block 8.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Michael Keilty 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.

Prentiss Searles (American Petroleum Institute) stated that he supported this item moving forward as Developing, and that devices should not be pointed out separately.

Robert Murnane stated that he supported this moving forward as a Developing Item. Nicholas Suemnick (Marathon Petroleum) stated that he supported this moving forward as Developing. Hal Prince (Florida) stated that the membership needs to make a decision on how we want to handle this issue.

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

Northeastern Weights and Measures Association

During the 2022 Interim Meeting. Michael Keilty (Endress Hauser) reported that the language in this item is similar to LPG-15.1 and MFM-15.1 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? Henry 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. Robert Murnane (Seraphin Test Measure) pointed out that some meters already meet 1/3 requirement and can already be used as a field standard. 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. Michael Keilty commented that fixed volume provers are different than master meters and SVP, with separate benefits or disadvantages. Michael Keilty stated that it is more important and beneficial to list different types of technologies and performance

requirements. Lou Sakin (Holliston, MA) requested that the item be withdrawn. Prentiss Searles (API) commented that he is not in favor of the proposal. Jason Flint (New Jersey) noted the language in this proposal mirrored LPG-15.1 and MFM-15.1, which were already recommended for withdrawal by the body. Jason 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 recommended that this item be Withdrawn.

At the 2023 NEWMA Annual Meeting, Michael Keilty indicated that this item was added last year to amend the code to also recognize field standard meters. N.3.5 would include these now and supports voting. Loren Minnich (NIST-OWM) supports as voting.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a voting status with no changes, and the body concurred.

Central Weights and Measures Association

During the 2022 Interim Meeting, Michael Keilty stated that 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.

At the 2023 CWMA Annual Meeting, Michael Keilty supported this item as voting in parallel with the Milk Meter Code, Vehicle Tank Code and Liquid Measuring Device Code. Robert Murnane (Seraphin Test Measures) supports this item as voting. Loren Minnich (NIST OWM) noted that the item was fully developed and ready to vote.

The CWMA S&T Committee believes this Block is fully developed and recommends a Voting status.

Item Block 2 (B2) Define True Value for Use in Error Calculations

B2: SCL-20.3	W	S.5.4. Relationship of Minimum Load Cell Verification Interval to the Scale Division
B2: SCL-20.4	W	Table 3. Parameters of Accuracy Classes.
B2: SCL-20.5	W	Table S.6.3.a. Marking Requirements, Note 3.
B2: SCL-20.6	W	T.N.1.2. Accuracy Classes and T.N.1.3. Scale Division.
B2: SCL-20.7	W	Table 7. Maintenance Tolerances
B2: A SCL-20.8	W	Table 8. Recommended Minimum Load

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)

Submitter's Purpose and Justification:

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

Item Under Consideration:

B2: SCL-20.3 A S.5.4. Relationship of Minimum Load Cell Verification Interval to the Scale Division

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[1] weighing/load-receiving element (such as hopper, railroad track, or vehicle scale weighing/load-receiving elements):*
>
> *(a)* $Vmin \leq \frac{\mathbf{d\ e}}{\sqrt{N}}$ *for scales without lever systems; and*
>
> *(b)* $Vmin \leq \frac{\mathbf{d\ e}}{\sqrt{N \times (scale\ multiple)}}$ *for scales with lever systems.*

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

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

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

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

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

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

[Nonretroactive as of January 1, 1994]

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

B2: SCL-20.4 A Table 3. Parameters of Accuracy Classes.

Amend Handbook 44, Scales Code as follows:

Table 3. Parameters for Accuracy Classes

Class	***Value of the Verification Scale Division e[1] ~~(d or e[1])~~***	***Number of Scale[4] Divisions (n)***	
		Minimum	***Maximum***
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	*--*
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5 000*	*100 000*
III[2,5]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2 000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*
U.S. Customary Units			
III[5]	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
	0.005 oz to 0.125 oz, inclusive	*100*	*10 000*
	equal to or greater than 0.01 lb	*500*	*10 000*
	equal to or greater than 0.25 oz	*500*	*10 000*
III L[3]	*equal to or greater than 5 lb*	*2 000*	*10 000*
IIII	*greater than 0.01 lb*	*100*	*1 200*
	greater than 0.25 oz	*100*	*1 200*

*[1] **~~For Class I and IIdevices 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)

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

(Added 1986) (Amended 2003)

*[3] The value of ~~a~~ **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)

[4] 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)

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

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

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

(Added 1986) (Amended 2003)

*[3] The value of ~~a~~ **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)

[4] 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 nmax for the summed indication shall not exceed the maximum specified for the accuracy class.

(Added 1997)

[5] The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.)
[Nonretroactive as of January 1, 1986]
(Amended 1986, 1987, 1997, 1998, 1999, 2003, and 2004**, and 20XX**)

B2: SCL-20.5 A Table S.6.3.a. Marking Requirements, Note 3.

Amend Handbook 44, Scales Code as follows:

3. The device shall be marked with the nominal capacity. *The nominal capacity shall be shown together with the value of the scale division "**d**" (e.g., 15 × 0.005 kg, 30 × 0.01 lb, or capacity = 15 kg, d = 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 scale division value ~~or weight unit~~ **with its associated nominal capacity** shall be marked on multiple range or multi-interval scales.* ***In the absence of a separate marking of the verification scale division "e" (see Note 4), the value of the verification scale division e shall be equal to the value of the scale division d.***

   [Nonretroactive as of January 1, 1983]
   (Amended 2005 and 20XX)

B2: SCL-20.6 A T.N.1.2. Accuracy Classes and T.N.1.3. Scale Division.

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 A Table 6. Maintenance Tolerances

Table 6.Maintenance Tolerances

(All values in this table are in verification scale divisions)								
Tolerance in Verification Scale Divisions								
	1		**2**		**3**		**5**	
Class	**Test Load**							
I	0 -	50 000	50 001 -	200 000	200 001 +			
II	0 -	5 000	5 001 -	20 000	20 001 +			
III	0 -	500	501 -	2 000	2 001 -	4 000	4 001 +	
IIII	0 -	50	51 -	200	201 -	400	401 +	

(All values in this table are in verification scale divisions)				
Tolerance in Verification Scale Divisions				
III L	0 -	500	501 - 1 000	(Add 1 ~~d~~ e for each additional 500 ~~d~~ e or fraction thereof)

B2: SCL-20.8 A Table 8. Recommended Minimum Load

Table 8. Recommended Minimum Load

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

~~For Class and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."~~ *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.

(Amended 20XX)

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

(Amended 1990) **(Amended 20XX)**

NIST OWM Detailed Technical Analysis:

The following was copied from OWM's analysis of the Block 2 items for the 2022 NCWM Annual Conference and remains unchanged for the 2023 NCWM Interim Meeting:

OWM looks forward to reviewing updates to the various items in this block once the NCWM Verification Scale Division (e) Task Group (TG) has completed its work amending the current proposals to reflect the agreed upon changes reported by the TG in its second report. Since there have been no updates to the different items in Block 2 since they were first submitted, OWM's analysis of this group of items remains unchanged from the 2022 NCWM Interim Meeting as follows:

It remains clear that not everyone agrees with the changes proposed by this block of items given that none of the four regional weights and measures associations, nor the SMA, all of which met in the fall of 2021,

could recommend to the national S&T Committee advancement of this block of items to a Voting status. Two of the regional associations recommended the block be reassigned to the Verification Scale Division Task Group. The other two regional associations recommended the block be developing. The SMA supported further development and the work of the Verification Scale Division (e) Task Group. We too disagree with some of the changes proposed. Consequently, as a group of items considered together, OWM cannot support them.

Although we are aware of the existence of a second draft report from the Verification Scale Division (e) Task Group that we think proposes, or at least suggests, additional changes/updates to the items in this block, we do not believe any of the items in Block 6 have changed since that report was first made available to us. We are hopeful, however, that some of the proposals in this block have been updated (but not yet published) or will be updated in the very near future and those updates will resolve, at least some concerns. We base this hope on comments made by Henry Oppermann (Weights and Measures Consulting, LLC) during Committee open hearings at the 2021 NEWMA Interim Meeting. Henry Oppermann reported during open hearings that he had talked to the submitter of this block of items and the two had reached agreement on some needed changes to the proposals. Henry Oppermann commented that he thought those agreed upon changes had perhaps already been made. Consequently, the draft of Block 2 items in NEWMA's 2021 S&T Interim Meeting agenda was not, in Henry Oppermann's opinion, the most recent draft. We are somewhat encouraged by this news because we share at least some of Henry Oppermann's concerns with respect to the current items in this block.

Further evidence that the proposals in the Committee's 2022 Interim Meeting agenda (i.e., NCWM Publication 15) may have been updated, but not yet published or widely distributed, are comments made by the Chair of the Verification Scale Division (e) Task Group during Committee open hearings at the 2021 CWMA Annual meeting. That is, the CWMA's S&T 2021 Annual Report indicates that Doug Musick, who was Chair of the Verification Scale Division (e) Task Group during its existence, provided updates from the Task Group and would be providing changes to the item to NCWM S&T Committee before the July NCWM Annual meeting. Based on our review and comparison of the Block 2 items in the CWMA's 2021 S&T Annual Meeting Agenda and the Committee's 2022 Interim Meeting agenda (i.e., NCWM Publication 15) none of the proposals have changed.

If there does, in fact, exist a more current draft of the proposals in Block 2 and that draft gets introduced on or before the 2022 NCWM Interim Meeting, we encourage the Committee to provide adequate time for review and discussion opposed to simply advancing any new draft for vote during the 2022 NCWM Interim Meeting. There are many changes proposed by this block of items (i.e., there are six individual items in all) and their significance should be of great enough concern to warrant, in our opinion, sufficient time for review and discussion, especially in light of the fact there still exists disagreement on the current proposals. As noted in earlier OWM comments and recommendations, the different proposals included in this block present several very significant changes to the Scales code of HB 44 with respect to the application of HB 44 requirements to scales having different values of e and d. Given these two values most often differ by a factor of ten, it is of utmost importance that everyone agree on which value is the application of the different HB 44 requirements to be based.

Summary of Discussions and Actions:

During the 2022 NCWM Interim Meeting, Richard Harshman (NIST OWM) commented that the items in this block represent very significant changes to the Scales Code of NIST HB 44 in that they are an attempt to clarify which value, the value of the scale division (d), or verification scale division (e), are the paragraph requirements to be based. It is important that everyone agree; however, but this has not yet

been the case. Richard Harshman noted that OWM disagreed with several of the changes proposed by the different items in this block as shown in the Committee's current agenda. Richard Harshman also reported that the various Block 2 items in the Committee's current agenda fail to reflect changes agreed to by members of the NCWM's Verification Scale Division (e) Task Group (TG) as indicated in its second report to the Committee. That is, the proposals hadn't been updated following the TG's submission of its second report to the Committee. There seemed to be a misunderstanding between the TG and Committee on who would perform this work and it never got done. OWM looked forward to reviewing the proposals once this updating had been completed.

Doug Musick (Kansas) Chair of the Verification Scale Division (e) TG acknowledged the accuracy of Richard Harshman's reporting of the misunderstanding between the TG and Committee. He then requested the Committee either reassign the Block 2 items to the TG, or, if the Committee preferred, the Committee could perform the updating itself based on the TG's most recent report. Doug Musick also noted that the TG's second report was included in Appendix A of the Committee's 2022 Interim Agenda (NCWM Publication 15).

Russ Vires (Mettler Toledo, LLC) speaking on behalf of the SMA stated that the SMA supports the further development of this item and the work of the Verification Scale Division (e) Task Group. The SMA would also like to encourage the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in this item.

The Committee also received several comments in support of reassigning the block of items to the TG for further revision.

The Committee, in consideration of the comments received, agreed to reassign the block of items to the Verification Scale Division (e) TG for additional updating.

During Committee open hearings at the NCWM 2022 Annual Meeting, the Committee received an update from the Task Group Chair Doug Musick (Kansas). Doug 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. Doug 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.

Regional Association Reporting:

Western Weights and Measures Association

During the 2021 Annual Meeting Open Hearing the following comments were heard:

Matt Douglas (California - DMS) remarked the language is not clear, recommend that this item be withdrawn (the whole block).

Russell Vires (Scale Manufactures Association) stated this is a carryover item. SMA supports further development of this item, recommend that the SMA encourage the use of term: Verification Scale Interval for (e) and Scale Division for (d). (He can send info.) States that his comments are the same from the Annual Meeting.

Diane Lee (NIST OWM) remarked that the NIST OWM comments are posted on NCWM website.

The WWMA S&T Committee recommended that this item remain Informational with concern given to the comments given during the WWMA open hearings. During the Committee work session, clarification was given regarding Committee member Matt Douglas' (California - DMS) testimony questioned whether or not the item provides assistance to an Inspector in the field in the performance of their job.

Due to timing constraints during open hearings at the 2022 WWMA meeting, 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 recommended that this item remain Assigned and looks forward to a future update.

Southern Weights and Measures Association

During the 2021 Annual Meeting Open Hearing Russ Vires (SMA) supported further development of this item and recommended the descriptive name changes for "e" and "d" as posted on the NCWM website.

This Committee recommended this item move forward with an Assigned status.

Northeastern Weights and Measures Association

During the 2021 Interim Meeting Open Hearing the following comments were heard.

Richard Harshman (NIST OWM) recommended keeping this item in Informational status due to the fact that the National S&T Committee has taken ownership and interpretations have been provided at NTEP and weighing sector meetings. Meeting notes are available on NCWM website.

Henry Opperman (Weights and Measures Consulting) objected to many of the blocked items and recommended keeping this item an Informational status.

Lou Staub (SMA) suggested the use of the term "verification scale interval" for "e" and "scale division" for "d".

John McGuire (New Jersey) recommended keeping the item in Informational status.

The NEWMA Specifications and Tolerances Committee recommends that this item be kept in Informational status.

During the 2022 NEWMA Annual Meeting Open Hearings, Russ Vires (Mettler Toledo, LLC), speaking on behalf of the SMA, recommended the identical changes to the individual items in Block 2 as shown in the SMA reporting contained within this report for the SMA's Spring 2022 meeting. Tina Butcher (NIST OWM) indicated she believes the latest revisions from task group have addressed concerns.

After hearing comments from the floor, the Committee recognized the need to further develop this block and recommended the block retain Assigned status.

Central Weights and Measures Association

During the 2021 Interim Meeting Open Hearing the Committee heard comments from the floor. Lou Straub (SMA) supports item. Would like to see it written that "scale division" will have value of "d" and "verification scale interval" for "e".

CWMA S&T Committee recommended that the item be assigned back to the Verification Scale Division Task Group.

During the 2022 CWMA Annual Meeting Open Hearings the Committee received the following comments:

Russ Vires (SMA): the SMA supports the further development of this item and the work of the Verification Scale Division (e) Task Group. Recommendation: the SMA would also like to encourage the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in this item.

Loren Minnich (Kansas): items shown under consideration are not the items the Task Group has submitted. The SMA recommendations conflict with current task group verbiage.

Doug Musick (Kansas): this proposal got put into the National Committee Agenda Appendix for some reason. Hope to rebuild the task group and get cleaned up before 2022 national. "verification interval" should be "verification scale division" (e), and "displayed scale division" (d). Having (d) and (e) in the same original table was confusing to inspectors. The current Task Group changes won't be in Pub 16. for the 2022 NCWM National Meeting.

Loren Minnich (Kansas): prefers the S&T Committee to evaluate the Appendix since it's more up to date.

The CWMA S&T Committee recommended this item remain as Assigned.

During the 2022 CWMA Interim Meeting, the Committee received no comments on this block of items and recommended this block remain in an Assigned status.

SMA

During the 2021 Fall Meeting the SMA supports the further development of this item and the work of the Verification Scale Division (e) Task Group. The SMA would also like to encourage the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in this item. The following changes are recommended to the individual items in this block:

B2: SCL-20.3 S.5.4 Relationship of Minimum Load Cell Verification Interval: No change

B2: SCL-20.4 Table 3. Parameters of Accuracy Classes

> Recommendation: The SMA recommends the following change to Table 3, Footnote 1: ***The manufacturer may design a scale such that the ~~verification scale division~~ verification interval e does not be equal to the scale division d.***

B2: SCL-20.5 Table S.6.3.A. Marking Requirements, Note e: No Change

B2: SCL-20.6 T.N.1.1. Accuracy Classes and T.N.1.3. Scale Division

Recommendation: The SMA recommends the following change: **"… except that (d) is not used in reference…"**

B2: SCL-20.7 Table 7. Maintenance Tolerances

Recommendation: The SMA recommends the following change: **Table 6. Maintenance Tolerances**

B2: SCL-20.8 Table 8 Recommended Minimum Load

Recommendation: The SMA recommends the following change**: *Scales ~~manufacturers are permitted~~ may have ~~to design scales where the value~~ a verification scale interval ~~division e~~ differs not equal to from the displayed scale division d.***

During the 2022 Spring Meeting, the SMA reported it supported the further development of this item and the work of the Verification Scale Division (e) Task Group. The SMA would also like to encourage the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in this item.

The SMA recommended the following changes to the individual items in Block 2:

B2: SCL-20.3 S.5.4 Relationship of Minimum Load Cell Verification Interval: No change

B2: SCL-20.4 Table 3. Parameters of Accuracy Classes

Recommendation: The SMA recommends the following change to Table 3, Footnote 1: Class I and II scales may be designed such that the verification scale division verification interval e does not be equal to the scale division d.

B2: SCL-20.5 Table S.6.3.A. Marking Requirements, Note 3: No Change

B2: SCL-20.6 T.N.1.2. Accuracy Classes and T.N.1.3. Scale Division

Recommendation: The SMA recommends the following change: "… except that (d) is not used in reference…"

B2: SCL-20.7 Table 7. Maintenance Tolerances

Recommendation: The SMA recommends the following change: Table 6. Maintenance Tolerances

B2: SCL-20.8 Table 8. Recommended Minimum Load

Recommendation: The SMA recommends striking the following language from the submitter's proposal: Scales manufacturers are permitted to design scales where the value a verification scale division e differs from the displayed scale division d.

Rationale: When taken with the SMA's recommendation for SCL-20.4, this will avoid duplication in the HB44 code.

During the 2022 Fall Meeting, the SMA continued to support the further development of this block of items and the work of the Verification Scale Division (e) Task Group. The SMA would encourage the work group to make the final changes to this block of Assigned Items and present it to the S&T Committee and Membership, otherwise remove it.

Recommendation: the SMA encourages the use of the terminology "Verification Interval" for "e" and "Scale Division" for "d" in every instance that it appears in the Handbook.

The SMA recommended the following changes to the individual items in Block 2:

B2: SCL-20.3 S.5.4 Relationship of Minimum Load Cell Verification Interval: No change

B2: SCL-20.4 Table 3. Parameters of Accuracy Classes

Recommendation: The SMA recommends the following change to Table 3, Footnote 1: ***Class I and II scales may be designed such that the ~~verification scale division~~ verification interval e does not ~~be~~ equal ~~to~~ the scale division d.***

B2: SCL-20.5 Table S.6.3.A. Marking Requirements, Note 3: No Change

B2: SCL-20.6 T.N.1.2. Accuracy Classes and T.N.1.3. Scale Division

Recommendation: The SMA recommends the following change: **"… except that (d) is not used in reference…"**

B2: SCL-20.8 Table 8. Recommended Minimum Load

Recommendation: The SMA recommends striking the following language from the submitter's proposal: ***~~Scales manufacturers are permitted to design scales where the value a~~ verification scale division e differs from the displayed scale division d.***

Rationale: When taken with the SMA's recommendation for SCL-20.4, this will avoid duplication in the HB44 code.

Item Block 3 (B3) Tolerances for Distance Testing in Taximeters and Transportation Network Systems

B3: TXI-20.1 W T. Tolerances
B3: TNS-20.1 W T. Tolerances

Source: New York Department of Agriculture and Markets

Submitter's Purpose and Justification:

Provide the same distance-measurement tolerances for the Taximeters Code and Transportation Network Systems Code.

Taximeter manufacturers are submitting devices identical to the devices in the Transportation Network Measurement Systems (TNMS) 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 the Submitter is 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.

Item Under Consideration:

The Item Under Consideration published in the Committee's 2023 Interim Report is shown below.

B3: TXI-20.1 D T. Tolerances

T. Tolerances

T.1. Tolerance Values.

T.1.1. On Distance Tests. – Maintenance and acceptance tolerances for taximeters shall be as follows:

(a) On Overregistration: 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 D T. Tolerances

T. Tolerances

T.1.1. Distance Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) On Overregistration: ~~**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.**

NIST OWM Detailed Technical Analysis:

Background: OWM appreciates the efforts of the submitter to harmonize the tolerance requirements in the Taximeters Code and the TNMS Code although, we did not believe it is necessary to increase the tolerance allowed since taximeters have been required to comply with the existing tolerances for decades.

OWM also noted that TNMS do not typically assess fare charges based on intervals as do taximeters. Taximeters will accumulate fare charges by summing the number of intervals comprising the trip's distance traveled and time elapsed and multiplying by the appropriate rate. In contrast, TNMS typically

base the fare charges on the total distance (and time in some cases) for the trip. For this reason, we did not believe it is necessary to amend paragraphs T.1.1.(a) and (b) to refer to "interval under test" as is shown in the proposal. OWM recommended that this proposal be further developed with the assistance of the NIST USNWG on Taximeters in such a way that will better align the HB 44 Taximeters and TNMS Codes.

The NIST led U.S. National Work Group (USNWG) on Taximeters has held virtual meetings in May, June, and October 2020 and June 2021 to further develop standards for both taximeters and TNMS. The focus of these meetings was the merger of the existing HB 44 Taximeters Code and the tentative TNMS Code. Those members attending these meetings were in general agreement that this is the appropriate direction the work group should take. The USNWG also began discussions on some of the areas to be addressed in a unified "Transportation-for-Hire Systems" Code that could present challenges in the development of appropriate requirements. Those areas included the design and function of indicating elements, provisions for sealing, and location services signal loss.

The submitter of the proposal (New York or NYS) agreed to work with the USNWG to further develop this proposal and is actively participating in those meetings. The submitter explained to the USNWG that some of the more recent systems submitted to the state of New York for type approval had not been able to comply with the existing taximeter tolerances. This failure was seen in systems that attempted to use location services (i.e., GPS) to measure distance. In response to that point, it was noted that other systems have been able to meet those tolerances and to expand the tolerances would be an approach that is not supported by most in the weights and measures community.

Also included as a topic in the meetings was this proposal submitted to the NCWM S&T Committee to amend the HB 44 Taximeters and TNMS Codes. The USNWG agreed that the two HB 44 Codes should be merged and that this could be accomplished by continuing its efforts in the future.

NIST OWM is aware that the developer of the proposal was not able to provide updates to the proposal in January 2022 because of technical difficulties with audio-visual equipment at the NCWM Interim Meeting. The NYS alternate proposal modified only the Taximeter Code tolerances and was made available on March 23, 2022 on the NCWM website. This update was later noted in the May 2022 CWMA and NEWMA Annual Meeting summaries. The NYS alternate proposal established a new set of taximeter over- and under-registration tolerances at 2.5 % which are equivalent to those applied to TNMS. The current tolerances remain in place when the taximeter source for distance measurements is connected to the vehicle. The proposed new tolerances apply when the taximeter's source for distance measurement is generated from equipment not physically connected to the vehicle such as a GPS. This mechanism for generating measurement data from sources not physically connected to the vehicle is similar in the operation of a TNMS.

On March 23, 2022, NYS also withdrew the portion of Block 3 designated as B3: TNS-20.1 T. Tolerances, and no longer recommended modifying Transportation Network Measurement Systems - Tentative Code paragraph T.1.1. Distance Tests maintenance and acceptance tolerances for over- and under-registration and to reestablish the limits of permissible error of the TNMS under test as a percentage of the interval under test and distance traveled over the test course.

Based on the methodology used to determine distance traveled the proposal would permit a dual tolerance structure for vehicles within a single company or operating in the same geographic area. Work may need to be stepped up to address issues identified in the areas of design and function of indicating elements, provisions for sealing, and location services signal loss so that these provisions are in the code for properly operating this newer technology in taxis.

In conclusion: By December 2022 NIST OWM agreed with the submitter's recommendation during the NEWMA October 25-26, 2022 Interim Meeting to withdraw the proposal. OWM continues to encourage stakeholders to work with the USNWG to ensure that future modifications to the NIST HB 44 Taximeters and TNMS Codes fully consider the technology used in both applications.

The work to update the taximeters and TNMS codes may need to be stepped up to address issues identified in the areas of design and function of indicating elements, provisions for sealing, and location services signal loss so that these provisions are in the code for properly operating this newer technology in taxis.

Summary of Discussions and Actions:

At the 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 NIST 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. Kurt Floren (Los Angeles County, California) pointed out that taximeters have been and still are meeting existing tolerances and therefore he questions the need to expand those tolerance values.

Stan Toy (Santa Clara County, California) expressed his belief that the tolerances for taximeters do not need to be expanded and that this item should be withdrawn. Jim Willis (New York) 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. James 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.

During the NCWM 2020 NCWM Annual Meeting due to the 2020 COVID-19 pandemic, this meeting was adjourned to January 2021, at which time two consecutive meetings were held virtually. Due to time constraints, only those items designated as 2020 Voting Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

At the NCWM 2021 Interim Meeting, 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 NIST 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.

James Willis (representing the submitter) stated a willingness to work with the USNWG on Taximeters.

During the Committee's work session, its members noted the submitter's willingness to work with the taximeter work group and agreed to maintain this item's Developing status.

During the 2022 NCWM Interim Meeting, a regulator from New York presented edits to the proposal. At the time of his comments these edits were not published in NCWM Publication 15 and when presented during Open Hearings, the 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 latest proposed modification to the proposal would provide the same tolerances for similar technology. The NY regulator concluded with a recommendation that this latest revised version of the proposal move forward as a Voting item.

A regulator from Los Angeles County, California 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.

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.

The Committee assigned a Developing status for this item at the 2022 NCWM Interim Meeting. The Committee recommended 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.

On March 23, 2022, the submitter requested the Committee replace the Item under Consideration shown above in the 2022 S&T Committee Interim Report with the following.

Modify NIST Handbook 44 Section 5.54 Taximeters Code as follows:

T.1. Tolerance Values.

T.1.1. On Distance Tests. – Maintenance and acceptance tolerances for taximeters shall be as follows:

<u>T.1.1.1. Meters Using Distance generated from sources physically connected to the vehicle (e.g., OBD sensor).</u>

(a) On Overregistration: 1 % of the interval under test.

(b) On Underregistration: 4 % of the interval under test, with an added tolerance of 30 m or 100 ft whenever the initial interval is included in the interval under test.

<u>T.1.1.2. Meters Using Distance generated from sources not physically connected to the vehicle (e.g., navigation satellite system such as GPS and /or other location services).</u>

<u>(a) On Overregistration: 2.5 %</u>

(b) On Underregistration: 2.5 %

Additionally, the submitter recommended withdrawing the TNMS portion of the original proposal and leave the existing TNMS Code as it currently appears in NIST Handbook 44.

During the NCWM 2022 Annual Meeting Open Hearings, the Committee received an update from submitter James Willis. Based on feedback, James Willis has made language changes which will be updated for the fall meetings. James Willis requested that the item retain its Developing status.

At the 2023 NCWM Interim Meeting, the submitter of this item indicated that this proposal is no longer needed and requested that it be Withdrawn.

Regional Association Reporting:

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Craig VanBuren (Michigan) indicated that trying to make two measurements of the same device 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. Craig VanBuren recommended this item be Withdrawn.

The CWMA S&T Committee recommended this remains as a Developing Item.

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received:

Matt Douglas (California Division of Measurement Standards) wanted to hear if this update addressed some of the concerns raised particularly by Kurt Floren. Did see the merit in how this was developed. Thought this is close to being ready if not already ready for a vote.

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 recommended that this item should remain Developing to allow membership to review the updated proposal.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, no comments were received on this item. The SWMA S&T Committee recommended this item remain as a Developing Item.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Jim Willis (New York and submitter) requested that this item be withdrawn in October 2022. At the request of the submitter, the Committee recommended that this item be withdrawn.

Item Block 4 (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.)

B4: GEN-21.2	V	G-S.5.6. Recorded Representations.
B4: LMD-21.2	V	S.1.6.5. Money Value Computations., UR.3. Use of a Device.
B4: VTM-21.1	V	S.1.1. Primary Elements., UR.2. User Requirements
B4: LPG-21.1	V	S.1.1. Primary Elements., UR.2. User Requirements
B4: CLM-21.1	V	S.1.4.1. ~~Printed Ticket~~ Recorded Representation., UR.2.6.3. ~~Printed Ticket~~ Recorded Representation.
B4: MLK-XX-X	V	S.1.4.2 ~~Printed Ticket~~ Recorded Representation., UR.2.2. ~~Printed Ticket~~, Recorded Representation.
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.
B4: CDL-21.1	V	S.1.4.1. ~~Printed Ticket~~ Recorded Representations., UR.2.4.2. ~~Tickets or Invoices.~~ Recorded Representation.
B4: HGM-21.1	V	S.2.6. Recorded Representations, Point of Sale Systems., S.6. ~~Printer.~~ Recording Element., UR.3.2. Vehicle-mounted Measuring Systems ~~Ticket Printer~~ Recording Element., UR.3.3. ~~Printed Ticket.~~ Recorded Representation.
B4: OTH-21.2	V	Appendix D - Definitions.: recorded representations, recording element.

Source: Kansas Department of Agriculture, Division of Weights and Measures

Submitter's Purpose and Justification:

Allow recorded values to be captured electronically as an alternative to a printed ticket or receipt.

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 values. 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.

NIST OWM Executive Summary for Item Block 4 (B4) – Electronically Captured Tickets or Receipts

NIST OWM Recommendation: This item has been through several years of review and revisions have been made to the item under consideration based on comments. NIST OWM believes that the additional changes made to the items under consideration provides clarity. NIST OWM supports a voting status for this item.

- NIST OWM found a minor edit and recommends updating B4: LMD-21.2, Paragraph U.R.3.3 to include **(Amended 20XX)** to part (b)(1) and add **(and 20XX)** to the end of the exceptions paragraph.

Table 2. Summary of Recommendations
Item Block 4 – Electronically captured tickets or receipts

	Status Recommendation	Note*	Comments
Submitter			• Proposed Revisions by Submitter (09-28-2020) • Further Comments (01-13-2021)
OWM	Voting		
WWMA	Developing		
NEWMA	Voting		
SWMA	Developing		
CWMA	Voting		
NCWM	Voting		

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

B4: GEN-21.2 V G-S.5.6. Recorded Representations.

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. However,** 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.

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 **<u>20XX</u>**)

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<u>,</u> ~~and~~ 2018<u>, and 20XX</u>)

…

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)**(Amended 20XX)**

(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 **and 20XX**)

(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

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

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**)

…

S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided. – Except for fleet sales and other price contract sales, a ~~**printed receipt**~~ **recorded representation** 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; and

(d) the final total price of the fuel sale after all post-delivery discounts are applied.

(Added 2016) **(Amended 20XX)**

…

UR.2. User Requirements.

…

UR.2.6. ~~Ticket Printer, Customer Ticket.~~ Recorded Representation– 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**~~ **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.

(Added 1992) (Amended 1994**, and 20XX**)

…

UR.2.7.2. 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. 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**~~ **recorded representation** of the transaction containing the applicable price per unit of measure, the total quantity delivered, and 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.

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.

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 create**d 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.

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.
(Amended 20XX)

And

UR.3.3 ~~Ticket Printer, Customer Ticket,~~ Recorded Representation. – 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**~~ **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.
(Added 1994) (**Amended 20XX**)

…

UR.3.4. ~~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: CDL-21.1 V S.1.4.1. ~~Printed Ticket~~Recorded Representations., UR.2.4.2. ~~Tickets or Invoices.~~ Recorded Representation.

Amend Handbook 44, Carbon Dioxide 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)

UR.2.4.2. ~~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**~~ **include** that the quantity delivered has been temperature or density compensated.

(Amended 20XX)

B4: HGM-21.1 D S.2.6. Recorded Representations, Point of Sale Systems., S.6. Printer. Recording Element., UR.3.2. Vehicle-mounted Measuring Systems Ticket Printer Recording Element., UR.3.3. Printed Ticket. Recorded Representation.

Amend Handbook 44, Hydrogen Gas-Measuring Devices Code as follows:

S.2.6. Recorded Representations, Point of Sale Systems. – A ~~**printed**~~ receipt shall be available through a built-in or separate recording element for transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash. The ~~**printed**~~ receipt shall contain the following information for products delivered by the dispenser:

(a) the total mass of the delivery;

(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.

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]**

NIST OWM Detailed Technical Analysis:

This item has been through several years of review and revisions have been made to the item under consideration based on comments. NIST OWM believes that the additional changes made to the items under consideration provides clarity. NIST OWM supported a voting status.

Below are previous comments provided by NIST OWM.

The key purpose of this block of proposals is to broaden the requirements by eliminating the term "print/printed" in specific NIST HB 44 codes and clarifying that providing an electronic recorded representation in lieu of a printed recorded representation is an acceptable option as was adopted in G-S.5.6. Recorded Representations in 2014. NIST OWM provides the following technical points for consideration.

Paragraph G-S.5.6. Recorded Representation addresses multiple points relative to recorded representations:

1. Any NIST Handbook 44 requirement applicable to indicating and recording elements also apply to recorded representations.

2. Recorded values must be printed in a numerical or "digital" form. The reference to the term "digitally" refers to the use of that term as described in the definition for "digital type," which describes "digitally" as being presented in numbers.

3. Providing the customer with an option of "not receiving a receipt" is acceptable, so long as the *customer* is making that choice to not receive a receipt.

4. For systems that are capable of issuing an electronic receipt, the customer may be given the option of receiving the receipt in an electronic form. However, providing the option for an electronic receipt does not negate any requirement for the system to provide the customer with the option of a hard copy receipt for those specific codes where a hard copy receipt is required. That is, the system may offer additional options beyond the hard copy form; however, the hard copy form must remain an option for the customer to choose. The first part of this also sentence recognizes that not all systems are capable of providing an electronic option (though this would not preclude some codes from requiring such an option), but when such an option is available, the customer may choose that option over other options provided.

The current Item Under Consideration presents the recommended changes to G-S.5.6. Recorded Representations as follows:

Item Under Consideration in the 2021 S&T Committee NCWM Interim Report:

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. However,** 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**)

With regard to the specific changes proposed to G-S.5.6., NIST OWM offers the following technical comments:

– **Sentence 2:** "All recorded values shall be ~~**printed provided**~~ **presented** digitally."

OWM believes the proposed change to the second sentence in G-S.5.6. are appropriate. The original intent of the second sentence was to address the need for a numerical format. As noted above, the reference in that sentence to the term "digitally" refers to the use of that term as described in the definition for "digital type," which describes "digitally" as being presented in numbers. The definition from NIST HB 44 Appendix D:

- **digital type. –** A system of indication or recording of the selector type or one that advances intermittently in which all values are presented digitally, or in numbers. In a digital indicating or recording element, or in digital representation, there are no graduations. [1.10]

The word "printed" reflects the technology that was available at the time the requirements were written; the use of the word "printed" was not intended to limit recorded representations to only

hard copy form. Thus, the use of the word "presented" in place of "printed" does not change the original intent of that statement and helps to recognize that other forms of recorded representations are now available.

As an editorial comment, OWM notes that the word "provided" is not part of the current language in G-S.5.6. Although the intent of showing the term as struck was to distinguish it from earlier versions of the proposal, this term should be struck from the proposal when presenting it for consideration.

– **Sentence 3:** "In applications where recorded representations are required the customer may be given the option of not receiving the recorded representation."

OWM believes the proposed change to the third sentence by adding the term "by a specific code" is appropriate and simply emphasizes that individual codes may specify the need for a recorded representation.

– **Sentence 4: "<u>Unless otherwise specified, recorded representations referenced in specific codes shall be made available to the customer as a minimum in hard copy form.</u>"**

OWM believes the addition of this new fourth sentence clarifies that the *customer* must have the option of receiving the recorded representation in hard copy form but recognizes there may be some codes (such as the tentative code 3.40 for Electric Vehicle Fueling Systems) in which offering only an electronic form is acceptable.

– **Sentence 5: "However,** 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."

OWM believes the addition of the word "However" is unnecessary and may cause confusion. The current form of the sentence is appropriate. Thus, OWM recommends striking the proposed addition of the word "However" at the start of that sentence.

Based on the assessment above OWM recommended the final proposal be modified to recommend the following:

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**~~ presented digitally. In applications where recorded representations are required **<u>by a specific code,</u>** the customer may be given the option of not receiving the recorded representation. **<u>Unless otherwise specified, recorded representations referenced in specific codes shall be made available to the customer as a minimum in hard copy form</u>**. 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 **<u>and 20XX</u>**)

These changes are represented in the 2022 NCWM Interim Meeting Report, Item Under Consideration with the exception of striking "However" as recommended above.

At the 2021 CWMA Annual Meeting, a suggestion was made to simplify G-S.5.6 by removing changes that were added to G-S.5.6 in 2014 to address systems with the capability of issuing an electronic receipt and, instead, specify the electronic receipt option as an acceptable form of receipt in each specific code. Although NIST OWM agrees that the General Code requirement may benefit from a restructuring of the paragraph to improve its use, NIST OWM believes there is value in providing information on options for recorded representation in the general code requirements. The specific intent of the decision made in 2014 to include this language in the General Code was to avoid the need to add specific language to each code. By doing so, this avoids a situation in which a given code is inadvertently overlooked and the potential option for an electronic form of recorded representation may be in question. Thus, OWM does not believe the reference to electronic receipts should be removed from the General Code.

Nevertheless, if there is a desire to streamline the paragraph, the Submitter and the Committee may wish to consider using an alternate format such as sub-paragraphs or bulleted points to help clarify the various sections of the paragraph. For example, G-S.5.6. might be restructured as follows:

G-S.5.6. Recorded Representations. – <u>The following shall apply to recorded representations.</u>

<u>(a)</u> Insofar as they are appropriate, the requirements for indicating and recording elements shall also apply to recorded representations.

<u>(b)</u> All recorded values shall be ~~printed~~ presented digitally.

<u>(c)</u> In applications where recorded representations are required by a specific code, the customer may be given the option of not receiving the recorded representation.

<u>(d)</u> 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 **<u>20XX</u>**)

In addition to its comments regarding the proposed changes to paragraph G-S.5.6. Recorded Representations, NIST OWM also recommends the following editorial changes to this block of items:

B4: LMD-21.2 - UR.3.4. ~~**Printed Ticket.**~~ Strike out "Printed Ticket"
B4: VTM-21.1 - S.1.4.2. ~~**Printed Ticket**~~ Strike out "Printed Ticket"

These changes are represented in the 2022 Interim Meeting Report, Item Under Consideration.

Summary of Discussions and Actions:

At the 2021 NCWM Interim Meeting Charles Stutesman (Kansas), 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. Dmitri Karimov (Meter Manufacturers Association) 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. 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 NCWM Interim Meeting agenda. The submitters should work together to provide one proposed change.

During the Committee work session, the Committee assigned a Developing status to Item Block 4.

At the 2021 NCWM Annual Meeting Charles Stutesman (Kansas) stated that he looks forward to maintaining Developing status between now and the 2022 NCWM Interim. Charlie Stutesman explained that when the electronic receipt provision was added to NIST HB 44 General Code requirements, a change to the specific Codes were needed because the specific Codes supersede the General Code. All the code sections included in this block have printer requirements. As such, it was not the goal to remove printers but to add the option for electronic receipts if customer wants it. Charlie Stutesman would appreciate comments and suggestions for changes to the proposal.

During the Committee work session, the Committee assigned a Developing status to Item Block 4.

At the 2022 NCWM Interim Meeting Charlie Stutesman noted that some editing and additional work is needed before forwarding as a Voting item. Charlie Stutesman recommended that the item remain Developing. California Division of Measurement Standards (DMS) recommended a Developing status for this item. Dimitri Karimov commented that proposed changes to recognize electronically captured tickets are needed and that editorial corrections are needed to some parts of the proposal. Dimitri Karimov agreed with a Developing status for this item. A Scale Manufacturers Association (SMA) representative also commented on support for this item because it recognizes the importance of providing flexible options for recorded representations to customers. SMA sees value in the item and agreed with a Developing status for this item. NIST OWM agreed with the need to address current language in the proposal and supports development.

During the Committee work session, the Committee assigned a Developing status to Item Block 4. The Committee supports the work and recommends the continued work of all stakeholders. For more information or to provide comment, please contact:

Charles Stutesman
Kansas Department of Agriculture
(785) 564-6683, **charles.stutesman@ks.gov**

At the 2022 NCWM Annual Meeting open hearings, Charlie Stutesman commented that he worked with NIST OWM to add changes to the item and he also requested additional feedback from interested parties. Charlie Stutesman requested a Developing status for this item.

During the Committee work session, the Committee agreed to a Developing status for this item to allow for additional comments from interested parties.

At the 2023 Interim Meeting open hearings SMA supported B4 GEN-21.2 and B4 OTH-21.2 as Voting and the MMA and other meter manufacturers supported a voting status for the entire block. NIST OWM supported a Developing status and also noted that they would also support Voting with a recommendation that “however” be removed for the proposed language in paragraph G-S.5.6. During the Committee’s work session, the Committee agreed to revise GEN-21.2 to remove the word “however” in G-S.5.6 and assigned a Voting status for this item.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting no comments were heard on this item. During open hearings, no comments were heard on this item.

The WWMA S&T Committee recommended 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.

Southern Weights and Measures Association

No comments were received on this item during the 2022 SWMA Annual Meeting. The SWMA S&T Committee recommended this item remain as a Developing Item.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, 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. John McGuire (New Jersey) is in favor of voting but noted that the item conflicts with New Jersey law. Jim Willis (New York), Walt Remmert (Pennsylvania), and Ms. Cheryl Ayer (New Hampshire) recommend a Voting status.

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

At the 2023 NEWMA Annual Meeting, Doug Bowland (SMA) supported the item with the rational that it provides flexible options of representation to the customer. After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with no changes, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, no comments were made from the floor. The CWMA S&T Committee recommended this remain as a Developing Item.

At the 2023 CWMA Annual Meeting, Thomas Schuller (SMA) supported this item as it provides flexibility for recording. Loren Minnich (NIST OWM) noted that the item is fully developed and ready for a Vote. The CWMA S&T Committee believes this block is fully developed and recommends a Voting status.

Item Block 6 (B6) Commercial and Law Enforcement, Axle and Axle Group Weights

(**Note:** The Committee removed these items from Block 6. SCL-22.1 8 and SCL-22.3 and they now appear as standalone Items under SCL – Scales.)

Item Block 7 (B7) Tolerances on Tests Using Transfer Standards

B7: CLM-22.1 V T.3. On Tests Using Type 2 Transfer Standards
B7: CDL-22.1 V T.3. On Tests Using Type 2 Transfer Standards
B7: HGM-22.1 V T.4. Tolerance Application on Tests Using Type 2 Transfer Standard Test Method

(**Note:** The Item Under Consideration was revised by the submitter based on comments from the 2022 NCWM Interim Meeting.)

Source: Seraphin Test Measure Company, A Division of Pemberton Fabricators, Inc.

Submitter's Purpose and Justification:

The purpose of these proposals is to change the language in the tolerance paragraphs to provide consistency with the changes in the combined amended proposals of 2022 S&T Agenda Item Block 8 (GEN-19.1. and OTH-22.1). In the codes mentioned below, the current language of Handbook 44 states that 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 language simply states that the formula given in the General Code (the proposed G-T.5.) be used, rather than repeat the formula in each of the specific codes listed below.

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:

Robert Murnane
Seraphin Test Measure Co.
(609) 267-922, **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.

NIST OWM Executive Summary for Item Block 7 (B7) – Tolerances on Tests Using Transfer Standards

NIST OWM Recommendation: When the S&T Committee presents Block 8 for a vote, OWM agrees that Block 7 should also go forward for a Vote.

- Block 7 Items are proposed changes to NIST HB 44 Codes that have transfer standard tolerance requirements.
- Because of the larger uncertainties associated with the use of transfer standards, the current Code requirement increases the tolerance to account for these uncertainties.
- The proposal would add a reference to the equation added to the General Code by B8: Item GEN-19.1, Paragraph G-T.5. to calculate the tolerances for devices tested with Type 2 Transfer standards replacing the requirements currently in those sections
- The equation places an upper limit on how large the uncertainty associated with the transfer standard can be.

Table 2. Summary of Recommendations
Block 7 Items (B7) – Tolerances on Tests Using Transfer Standards

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		Vote contingent on adoption of Block 8
WWMA	Developing		Based on 2022 WWMA Annual Meeting
NEWMA	Voting		
SWMA	Developing		Based on 2022 SWMA Annual Meeting
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry	1		Updated language from submitter
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**

1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration

B7: CLM-22.1 D T.3. On Tests Using Type 2 Transfer Standards.

Amend Handbook 44, Cryogenic Liquid-Measuring Devices Code as follows:

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 D T.3. On Tests Using Type 2 Transfer Standards.

Amend Handbook 44, Carbon Dioxide Liquid-Measuring Devices Code as follows:

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 D T.4. Tolerance Application on Tests Using Type 2 Transfer Standard Test Method.

Amend Handbook 44, Hydrogen Gas-Measuring Devices Code as follows:

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)

NIST OWM Detailed Technical Analysis:

Seraphin proposed Block 7 Items to address the changes that are proposed in Block 8 concerning transfer standards. Block 7 Items in the NCWM Interim Meeting Report (Pub. 15 [2022]) were revised based on comments heard during the 2022 NCWM Interim Meeting.

Transfer standards are address in the Cryogenic Liquid-Measuring Devices Code, the Carbon Dioxide Liquid-Measuring Devices Code and the Hydrogen Gas-Measuring Devices Code. These codes already specify that a larger tolerance be used when transfer standards are used to account for the higher

uncertainty associated with these types of standards and the fact that they will not likely meet the Fundamental Considerations paragraph 3.2. Tolerances for Standards.

The proposed changes in Block 8 define the different types of standards (Field Standard, Type 1 transfer standard and Type 2 transfer standard). Block 8 also proposes to add a General Code requirement with an equation that should be used to determine the tolerance applied to devices tested with Type 2 transfer standards because Type 2 transfer standards will not likely meet the error and uncertainty prescribed in the fundamental considerations. The equation places an upper limit on the amount of uncertainty applied to the Increased MPE formula for determining tolerances for Type 2 transfer standards.

Block 7 makes changes to the aforementioned codes to reference the General Code requirement with the equation that will be used to calculate the tolerance when using type 2 transfer standards in these codes.

When the S&T Committee presents the combined item GEN-19.1 and OTH-22.1, Block 8 Item for a vote, then this item, Block 7 may also go forward for a vote.

Summary of Discussions and Actions:

At the 2022 NCWM Interim Meeting, the Committee recommended that this item be given a Developing status for further development by the submitter based on comments heard during the 2022 NCWM Interim Meeting. Since the 2022 NCWM Interim Meeting, the submitter made additional changes to the Items Under Consideration which are currently reflected in Block 7 above. These changes add "Type 2" to clarify the type of transfer standard and references the revised equation in the proposed Block 8 item of this report.

At the 2022 NCWM Annual Meeting, the submitter provided no comments and as a Developing Item no additional comments were heard on this this item.

During the Committee work session. the Committee agreed to maintain a Developing status for this item.

At the 2023 NCWM Interim Meeting, the Committee heard updates to the item from Robert Murnane. He explained the addition of the term Type 2 and the reference to the General Code item in Block 8 which prescribes increased tolerances for Type 2 transfer standards. Based on these changes he believes this item and Block 8 are fully developed and ready for a vote.

Tim Chesser (Arkansas) was in favor of making it a Voting item. Kevin Schnepp (California , Division of Measurement Standards [CA DMS]) was in favor of the item. Dmitri Karimov (Liquid Controls)commented that Block 7 and Block 8 should move forward together and have several benefits. Michael Keilty (Endress+Hauser) agreed that 1 Block 7 and 8 were ready for a vote. Brent Price (Gilbarco) was in favor of the item suggested maybe adding "state" in front of "director".

Tina Butcher (NIST OWM) stated that the item revises tolerances and guidance in identifying transfer standards. She provided a brief overview of the NIST analysis written by Diane Lee (NIST OWM), which can be found on both the NIST OWM and NCWM websites. This item is related to Block 8 items GEN 19.1 and OTH 22.1.

Matt Douglas (CA DMS) recommends this Block and the associated items be given Developing status. Dimitri Karimov (representing the Meter Manufacturers Association [MMA]) stated that there was no consensus within the MMA.

The Committee assigned the item a Voting status based on the updates provided during the meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received: Robert Murnane 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.

Michael Keilty 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. Robert Murnane 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 recommended that this item should remain Developing to allow membership to review the updated proposal. The Committee further recommended that this item be blocked with Block 8 as the items in Block 7 are contingent on Block 8 items.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Michael Keilty 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 recommended this item remain as a Developing Item.

Northeastern Weights and Measures Association

During the 2022 NEWMA Interim Meeting, Robert Murnane 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 Chair and shared with the body. Robert Murnane asks that the same status be given to Block 7 and Block 8 as they are directly linked.

Michael Keilty 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. Michael Keilty recommended a developing status. (Michael 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 recommended that this item be assigned a Voting status.

At the 2023 NEWMA Annual Meeting, Robert Murnane asked that if Block 8 does not pass, then Block 7 be removed from voting because the tolerances in Block 7 are tied to Block 8. Loren Minnich (NIST OWM) agreed with Robert Murnane and supports the item and his suggestion regarding Block 7 and Block 8.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status with a suggestion to the NCWM S&T Committee to remove Block 7 from Voting if Block 8 does not pass, and the body concurred

Central Weights and Measures Association

During the 2022 CWMA Interim Meeting, Robert Murnane stated that 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.

At the 2023 CWMA Annual Meeting, Robert Murnane commented Block 7 cannot move forward without passing Block 8. He recommended making a Voting item as one block (combining Block 7 and 8)

Loren Minnich commented that the OWM supports as voting in combination with Block 8.

Michael Keilty commented that Block 8 talks about transfer standards. Block 7 talks about more specialized testing, and equipment used would be field standard meters. The uncertainty of the standard doesn't meet the 1/3 requirement, so this language is necessary for these code sections. Transfer standard meters in these CLM, CDL, HGM was the basis for his LPG and MFM items. Fully supports and ready for vote.

The Committee believes Block 7 and Block 8 should be combined into a single block

The CWMA S&T Committee believes this block is fully developed and recommends Voting status.

Item Block 8 (B8) Tolerances on Tests Using Transfer Standards, Appendix A – Tolerances for Standards, and Appendix D – Field Standards 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.

B8: OTH-22.1 V Appendix A: Fundamental Considerations, 3. Testing Apparatus

(**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. The OWM and Seraphin proposals were submitted to the S&T Committee just before the 2022 NCWM Interim Meeting.

Note: The joint OWM and Seraphin proposals submitted to the S&T Committee, just before the 2022 NCWM Interim Meeting, were updated with two changes at the request of the submitters following the 2022 Interim Meeting. The first change is in the definition of "Standard, Field." The words "(typically one year)" were replaced with "(as determined by the Director)". The second change was to add the words "to the International System of Units (SI)" in Section 3.1.3. of the Fundamental Considerations. These two changes are reflected in the items below.

Note: The current Item Under Consideration represents additional changes made by the submitters in November 2022 based on comments received from the regional meetings in 2022.)

Source: The NIST Office of Weights and Measures and Seraphin Test Measure Company.

Submitter's Purpose and Justification:

(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.

Footnote 2 in the Fundamental Consideration of NIST Handbook 44 already provides a statement regarding the authority of the Director to approve field test standards or 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.

A tolerance statement is added to the general code that addresses uncertainties of Type 2 Transfer standards (T2TS) since they do not meet the NIST Handbook 44 Fundamental Consideration that state "When the standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable device tolerance". Several equations were considered to include an OIML equation. After discussion an alternative equation was agreed upon. An assessment of the two equations, the 2/3 Formula: Increased MPE = (2/3 × MPE + U) with an upper limit of U_{MAX} = 2/3 MPE and the OIML Formula: Reduced MPE = (4/3 × MPE – *U*) are provided below:

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.

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 NIST HB 44 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 NIST Handbook 44 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 NIST Handbook 44 tolerance.

Type 2 Transfer Standards: Uncertainty is Added to the Tolerance

When the uncertainty associated with a T2TS exceeds 1/3 of the tolerance applied to the device under test, the uncertainty of the T2TS is recognized in the field test result by increasing the tolerance that is applied to the device under test. The OIML formula and the 2/3 formula take different approaches to increasing the tolerance for the device under test.

	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

NIST OWM Executive Summary for Item Block 8 (B8) – Tolerances on Tests Using Transfer Standards, Appendix A – Tolerances for Standards, and Appendix D – Field Standards and Transfer Standards

NIST OWM Recommendation: The submitters agree that these items, GEN-19.1 and OTH-22.1 are fully developed and recommend their adoption during the 2023 NCWM Annual Meeting.

- State and industry have a need to use various types of test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when test data supports their use.

- Block 8 clarifies the use and definition of three types of standards to be included in NIST HB 44:(1) Fields standards, (2) Type 1 transfer standards and (3) Type 2 transfer standards; it provides an equation that will be used to calculate the tolerances when Type 2 transfer standards are used, provides clarification that the State Director has the authority to approve the use of a standard and that specific requirements in NIST HB 44 device codes are not necessary to approve a standard for use.

- In addition to the changes in Block 8, GEN-23.1 adds a General Code requirement so that rather than revising a specific code in Handbook 44 every time a new field or transfer standard is proposed or developed, an overall statement in the General Code recognizes the use of other field and transfer standards that meet the requirements of Appendix A.

- NIST OWM also observed that the appropriate references to NIST HB 44 codes should be added to the definitions in Block 8, e.g., [1.10].

- It was noted that the term "Standard, Field" has a different definition in NIST HB 130. It appears that the definition in NIST HB 130 describes the standard from a laboratory perspective and hierarchy of testing. As such, some future effort may be needed to harmonize the terms across all NIST handbooks.

- On page S&T 441 line 21 of the NCWM S&T Agenda the word "an" should be replaced with "a" and on line 42 the word "meter" shouldn't be underlined as it is being removed if this item is adopted.

Table 2. Summary of Recommendations
Item Block 8 (B8) – Tolerances on Tests Using Transfer Standards, Appendix A – Tolerances for Standards, and Appendix D – Field Standards and Transfer Standards

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		
NEWMA	Voting		
SWMA	Developing		
CWMA	Voting		
NCWM	Voting		

	Number of Support Letters	Number of Opposition Letters	Comments
Industry			Updated Proposal from Seraphine Test Measure Co. (01-06-2022)
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**
1 Submitted modified language
2 Item not discussed
3 No meeting held
4 Not submitted on agenda
5 No recommendation or not considered

Item Under Consideration:

B8: GEN-19.1 D 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.

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:

Increased MPE = (2/3 × MPE + U)

with an upper limit of U_{MAX} = 2/3 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 an extended period of time (as determined by the Director), (c) is valid (corrections that may be used) over the range of environmental and operational parameters in which the commercial measuring devices are 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 proven to be stable (accurate and repeatable) for a short time under the limited environmental and operational conditions during which the transfer standard is used. A Type 1 transfer standard is a transfer standard that meets

the one-third accuracy requirement for a short time over a limited range of environmental conditions and/or a limited range of operating conditions 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 D Appendix A: Fundamental Considerations, 3. Testing Apparatus

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.

~~**[2] 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.[2] – 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 will 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 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.

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 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 20XX)

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.

NIST OWM Detailed Technical Analysis:

State and industry have a need to use various types of test standards to evaluate commercial devices installed in the marketplace. NIST OWM recognizes the need to use various standards to test commercial devices and support the use of these standards when supported by test data. Several proposals for changes to NIST HB 44 have been considered to address the use of these standards. Some were to address terminology for various types of standards in NIST HB 44. Other proposals were to provide specific requirements for some codes in NIST HB 44 for the purpose of recognizing these standards in the handbook, but the responsibility for recognition of standards is already address in the fundamental consideration section in NIST HB 44. These proposals also included varying terms used to describe these standards and were subsequently all combined as a Block item and assigned to a task group. With limited success as a block item, it was decided to separate some items into their original block, some as individual items for consideration, and some items were withdrawn..

Block 8 Items are a combined modification of the 2021 S&T Agenda Block 1 Item GEN-19.1 and OTH-22.1. With the S&T Committee changes to the status of items GEN-19.1 and OTH-22.1 from "assigned" to "developing," the submitters, Seraphin and NIST OWM, saw the need to add clarification to NIST HB 44 for the different terms describing standards used to test commercial devices and the need to provide clarification to support States when evaluating what can be accepted as standards, and worked together to develop these items. They were revised to address discussions within the NCWM Field Standards Task

Group and other comments received at the regional weights and measures associations meetings and the 2022 NCWM Interim Meeting. There is also a companion item Block 7 that helps to clarify the use of the term transfer standard in NIST HB 44.

Block 8 will add definitions for three types of standards to be included in NIST HB 44 Appendix D:

1. Field standard
2. Type 1 transfer standard
3. Type 2 transfer standard

It adds an equation to the General Code to calculate the tolerance when a Type 2 transfer standard is used and provides additional considerations when evaluating transfer standards and reinforces that the Director has the authority to approve the use of standards and that specific requirements in NIST HB 44 code are not necessary to approve a standard for use.

Although 3 types of standards will be specified in NIST HB 44, Block 8 will add language reinforcing that whenever possible and practical, field standards should be used to test commercial devices. Separating the standards into Field, Type 1, and Type 2 will determine if the tolerances should be increased to account for the error and uncertainty in the standard. Both Field standards and Type 1 transfer standards must comply with the current Fundamental Considerations in NIST HB 44 that state "When a Standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable device tolerance". Type 2 transfer standards do 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. With the inability to meet the one-third requirement (error + uncertainty) that Field standards and Type 1 transfer standards are required to meet, an equation was added to the General code to increase the tolerances for devices tested with Type 2 transfer standards. The basic tolerance (acceptance, maintenance, and minimum tolerances) is multiplied by 2/3 to which is added the uncertainty of the standard. This increases the total tolerance when using a Type 2 transfer standard to account for the error and uncertainty of the standard.

While a larger tolerance is used to account for the uncertainty in Type 2 standards, there must be a limit. As stated in the Fundamental Considerations "Tolerance values are so fixed that the permissible errors are sufficiently small that there is no serious injury to either the buyer or the seller of commodities". As such a stipulation was added that the maximum limit for the uncertainty of type 2 standards must be 2/3 of the MPE. The proposed equation provides a uniform method for considering the uncertainties associated with Type 2 Standards. An example of calculating the equation is provided below.

Increased MPE = $(2/3 \times \text{MPE} + U)$

with an upper limit of $U_{MAX} = 2/3$ MPE

Example Calculation

Assuming the following:

MPE (basic tolerance)=0.01

Uncertainty=0.005

Increased MPE = (2/3 × 0.01 + 0.005)

Increased MPE = (.006667 + 0.005)

Increased MPE = 0.011667

In this example the uncertainty does not exceed the U_{MAX} 2/3 MPE 0.005 < 0.006667

Henry Oppermann (Seraphin) provided an analysis of the equation which is provided in the Purpose and Justification section of this OWM Technical Analysis.

This Block also helps to clarify that the Director has the authority to approve Standards for use within a jurisdiction. This information is already included in a footnote in the Fundamental Considerations but has been moved to Section 3 in the Fundamental Considerations. Language was also added to clarify that specific language is not needed in various NIST HB Codes in order that these standards be accepted.

In addition to the changes in Block 8, GEN-23.1 is included on the 2023 NCWM Annual Meeting S&T agenda. This proposal adds a General Code requirement so that rather than revising a specific code in Handbook 44 every time a new field or transfer standard is proposed or developed, an overall statement in the General Code recognizes the use of other field and transfer standards that meet the requirements for use as field or transfer standards is proposed 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 s as outlined in Appendix A - Fundamental Considerations, Section 3. Testing Apparatus.**

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.

The submitters agree that these items, GEN-19.1 and OTH-22.1 are fully developed and support the Voting status assigned by the S&T Committee for consideration at the NCWM 2023 Annual Meeting..

Summary of Discussions and Actions:

At the 2022 NCWM Interim Meeting there was discussion concerning specifying a 1-year length of time for the stability of a field standard. The concern was whether or not this was an appropriate length of time and how a specific length of time for a standards stability could change due to many factors. Some expressed concerns with more time needed to review the latest edition of the proposal. NIST and Seraphin agreed to further develop the item and NIST OWM requested that both GEN-19.1 and the OTH-22.1 be combined. During their work session, the Committee agreed to combine both GEN-19.1 and OTH-22.1 and agreed to a Developing status for this item. For more information or to provide comment, please contact:

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or

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NIST Office of Weights and Measures
diane.lee@nist.gov

At the 2022 Annual Meeting Open Hearings, the Committee heard comments for Tina Butcher (submitter). Tina Butcher provided the NIST OWM technical analysis for this item as provided in the executive summary of the report. Tina Butcher noted that this item is ready to move forward as voting for the 2023 NCWM cycle.

During the Committee work session, the Committee maintained the Developing status of this item.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting, Robert Murnane asked if they had the updated proposal online? The September 1st version was so that we didn't have to hunt and peck to find words to change. He remarked that Section 3.2: Tolerance for Standards: in the first paragraph, where it says accuracy of standards it should say "field standards". On S&T agenda page 309, line 42, it should say "field standard or transfer standard". It is up to the discretion of the State Director.

Matt Douglas (S&T Committee) commented that the equation looks like when the error of the transfer standard is less than 1/3 the applicable tolerance, you would end up with a lower tolerance for the device even though it looks like the intention would be to give an extended tolerance. Robert Murnane stated that the equation gives the benefit to the meter, I'll ask you to look at that paper.

Michael Keilty (Endress+Hauser) remarked that adding "Weighing and Measuring" is a good idea. If you were testing a type 1 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. I recommend Developing.

Kurt Floren (County of Los Angeles) stated he did not want to be a hurdle to this. I'm still struggling. I'm picturing myself in a courtroom because we've taken formal enforcement action. We aren't equipped to test all "field conditions" in a Metrology lab. Is there any way for us to clarify certain things? What is an extended time and what is a short time with regard to how long a device remains accurate? I cannot define that, and I have continued questions.

Brent Price (Gilbarco) commented that S&T Page 310, line 8: I'm questioning if we need that last sentence. Michael Keilty wondered what does long-term vs. short-term mean? I recommend that the item continue to be developing and answer Kurt Floren's questions.

Robert Murnane stated this is our current attempt at this and there needs to be definitions, there is no real definition. What are you guys doing now to defend yourselves with no definition (referencing transfer standard vs field standard). I look for input but haven't had much. I think this could be a Voting Item.

Kurt Floren stated that field standard encompasses everything imaginable. It suggests that we have to evidence that every block weight that we have has been tested and proven to be stable under every possible scenario. We need to be very specific about what is a transfer standard.

The proposed changes to these items that Robert Murnane provided during open hearings were posted on the WWMA website. The WWMA S&T Committee recommended that this item should remain Developing, and that the submitter provides the updated language to NCWM to allow membership to review the updated proposal. The Committee further recommended that this item be blocked with Block 7 as the items in Block 7 are contingent on Block 8 items.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Robert Murnane stated that you can't always define every environmental issue, and we must be able to use judgment.

Michael Keilty 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 recommended this item move forward as a Developing Item.

Northeastern Weights and Measures Association

During the 2022 NEWMA Interim Meeting, Robert Murnane 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 Chair and shared with the body. Robert Murnane asks that the same status be given to Block 7 and Block 8 as they are directly linked. Robert Murnane indicated that this proposal draws from the Fundamental Considerations and clarifies that State Directors have the authority to use any standards. Michael Keilty questioned Section 3.2 that was shaded, regarding corrections by a metrology lab and clarification was given by Robert 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 recommended that this item be assigned a Voting status.

At the 2023 NEWMA Annual Meeting Robert Murnane recommended voting on Block 7 and 8 together as they are tied together. This proposal by was submitted by NIST and Seraphin, and numerous changes were made to the item with input from stakeholders. He believes this is a sound proposal, is fully developed, and supports as voting.

Michael Keilty commented that the item has been worked and vetted. Block 8 items are modifying general code to add a formula. The formula is needed to define Type 2 standards. Type 1 meets 1/3, if not, then Type 2 and this is the limit of a Type 2 standard. The item goes a long way in explaining what needs to be done when using transfer standard and improves Appendix A Section 3. Supports as voting.

Loren Minnich (NIST OWM) supports the groups of items as voting.

After hearing comments from the floor, the Committee recommended to the body that this item maintain a Voting status and recommends to the NCWM S&T Committee that this item and Block 7 be voted on together, and the body concurred.

Central Weights and Measures Association

During the 2022 CWMA Interim Meeting, Robert Murnane stated that the nomenclature has been cleaned up since previous version. The intent has not changed, simply clarifications. Former contended point was referring to only measuring devices instead of weighing and measuring devices. He 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 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.

At the 2023 CWMA Annual Meeting the following comments were heard.

Robert Murnane provided a white paper with examples of types of transfer standards in response to former requests during open hearings which is posted to NCWM and CWMA websites. Purpose is to explain critical difference between field standard and transfer standards. No clear definition or tolerance is associated with transfer standards 1 and 2. With tolerances listed, there is no need to list individual new technologies. The Director has the ability to approve based on the situation. Supports moving as voting.

Loren Minnich stated that NIST OWM believes this item is fully developed and ready to vote

Michael Keilty stated there was overwhelming support for all these items due to working together with all parties. This Block 8 adds more content to Appendix A. Introduces these to inspectors and directors by adding this. Move forward as voting.

John Hathaway (Murray Equipment) supports as voting. This is usually used with volatile fluids that are difficult to return to storage after testing. Move forward in the interest of fair test conditions.

The Committee believes Block 7 and Block 8 should be combined into a single block. The CWMA S&T Committee believes this block is fully developed and recommends Voting status.

Item(s) Considered but Not Accepted by Fall Regional Associations

LMD-23.3 or LMD-23.1 Automatic Temperature Compensation Task Group

(**Note:** This item was numbered as LMD-23.3 on the 2022 Fall WWMA, SWMA, and NEWMA Agendas and LMD-23.1 on the CWMA agenda. This item was withdrawn by all 2022 Fall Regional Weights and Measures Associations prior to the 2023 NCWM Interim Meeting.)

Source: Michael Cleary, retired State of California

Submitter's Purpose and Justification:

Revisit implementing Temperature Compensation of motor fuel at retail. Given the skyrocketing price of gasoline and diesel fuel the Conference should study the impact on the American consumer.

Item Under Consideration:

Form a Task Group to research the issue of Automatic Temperature Compensation for retail fuels.

NIST OWM Detailed Technical Analysis:

This item was not included on the 2023 NCWM Interim Meeting Agenda; thus, no NIST OWM analysis is provided.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting the following comments were received: Prentiss Searles (American Petroleum Institute), stated that this is not a complete request; this task was addressed several years ago. There is no change in data or outcome, and we do not need to revisit.

Scott Simmons (Colorado Division of Oil and Public Safety) agrees with Prentiss Searles' comments.

Kevin Schnepp (California Division of Measurement Standards) stated that California did a study and concluded that the cost far outweighed the benefit. Kevin Schnepp recommended the withdrawal of this item.

During open hearings, comments from the floor supported the withdrawal of this item. The WWMA S&T Committee feels that this item is not a complete proposal, that the proposal does not have merit as the topic has previously been reviewed and recommends that this item be withdrawn.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting,. Matt Curran (Florida) stated that NCWM has seen proposals similar to this one in the past. He referenced a study from the California Energy Commission that determined the net cost difference observed before and after adding temperature compensation was very small. He also suggested that, if the item ends up being withdrawn, the submitter may consider sending it to FALS.

Prentiss Searles (API) stated that he did not support this item, and recommend it be withdrawn. Tim Chesser (Arkansas) agreed with Prentiss Searles. Ken Ramsburg (Maryland) opposed this item and recommended withdrawal. Tory Brewer (West Virginia) opposed this item. John Stokes (South Carolina) recommended this item be withdrawn. Robert Murnane (Seraphin) stated that he totally disagrees with this item and recommends its withdrawal.

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

Northeastern Weights and Measures Association

At the 2022 Interim Meeting Prentiss Searles , John McGuire (New Jersey), Jason Flint (New Jersey) requested that the item be withdrawn as no information or direction was given in the proposal. Diane Lee (NIST OWM) indicated that temperature compensation for retail motor fuel devices had been discussed in 2005 and was not approved by NCWM. Lou Sakin (Holliston, Massachusetts) and John Gaccione

(Westchester County, New York) referenced a California study which determined cost of retrofitting devices would far outweigh any savings.

After hearing comments from the body, the Committee agreed with the comments that this item does not have merit and is recommending that this item be Withdrawn.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Loren Minnich (Kansas) stated that he does not support. He also noted that the item be Withdrawn and that it has already been thoroughly studied.

Michael Keilty (Endress+Hauser) noted that LMD-23.1 (LM-23.1 is also assigned to a separate item Block 1.

Craig VanBuren (Michigan) requested that the item be withdrawn. Greg VanderPlaats (Minnesota) requested withdraw. Prentiss Searles requested that the item be Withdrawn.

The CWMA S&T Committee recommended this item be withdrawn. The Committee requested that these items be renumbered.

References:

[1] NIST OWM Analysis and Executive Summary reports **https://www.nist.gov/pml/weights-and-measures/publications/owm-technical-analysis**
[2] National Conference on Weights and Measures Publication 15 (2023) and 16 (2022) **https://www.ncwm.com**
[3] 1905-2022 NCWM Annual Conference reports **https://www.nist.gov/pml/owm/publications/ncwm-annual-reports**

Appendix A. Supplemental Documents:

There are no supplemental documents within this Analysis

Appendix B. List of Symbols, Abbreviations and Acronyms

ABWS
Automatic Bulk Weighing System

AAR
Association of American Railroads

API
American Petroleum Institute

CNG
Compressed Natural Gas

CWMA
Central Weights and Measures Association

EPO
Examination Procedure Outline

EV
Electric Vehicle

EVFE
Electric Vehicle Fueling Equipment

EVSE
Electric Vehicle Supply Equipment

FHWA
Federal Highway Administration

GMM
Grain Moisture Meter

GPS
Global Positional System

HB
Handbook

LMD
Liquid Measuring Devices

LNG
Liquified Natural Gas

LPG
Liquified Petroleum Gas

MMA
Meter Manufacturer Association

MDMD
Multiple Dimension Measuring Device

NCWM
National Conference on Weights and Measures

NEWMA
Northeastern Weights and Measures Association

NIST
National Institute of Standards and Technology

NTEP
National Type Evaluation Program

OWM
Office of Weights and Measures

OIML
International Organization of Legal Metrology

RMFD
Retail Motor Fuel Dispenser

S&T
Specification and Tolerances

SD
Secure Digital

SI
International System of Units

SMA
Scale Manufacturers Association

SWMA
Southern Weights and Measures Association

TC
Technical Committee

USNWG
U.S. National Work Group

VTM
Vehicle Tank Meter

WIM
Weigh-in-MotionOffice of Weights and Measures

WWMA
Western Weights and Measures Association