

**NIST Office of Weights and Measures (OWM) Analysis
Specifications and Tolerances (S&T)
2024 NCWM Interim Meeting Agenda**

The NIST OWM Analysis is submitted to assist the Weights and Measures community as it deliberates on items before the Conference. NIST 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 a 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 the date of this report and does not address information received after this date.

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Subject Series List for the Specifications and Tolerances Committee

Handbook 44 – General Code.....	GEN Series
Scales.....	SCL Series
Belt-Conveyor Scale Systems	BCS Series
Automatic Bulk Weighing Systems	ABW Series
Weights.....	WTS Series
Automatic Weighing Systems	AWS Series
Weigh-In-Motion Systems used for Vehicle Enforcement Screening	WIM Series
Liquid-Measuring Devices	LMD Series
Vehicle-Tank Meters	VTM Series
Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices.....	LPG Series
Hydrocarbon Gas Vapor-Measuring Devices.....	HGV Series
Cryogenic Liquid-Measuring Devices	CLM Series
Milk Meters	MLK Series
Water Meters	WTR Series
Mass Flow Meters	MFM Series
Carbon Dioxide Liquid-Measuring Devices.....	CDL Series
Hydrogen Gas-Metering Devices.....	HGM Series
Electric Vehicle Refueling Systems	EVF Series
Vehicle Tanks Used as Measures	VTU Series
Liquid Measures	LQM Series
Farm Milk Tanks.....	FMT Series
Measure-Containers.....	MRC Series
Graduates.....	GDT Series
Dry Measures	DRY Series
Berry Baskets and Boxes.....	BBB Series
Fabric-Measuring Devices.....	FAB Series
Wire-and Cordage-Measuring Devices	WAC Series
Linear Measures	LIN Series
Odometers	ODO Series
Taximeters	TXI Series
Timing Devices	TIM Series
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**Details of All Items
 (In order by Reference Key)**

SCL – Scales

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

Source: Rice Lake Weighing System

Submitter’s Purpose and Justification:

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

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

The submitter requested Voting status for 2024.

NIST OWM Executive Summary for SCL-24.1 – S.1.7. Capacity Indication, Weight Ranges, and Unit Weights
<p>NIST OWM Recommendation: Withdrawn</p> <ul style="list-style-type: none"> • It is unclear what problem the submitter is trying to solve. It appears that the submitter misinterpreted the term “computing scale”. A computing scale is defined as: “One that indicates the money values of amounts of commodity weighed, at predetermined unit prices, throughout all or part of the weighing range of the scale.” • The term “electronic” was included to differentiate between analog computing scales, e.g., drum or fan type scales, from scales that display weight values in an electronic digital format. • OWM believes the proposed change is ambiguous and would cause more confusion than the terms used in the current language.

**Table 2. Summary of Recommendations
 SCL-24.1 – S.1.7. Capacity Indication, Weight Ranges, and Unit Weights**

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

Number of Support Letters	Number of Opposition Letters	Comments
Industry		
Manufacturers		
Retailers and Consumers		
Trade Association	1	Scale Manufacturers 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 NIST Handbook 44, Scales Code as follows:

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

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

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

(Amended 20XX)

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

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

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

NIST OWM Detailed Technical Analysis:

It is unclear what problem the submitter tries to solve. The term “computing scale” is defined. The term “electronic” is a general adjective that is widely understood and does not need further explanation.

The proposed change is ambiguous and will probably cause more confusion than the current language:

- The terms POS and ECR are insufficient. POS stands for point of sale indicating the location of the transaction, not the instrument. ECR stands for electronic cash register which does not include the weighing instrument connected to the ECR.
- The term “retail scale” is undefined but the term “retail device” is. A retail device is used for sale to the end user. The definition does not require the device to have a price calculation function as the definition of “computing scale” describes.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Greg VanderPlaats from Minnesota stated that the terms ‘Retail Scale’, ECR, and POS are not defined in NIST Handbook 44. Steve Peter (Wisconsin) agreed with Greg’s comments. Steve also suggested adding the word ‘Price’ to the term Electronic Computing Scales.

The Committee recommends that this item is a Developing item.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, the SMA has not had the opportunity to assess the item and will meet in November 2023. Steve Harrington (Oregon) expressed confusion regarding terms in the proposed language. Steve recommended Developing as a status of this item. The State and two counties in California echoed the confusion expressed by Oregon. Kurt Floren (Los Angeles County, California) stated there is an existing definition for computing scales and this item may confuse these existing definitions. POS means Point of Sale not Point of Sale System and ECR means Electronic Cash Register which may not be interfaced with a weighing device. Kurt would like more information from Rice Lake and/or SMA regarding this item and agreed with Oregon on a Developmental status for this item. During open hearings testimony was received that the SMA has not evaluated this proposal. Comments were heard supporting a Developmental status, as the item needs further clarification on the terms and definitions in the item. The WWMA S&T Committee recommends that this item be assigned a Developing status. This will allow the submitter the opportunity to address the comments heard during the open hearings. The Committee also looks forward to comments from the SMA and NIST OWM regarding this item.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, the Committee heard no comments on this item during Open Hearings. The Committee does not agree that the term electronic computing scales is confusing, therefore, making this item unnecessary.

The Committee recommends Withdrawal of this item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, the State of New York opposed this item as computing scales are clearly defined in the definitions and not all electronic retail scales are computing scales. The

Commonwealth of Massachusetts recommends withdrawing this item. Upon consensus of the body, the Committee recommended this item be Withdrawn.

SCL-24.2. Multiple Sections Regarding Tare

Source: Ross Andersen (retired New York)

Submitter's Purpose and Justification:

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

This proposal recommends changes to the Scales Code to address:

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

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

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

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

$$\begin{array}{rclcl} \text{Net load} & = & \text{Gross load} & - & \text{Tare load} \\ \text{Commodity} & = & \text{Commodity} + \text{Tare} & - & \text{Tare} \end{array}$$

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

$$\begin{array}{rclcl} \text{Net weight} & = & \text{Gross indication} & - & \text{Gross indication} \\ \text{Net load} & = & \text{Gross Load} & - & \text{Tare load} \\ \text{Commodity} & = & \text{Commodity} + \text{Tare} & - & \text{Tare} \end{array}$$

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

$$\begin{array}{rclcl} \text{Net weight} & = & \text{Net indication} & - & (\text{Tare indication is zero}) \\ \text{Net load} & = & \text{Gross load} & & \\ \text{Commodity} & = & \text{Commodity} + \text{Tare} & & \end{array}$$

The objective of any weighing process is to find the net weight, which might be assigned from one or more instrument indications with different loads on the load receptor and different methods of operating

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the instrument. We work with these terms every day, but we ignore or struggle with the inherent confusion. Good regulations avoid this kind of confusion using clear terminology.

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

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

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

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

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

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

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

If the instrument simultaneously indicates the Net, Gross, and Tare weights (or prints them), do the values have to be in mathematical agreement?

If you say yes, on what code requirement do you base your decision? Under some circumstances mathematical agreement cannot be mandated due to rounding issues.

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

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

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

Regarding the Proposed Definitions:

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

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

- Weights may be assigned by the operator or by the instrument. Examples: 1) A gross indication when the commodity is the only load on the load receptor is designated the net weight by the operator. 2) A weigh-in/weigh-out system employs two gross indications that are used to calculate a net weight. If the operator calculates the net weight, the operator is also responsible to identify the respective net, gross and tare weights. If the instrument calculates the net weight, it must identify the respective net, gross, and tare weights.
- Requirements applicable to indications are also applicable to recorded representations (values printed or transmitted by the instrument) as per G-S.5.6. Note that some code requirements emphasize the recorded representations (redundantly), and some do not. This does not apply to actions of an operator such as manually computing net values from two measured weight values for gross and tare.
- The term “gross load” unavoidably has two meanings, but this is acceptable since the operator (or the official) clearly knows which applies based on how the scale is used.
Example 1: a candy store may have a scoop that is sometimes used in the weighing operation. For the purposes of S.1.7. Capacity Indications, the scoop is part of the gross load placed on the load receptor and the weighing range of the scale is reduced by the scoop weight. However, for the purposes of the transaction, the scoop becomes part of the load receptor after a zero operation and is not part of the gross load (commodity and tare). A possible exception is the scale with a combined zero/tare key. However, these are not permitted in direct sale and the net weighing essentially begins at gross zero that is accurate to at least $\frac{1}{4}$ e.
Example 2: if the commodity alone is placed on the load receptor, it is a gross load (by the first meaning) and a net load. This is the case when candy in the scoop is weighed for the transaction after including the scoop in the gross zero as in example 1. The net load is introduced into the packaging (tare) after the weighing operation.
Example 3: if the tare alone is placed on the load receptor it is thus a gross load (by the first meaning) and a tare load. However, there are nuances to the meaning of tare load (next bullet).

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- The term “tare load” is used only once in the current Scales Code in T.N.2.1. The proposed revision to that section would remove it. In practice, a tare load results in either a non-zero gross indication, or a zero net indication. Both are consistent with the new definitions of gross and net loads. There is also the possibility that a tare weighing mechanism is in use that displays or prints the tare weight. However, the value displayed on the tare weighing mechanism does not necessarily correspond to the current loading, since the tare weighing mechanism will remain at the tare indication when either the tare is removed from or the gross load (commodity and tare) are placed on the load receptor.
- The term “tare indication” is necessary as tolerances are applicable to a dedicated tare display in the revised T.N.2.1.
- To further help explain the terminology, consider four basic weighing procedures. Instrument in all examples is Class III Max 30 lb d = 0.01 lb
(Net, gross and tare descriptors in parentheses are optional as per proposed S.1.15.)

1. Direct Weighing

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

2. Difference Weighing

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

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

3. Weighing using Tare Mechanism

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

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

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

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

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

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

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

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

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

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

Regarding S.1.1.1. Digital Indicating Elements.

Justification: The changes mirror those proposed by the Verification Scale Division e Task Group. The current Code has no requirement on the accuracy of zero setting. The new part (b) ensures that zero setting is accurate within 1/4 e. The amendments to (c) are further explained in the reports of the Task Group and are not relevant to this proposal. The proposed (b) is nonretroactive since it is a major change.

Regarding S.1.2.1. Digital Indicating Scales, Units.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Regarding T.N.2.1. General.

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

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

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

2. Errors in net indications, beginning at net load zero when using a tare mechanism. – This also has traditionally been the practice even in the Scales Code pre-1984. This net zero setting is also accurate to $1/4 e$ per proposed S.1.1.1.(b). The current wording is ambiguous.
3. Errors in Tare indications displayed on a dedicated tare weighing mechanism when a tare mechanism is in operation. – A good example is a dedicated tare weighbeam with a locking poise. Without this statement, you could not apply tolerances to the indication of the tare weighbeam. With an electronic scale, the dedicated tare display is rare, but the approach is the same as the dedicated weighbeam. A digital value in the tare display will be transferred from the gross weight display when the tare mechanism is activated. We expect the value to match the original gross weight exactly, and thus tolerances should apply. This does not apply to a preset tare since a preset tare is not actually weighed, but introduced externally. Also remember that the tare display will remain at the same value, regardless of the load on the load receptor, until another tare mechanism is activated, or the tare is cleared.
4. Errors in net values recorded on a dynamic monorail scale. – The dynamic monorail is a unique case since these instruments only record net weight. In OIML these devices are not part of R76 on which the Scales Code is based, but rather R51. The text further clarifies that tolerances are not applied to net values on other types of scales when a preset tare is in operation.
5. The graphic highlights the difference between tare and preset tare devices. The values are in d. In the example, the gross value of the tare is about 3.4 d. When using a tare mechanism, the center of net zero is set at the gross value of 3.4 d. If the tare is removed the no load is at -3.4 d. With a tare mechanism the net divisions may not align with the gross divisions since the tare may not be a whole number of d.



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

net zero. In the R76 test in net mode, the applied tare load is chosen near the break point between divisions to verify that the net zero is set accurate to ¼ e.

NIST OWM Executive Summary for SCL-24.2. – Multiple Sections Regarding Tare
<p>NIST OWM Recommendation: Developing/Assigned</p> <ul style="list-style-type: none"> • NIST OWM recognizes the issues raised by the submitter and is of the opinion that the proposed amendments help solve these issues. However, as the submitter already indicated, the item is not yet fully developed. NIST OWM supports further development of the item, either by the submitter or by a task group.

**Table 2. Summary of Recommendations
SCL-24.2. – Multiple Sections Regarding Tare**

	Status Recommendation	Note*	Comments
Submitter	Developing		
OWM	Developing or Assigned		
WWMA	Developing		
NEWMA	Developing		
SWMA	Withdrawn		
CWMA	Developing		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association		1	Scale Manufacturers 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:

(NIST OWM has applied the appropriate formatting according to NIST Handbooks)

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

Appendix D, Definitions:

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

Add new definitions as follows:

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

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

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

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

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

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

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

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

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

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

Scales Code changes:

S.1.1.1. Digital Indicating Elements.

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

(b) **After zero setting the effect of zero deviation on the result of the weighing shall be not more than $\pm 0.25 e$.**
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

(c) **A digital indicating device shall either automatically maintain a “center-of-zero” condition to $\pm \frac{1}{4}$ scale division or less, or have an auxiliary or supplemental “center-of-zero” indicator that defines a zero balance condition to $\pm \frac{1}{4}$ of a scale division or less. A “center-of-zero” indication may operate when zero is indicated for gross and/or net mode(s). A digital indicating device shall have a “center-of-zero” indicator that indicates when the deviation from zero is not more than $\pm \frac{1}{4}$ verification scale division. A “center-of-zero” indication may operate when zero is indicated for gross and/or net mode(s). The “center-of-zero” indicator is not mandatory on a device equipped with an auxiliary indicating device or equipped with a zero-tracking mechanism.**
[Nonretroactive as of January 1, 1993]

~~(e)~~(d) **For electronic cash registers (ECRs) and point-of-sale systems (POS systems) the display of measurement units shall be a minimum of 9.5 mm ($\frac{3}{8}$ inch) in height.**
[Nonretroactive as of January 1, 2021]
(Added 2019)

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

...

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

The requirement that the value of the scale division be expressed only as 1, 2, or 5, or a decimal multiple or submultiple of only 1, 2, or 5 does not apply to net weights **indications and recorded representations** that are calculated from gross and tare weights **(measured without use of a tare or preset tare mechanism) indications** where the scale division of the gross weight is different from the

scale division of the tare weight(s) on multi-interval or multiple range scales. For example, a multiple range or multi-interval scale may indicate and record tare weights in a lower weighing range (WR) or weighing segment (WS), gross weights in the higher weighing range or weighing segment, and **calculated** net weights as follows:

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

[Nonretroactive as of January 1, 1989]

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

...

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

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

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

[Nonretroactive as of January 1, 1993]

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

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

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

...

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

[*Nonretroactive as of January 1, 1983]

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

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

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

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

(Nonretroactive as of January 1, 20XX)

(Added 20XX)

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

(Nonretroactive as of January 1, 20XX)

(Added 20XX)

...

S.1.15. Marking of Weight Indications.

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

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

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

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

(Nonretroactive as of January 1, 20XX)

(Added 20XX)

S.1.16. Printing of Weighing Results.

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

- (b) f only net weight is printed without corresponding gross or tare values, it may be printed without any designation. A symbol for designation shall be “N”.**
- (c) Gross, net, or tare weights determined by a multiple range instrument or by a multi-interval instrument need not be marked by a special designation referring to the (partial) weighing range. (see also S.1.2.1.)**
- (d) If net weights are printed together with the corresponding gross and/or tare weights, the net and tare weights shall at least be identified by the corresponding symbols “N” and “T”. If the gross weight is identified, the symbol “G” shall be used.**

(e) However, it is permitted to replace “G”, “N” and “T” by complete words in English.
(Nonretroactive as of January 1, 20XX)
(Added 20XX)

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

Alternative proposal.

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

...

T.N.2.1. General. – The tolerance values ~~are positive (+) and negative (–) herein prescribed shall be applied to errors of overregistration and underregistration, with the weighing device adjusted to zero at no load. When tare is in use, the tolerance values are applied from the tare zero reference (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads.~~ The tolerances apply to 1) errors in gross indications (starting at gross load zero), 2) errors in net indications (starting at net load zero) when a tare mechanism is in operation, 3) errors in tare indications on a dedicated tare

display when a tare mechanism is in operation, and 4) errors in net indications on a dynamic monorail scale (using a preset tare mechanism). Tolerances do not apply to errors in net indications for scales other than on dynamic monorail scales, when a preset tare mechanism is in operation.

(Amended 2008 **and 20XX**)

NIST OWM Detailed Technical Analysis:

S.1.2.1 in the current scale code suggests that when tare is applied, the values of Tare, Net and Gross must be in mathematical agreement, i.e., $Tare + Net = Gross$. This means that one of these values is always a calculated value from two rounded weight values. S.1.2.1 suggest that the Net value is calculated from the Gross value and the Tare value:

$$Net = Gross - Tare$$

The consequence of the requirement of mathematical agreement is that the calculated value has a rounding error. On a normal single interval scale, this rounding error can be as big as $0.5 e$. If the calculation is performed as suggested in the example of S.1.2.1 then this rounding error occurs in the Net value while this is the value that is used for the transaction.

Example 1:

A scale with $e = 1$ g
The actual tare value = 10.5 g and the actual net = 20.9 g

$$\Rightarrow \text{The actual gross} = 10.5 \text{ g} + 20.9 \text{ g} = 31.4 \text{ g}$$

Indication rounded to e :

$$Gross = 31 \text{ g}, Tare = 11 \text{ g}$$

Net calculation due to mathematical agreement:

$$Net = Gross - Tare = 31 - 11 = 20 \text{ g}$$

The indication is 20 g while in reality it should be 21 g.

When using flip weights to determine the error in the Net value, the Net indication changes at the first flip weight, **indicating an error of $-0.5 e$** . This error, due to rounding only, is equal to the acceptance tolerance. On top of this rounding error, there is the intrinsic error (the inaccuracy) of the scale.

On a multi-interval scale this problem is even bigger.

Example 2:

A multi-interval scale to fill propane tanks: $6/15$ kg x $2/5$ g
The tank weighs 7.003 kg and the propane weighs 0.999 kg

$$\Rightarrow \text{The actual gross} = 7.003 \text{ kg} + 0.999 \text{ kg} = 8.002 \text{ kg}$$

Indications rounded to e:

Gross = 8.000 kg (e=5 g)

Tare = 7.005 kg (e=5 g)

Net calculation due to mathematical agreement:

Net = Gross – Tare = 8.000 kg – 7.005 kg = 0.995 kg

Because the net value falls in the lower range, its corresponding scale division, e is 2 g. The acceptance tolerance is $0.5 e = 1 \text{ g}$.

The difference between the indication and the true value is 4 g which is **4x the acceptance tolerance**.

The current language in the scale code and our test procedures have several shortcomings that facilitate the problem of rounding errors and create non-uniformity:

- 1) The rule that Gross, Tare and Net must be mathematical agreement is generally applied but there is no such requirement in HB44. Only the example in S.1.2.1 seems to suggest that they must be in mathematical agreement, but a clear requirement is missing.
- 2) There is a general rule that rounding must be the very last operation. However, mathematical agreement forces to first round two weight values and then calculate the third one. This is the only way to guarantee mathematical agreement. Therefore, in the tare calculation, rounding is NOT the final operation.
- 3) The rule of mathematical agreement requires that one of the values is a calculated value, but the code does not specify which value shall be calculated. This leads to different implementations of the tare operation on instruments in the field.
- 4) S.1.2.1 suggests that the Net value should be the calculated value. However, this is the value that is used for the commercial transactions. Of the three values, rounding of the Gross value would have the least impact and would therefore be a better choice to be the calculated value.
- 5) The size of the rounding error depends on the actual loads. Since tests are normally performed with test loads equal to an exact number of scale divisions, (e.g., a tare weight of exactly 50 e and a net load of 200 e), the rounding error is zero (or close to zero) and the problem remains hidden. A better way to test the tare function on a scale is to use a tare weight close to the changeover point between to indications.
- 6) There is no requirement for error at Net zero to be within 0.25 e. If the rounding error is applied to the Net value, this often manifests itself in an error at Net zero. Unfortunately, currently there is no requirement that the Net zero must be within 0.25 e after activating Tare (or after zero-setting). Hence there is no test for checking whether Net zero is within 0.25 e and this problem is not detected in the field.
- 7) The rounding error varies between -0.5 to $+0.5$ scale divisions (d, not e). That means that when the scale is placed in high resolution mode for testing where $d = 1/10$ of e, the rounding error is at max $0.5 d$ which is equal to $0.05 e$ and well within tolerance. Hence, the problem remains undetected. The only way to make this problem visible is by testing it in normal resolution.

SCL-24.2 is an attempt to address these shortcomings. NIST OWM supports the item in an effort to avoid rounding errors in weight values used in commercial transactions and to increase uniformity in the implementation of tare functionality.

That being said, NIST OWM does not think the item has been fully vetted yet and supports a developing status.

Regional Association Reporting:

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, Cory Hainy (SMA) remarked the association has not met on this item and intends to review it in the November 2023 SMA meeting.

Steve Harrington (Oregon) expressed concerns regarding terminology throughout the item but acknowledged that there is merit to the item. They recommend this item be separated by the appropriate sections that would correspond to the handbook and that the items be blocked together. They also recommend this item be assigned a developing status.

Kevin Schnepf (California) echoed the comments from Oregon, supports a developing status, and looks forward to comments from the SMA.

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

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

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, Cory Hainy (SMA) stated they have not reviewed the item. The Committee disagrees with the justification and the use of alternate proposals within the item.

The Committee recommends the item be Withdrawn.

Northeastern Weights and Measures Association

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

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Developing and seeks input from industry stakeholders.

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: Voting, with the recommended edits as indicated below

- | |
|--|
| <ul style="list-style-type: none">• The adoption of GEN-22.1 in 2022, which amended paragraph G-A.1. Commercial and Law-Enforcement Equipment of NIST Handbook 44 clarifying that weighing and measuring equipment used for the purpose of providing a weight or measure for a fee constitutes commercial use of that equipment, necessitated this proposal.• The WWMA & NEWMA regions had concerns with “split-weighing”:<ul style="list-style-type: none">○ SCL-22.1 was adopted at the 2023 NCWM Annual Meeting and adds paragraph S.1.15. to NIST Handbook 44 requiring the recorded value be identified as “Not-Legal-For-Trade” when not all weights value were determined simultaneously (split-weighed).○ Paragraph UR.3.3. will still require a vehicle or vehicle combination to be weighed “commercially” 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 weigh in single drafts. This item would add another exemption to this paragraph for scales used to weigh <u>axle loads, axle-group loads, and the gross weight of vehicles and coupled-vehicle combinations for a fee</u>, when those values are only used “to determine compliance with highway legal load limits and safe distribution of the load”.○ SCL-22.3 also adds a new paragraph, UR.3.4. which clarifies that it is acceptable to use multi-platform vehicle scale systems to charge a fee for the commercial service of providing customers (usually truckers) axle weights, axle group weights, and the gross weight of their vehicles to enable them to determine compliance with state and federal legal load limits. |
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NIST OWM Executive Summary for SCL-22.3 – Single-Draft Vehicle Weighing and UR.3.4. Axle and Axle Group Weight Values.

- In addition, this new UR.3.4. paragraph clarifies how these weights must be obtained to be used as commercial values, i.e., the summed total of a vehicle that is “split-weighed” cannot be used as the basis for a commercial transaction.
- OWM proposed amendments to this item in May 2023 based on feedback received from the SMA during and after the 2023 NCWM Interim Meeting and requested that the Committee replace the current proposal in SCL-22.3. The item under consideration reflects these amendments.
- OWM suggests the following minor edits:
 - Remove the word “axle-“ throughout the item and replace it with “axle load” instead of “axle-“ not including the term “axle-group loads”.
 - Add the word “established” between the words “with” and “highway” in the last paragraph of UR.3.3., formerly the “Note”.
 - Remove the “s” from “subparts” in the last paragraph of UR.3.4.
 - Add the amended date to paragraph UR.3.3. and the added date to UR.3.4.
 - The item would then appear as this:

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

- (a) a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results; or
- (b) a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

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

(Added 1992) (Amended 20XX)

And

NIST OWM Executive Summary for SCL-22.3 – Single-Draft Vehicle Weighing and UR.3.4. Axle and Axle Group Weight Values.
<p><u>UR.3.4. Weighing of Axle Loads and Axle-Group Loads – Establishing weight values for the different individual axle loads and axle-group loads of a vehicle or coupled-vehicle combination is oftentimes necessary to verify compliance with established highway weight requirements and safe distribution of the load. When a fee is charged for this service, the scale’s application is considered “commercial” under the provisions of paragraph G-A.1. Commercial and Law Enforcement Equipment and the scale shall comply with all applicable NIST Handbook 44 requirements for commercial weighing systems.</u></p> <p><u>When weight values for axle loads and/or axle-group loads are obtained using multiple-independent platform vehicle scale systems in which all parts of the vehicle or coupled-vehicle combination being weighed are simultaneously positioned on live elements of the scale, the values for the different axle loads and axle-group loads may be summed to establish the legal gross vehicle weight.</u></p> <p><u>In no case, however, shall a summed result of the different axle loads and axle-group loads of a vehicle or coupled vehicle combination weighed in multiple drafts be used as the legal gross weight unless subpart (a) or (b) of paragraph UR.3.3. Single-Draft Vehicle Weighing is met.</u> (Added 20XX)</p> <ul style="list-style-type: none"> • With these minor edits OWM requests a Voting status • 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 Vehicle Weighing and UR.3.4. Axle and Axle Group Weight Values**

	Status Recommendation		Note*	Comments
Submitter (OWM)	Voting			
WWMA	Developing			
NEWMA	Developing			
SWMA	Voting			
CWMA	Voting			
NCWM				
	Number of Support Letters	Number of Opposition Letters	Comments	
Industry				
Manufacturers				
Retailers and Consumers				
Trade Association		1	Scale Manufacturers 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 weight requirements and safe distribution of the load.

(Added 1992) (Amended 20XX)

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 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 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 legal gross vehicle 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 as the legal gross vehicle weight unless subparts (a) and (b) of paragraph UR.3.3. Single-Draft Vehicle Weighing.
(Added 20XX)

Renumber existing paragraphs UR.3.4 through UR.3.12.

NIST OWM Detailed Technical Analysis:

OWM developed two proposals, SCL-22.1 (adopted in 2023) and SCL-22.3, to address gaps in NIST Handbook 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 determining axle and axle-group weights, as well as the gross vehicle weight. 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 gross vehicle weights from summing the axle loads 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” (weigh in multiple drafts) the axle and axle groups of “over-sized” coupled-vehicle combinations because not all axle and axle groups could be positioned simultaneously on the live portion of the scale.

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, to establish transportation charges, or for other commercial purposes. While the printed ticket for those weight determinations may provide clear indication that the gross vehicle weight value recorded was “non certifiable,” it is questionable whether this is permitted since HB 44 Scales Code paragraph UR.3.3. Single-Draft Vehicle Weighing requires a vehicle or coupled-vehicle combination to be commercially weighed on a vehicle scale only as a single draft. Note: A manufacturer of a particular scale system advised us that most vehicles and coupled-vehicle combinations that are weighed on this type of scale can be weighed as a single draft. It is only the occasional oversized vehicle or coupled-vehicle combination that exceeds the length of the scale and 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 gross vehicle weight of vehicles and coupled-vehicle combinations for a fee. Although we recognize that single-platform vehicle scales may 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 approaches 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 an important concern given that these proposals, if adopted, would make it permissible to split weigh vehicles and coupled-vehicle combinations for a fee, provided that the weighing results are used only to verify that the different axle, axle-group loads, and gross 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 suitable 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 the newly adopted 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 gross 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. When used to provide a gross vehicle weight that determines compliance with maximum legal load limits and safe distribution of the load this is an acceptable practice. 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 gross vehicle weight undoubtedly occurred when using those scales to ensure vehicles didn't exceed maximum legal load limits. For these reasons, OWM has provided the Committee this proposal to add paragraph UR.3.4. to the Scales Code, 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. They also reported that they 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 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. They 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 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.

During the 2023 NCWM Annual Meeting, Jan Konijnenburg (NIST Office of Weights & Measures) requested the Committee update the item to reflect the most current language as included in the NIST OWM Executive Summary. The Committee agreed to update the item to reflect these changes.

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.

At the 2023 WWMA Annual Meeting, Loren Minnich (NIST OWM) remarked that the SMA comments have been addressed and recommends this item is ready for a vote.

Cory Hainy (SMA) expressed the April 2023 analysis represents their position prior to the updates to the item and will reconvene in November 2023 to analyze the item. They support this item as developing status.

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

Kevin Schnepf (California) supports a voting status contingent on SMA analysis of the item.

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

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, for Items 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.

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

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

Northeastern Weights and Measures Association

At the 2023 NEWMA 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.

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

Scale Manufacturers Association Spring 2023 Meeting

At the 2023 Spring Meeting SMA supported the further development of this item and submitted feedback to the submitter.

At the 2023 Fall Meeting the SMA noted that they do not support the language proposed to be added to the note in UR.3.3. as it would allow “the possibility of split weighing”.

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:

1. The mission of the task group, as defined by the S&T Committee, was to review Handbook 44, Section 2.20. Scales and relevant portions of OIML R76, using the items included in S&T Agenda Items: Block 2 as a reference point, and recommend changes as necessary to:
2. Clarify how the error is determined in relation to the verification scale division (e) and the scale division (d)
3. Clarify which is the proper reference; the verification scale division (e) or the scale division (d) throughout this section
4. Ensure proper selection of a scale in reference to the verification scale division (e) and the scale division (d)
5. Clarify the relationship between the verification scale division (e) or the scale division (d)

Background:

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

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

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

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.
<p>NIST OWM Recommendation: Voting</p> <ul style="list-style-type: none"> NIST OWM is of the opinion that the proposal is fully developed and supports a Voting status for this group of items. NIST OWM would like to stress the importance of this item. The current scale code in Handbook 44 contains several contradictions and inconsistencies with respect to the use of the terms “scale division”, and “verification scale division”. This leads to confusion and non-uniformity in the application of the code. The proposal presented by the task group is meant to clean up the code and bring clarification of the requirements with respect to e and d.

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	Voting			
OWM	Voting			
WWMA	Informational			
NEWMA	Voting			
SWMA	Assigned			
CWMA	Assigned			
NCWM				
	Number of Support Letters	Number of Opposition Letters	Comments	
Industry				
Manufacturers				
Retailers and Consumers				
Trade Association	1		Scale Manufacturers 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:

Changes proposed to Appendix D. Definitions

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

(Added 20XX)

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

(Added 20XX)

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

(Added 20XX)

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

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

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

(Amended 20XX)

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

(Amended 20XX)

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

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

(Added 20XX)

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

(Added 1987) (Amended 20XX)

Changes proposed to Section 2.20. Scales Code

S.1.1.1. Digital Indicating Elements.

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

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

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

[Nonretroactive as of January 1, 1993]

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

[Nonretroactive as of January 1, 2021]

(Added 2019)

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

S.1.2. Value of Scale ~~Division~~ Units. – Except for batching scales and weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division “d” and the verification scale interval “e” expressed in a unit of weight shall be equal to:

(a) 1, 2, or 5; or

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

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

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

Examples: scale divisions may be $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, etc.

[Nonretroactive as of January 1, 1986]

(Amended 20XX)

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

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

as follows:

$$\begin{array}{r}
 55 \text{ kg Gross Weight (WR2 } d = 5 \text{ kg)} \\
 - 4 \text{ kg Tare Weight (WR1 } d = 2 \text{ kg)} \\
 \hline
 = 51 \text{ kg Net Weight (Mathematically Correct)}
 \end{array}
 \qquad
 \begin{array}{r}
 10.05 \text{ lb Gross Weight (WS2 } d = 0.05 \text{ lb)} \\
 - 0.06 \text{ lb Tare Weight (WS1 } d = 0.02 \text{ lb)} \\
 \hline
 = 9.99 \text{ lb Net Weight (Mathematically Correct)}
 \end{array}$$

Correct)

[Nonretroactive as of January 1, 1989]

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

S.1.2.2. Verification Scale Interval **“e”.**

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

$$d < e \leq 10 d$$

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

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

~~(Added 1999)~~

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

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

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

- (a) The value of “e” shall be greater than “d” and less than or equal to 10 “d” ($d < e < 10 d$), and**
- (b) The value of “e” must satisfy the relationship, $e = 10^k$ of the unit of measure, where k is a positive or negative whole number or zero.**

Examples:

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

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

Examples:

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

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

(Added 1999) (Amended 20XX)

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

(Added 1999) (Amended 20XX)

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

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

(Added 20XX)

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

(a) while pressing a key; or

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

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

(Added 20XX)

(Amended 2021 and 20XX)

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

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

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

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

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

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

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

[Nonretroactive as of January 1, 1994]

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

Table 3. Parameters for Accuracy Classes			
Class	Value of the Verification Scale DivisionInterval (d or e^1)	Number of Verification Scale⁴³ DivisionsIntervals (n)	
		Minimum	Maximum
SI Units			
<i>I</i>	<i>equal to or greater than 1 mg</i>	<i>50 000</i>	<i>--</i>
<i>II</i>	<i>1 to 50 mg, inclusive</i>	<i>100</i>	<i>100 000</i>
	<i>equal to or greater than 100 mg</i>	<i>5 000</i>	<i>100 000</i>
<i>III^{21,54}</i>	<i>0.1 to 2 g, inclusive</i>	<i>100</i>	<i>10 000</i>
	<i>equal to or greater than 5 g</i>	<i>500</i>	<i>10 000</i>
<i>III L³²</i>	<i>equal to or greater than 2 kg</i>	<i>2 000</i>	<i>10 000</i>
<i>IIII</i>	<i>equal to or greater than 5 g</i>	<i>100</i>	<i>1 200</i>

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

²¹ A Class III scale marked “For prescription weighing only” may have a verification scale **divisioninterval** (e) not less than 0.01 g.
(Added 1986) (Amended 2003)

³² The value of a **verification** scale **divisioninterval** (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 **divisionsintervals** (n) shall be not less than 1000.
(Amended 20XX)

⁴³ On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of **verification** scale **divisionsintervals**, (n), for each weighing range is determined by dividing the scale capacity for each range by the verification scale **divisioninterval**, (e), for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.
(Added 1997)(**Amended 20XX**)

⁵⁴ The minimum number of **verification** scale **divisionsintervals** (n) for a Class III Hopper Scale used for weighing grain shall be 2000.)
(Amended 20XX)

[Nonretroactive as of January 1, 1986]

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

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

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

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 <u>Verification Scale Interval</u> , "e" (3)(4)	X	X			
Temperature Limits (5)	X	X	X	X	
Concentrated Load Capacity (CLC) (12)(20)(22)					
Special Application (13)	X	X	X		
Maximum Number of <u>Verification Scale Divisions</u> <u>Intervals</u> (n_{max}) (6)		X (8)	X (19)	X	

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

Table S.6.3.b.

Notes for Table S.6.3.a. Marking Requirements

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

- The device shall be marked with the nominal capacity. The nominal capacity may be prefaced by the terms "capacity" or "Max." *For any scale where the value of "e" is equal to the value of "d" (see S.1.2.2.), ~~the~~ nominal capacity shall be shown together with the value of the scale division "d" or the verification scale interval "e" (e.g., 15 × 0.005 kg, ~~30 × 0.01 lb,~~ or capacity = 15 kg, d = 0.005 kg, or Max 15 kg e = 0.005 kg) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device. **On multiple range or multi-interval scales the value of ~~the~~ Each scale division value "d" or verification scale interval "e" or weight unit shall be marked together with***

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

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

its associated nominal capacity on multiple range or multi-interval scales. For any scale that has no “d” or any scale where “e” does not equal “d” refer to Note 4.

[Nonretroactive as of January 1, 1983]

(Amended 2005 **and 20XX**)

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

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

(b) For a scale where e does not equal d, such as a scale equipped with an auxiliary indication or a weight classifier marked for special use, the nominal capacity shall be shown together with the scale division “d” and the verification scale interval “e,” (e.g., capacity 1,000 g e = 0.1 g d = 0.01 g, or Max 1,000 g e = 0.1 g d = 0.01 g).

[Nonretroactive as of January 1, 1986]

(Amended 20XX)

5. Required only on Class III, III L, and IIII devices if the temperature range on the NTEP CC is narrower than and within $-10\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$ ($14\text{ }^{\circ}\text{F}$ to $104\text{ }^{\circ}\text{F}$). [Nonretroactive as of January 1, 1986]
(Amended 1999)

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

7. Denotes compliance for single or multiple load cell applications. It is acceptable to use a load cell with the “S” or Single Cell designation in multiple load cell applications as long as all other parameters meet applicable requirements. A load cell with the “M” or Multiple Cell designation can be used only in multiple load cell applications.

[Nonretroactive as of January 1, 1988]

(Amended 1999)

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

[Nonretroactive as of January 1, 1988]

(Amended 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.

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

(Amended 1990 and 20XX)

T.2. Sensitivity Requirement (SR).

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

(Amended 20XX)

T.2.4. Jewelers' Scales.

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

(Amended 20XX)

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

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

(Amended 20XX)

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

(Amended 20XX)

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

(Amended 20XX)

T.N.1. Principles.

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

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

(Amended 20XX)

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

(Amended 20XX)

T.N.3. Tolerance Values.

T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales. – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 ~~e~~ or 0.1 % of the scale capacity, whichever is less. (Amended 1986 and 20XX)

Table 6. Maintenance Tolerances (All values in this table are in <u>verification scale divisions</u> intervals (e))				
Tolerance in Scale Divisions				
	1	2	3	5
Class	Test Load <u>Applied</u>			
I	0 - 50 000	50 001 - 200 000	200 001 +	
II	0 - 5 000	5 001 - 20 000	20 001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1 e for each additional 500 e or fraction thereof)	

(Amended 20XX)

T.N.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 divisioninterval (e) (e) and be within tolerance limits.

(Amended 1986 and 20XX)

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

T.N.6.1. Test Load.

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

(Amended 20XX)

T.N.8. Influence Factors.

...

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

- (a) three ~~divisionse~~ per 5 °C (9 °F) change in temperature for Class III L devices; or
- (b) one ~~divisione~~ 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 ~~scale division (d)~~; or the equipment shall:

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

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

(Amended 1997 and 20XX)

UR.3. Use Requirements.

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

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

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

~~be less than or equal to “d.”~~**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~~)

Other Issues Discussed by the Task Group:

1. Based on input from the Scale Manufacturers Association and discussion within the task group the decision was made to replace all references to the “verification scale division” with the term “verification scale interval”. The intent of this change is to clearly differentiate between the verification scale interval (e) and the scale division (d)
2. For reference, the following specifications, tolerances, and user requirements are specific to the scale division (d).

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

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

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

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

In 1984, an initiative was taken by the National Conference on Weights and Measures (NCWM) to harmonize the scale code in section 2.20, Scales, of the NIST Handbook 44 (NIST HB 44) with OIML R 76, the international standard on non-automatic weighing instruments used in legal metrology applications. Although many aspects of OIML R 76 were adopted in NIST HB 44, the exact same wording was not incorporated directly which led to unintended deviations, including the application of “scale division” (d), and the “verification scale division” (e). Furthermore, the current text in NIST HB 44 section 2.20 contains some inconsistencies and contradictions. This leads to confusion and creates non-uniformity in application of NIST HB 44 to scales where the “scale division” (d) differs from the “verification scale division” (e).

To evaluate the proposal of the task group, it is important to understand the difference between the “scale division” (d) and the “verification scale division” (e) as they were intended to be implemented in the Scale Code of Handbook 44. These are the definitions of scale division and verification scale division:

scale division, value of (d). – The value of the scale division, expressed in units of mass, is the smallest subdivision of the scale for analog indication or the difference between two consecutively indicated or printed values for digital indication or printing.

In other words, d is the resolution of the indication of a weighing instrument (the displayed, printed, or recorded value).

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. ...

Note that the definition of e does not state anything about the resolution of the indication of the weighing instrument. The verification scale division is used to define the accuracy classes and the applicable tolerances. The value of e is therefore a measure for the accuracy of the instrument, regardless of the resolution of the indication.

All requirements related to tolerance values should refer to e, while all requirements related to the resolution of the indications should refer to d.

In order to avoid confusion in the field and create uniformity in the understanding of the terms “scale division” and “verification scale division”, it is important that the Scale Code is cleaned up.

The majority of these proposed amendments simply replace “d” with “e” in those specification requirements that deal with the accuracy classification of a scale and the requirements that specify tolerances. Some have been amended to clarify how “e” & “d” interact when they are not equal to each other, e.g., when “e” is less than “d”, as can be the case with weight classifiers, and when “d” is less than “e”, as is the case with some Class I & II devices.

One change of note, to Table 8 Recommended Minimum Load, has been proposed to provide uniformity when determining the minimum load applied to a scale. Table 8 now only references “e”. In those instances where “e is not equal to “d” the minimum recommended load, if determined using “d” would be different for scales that have the same value for “e”. This is illustrated in the following table:

Accuracy Class	Value of “e”	Value of “d”	Recommended Min. Load in “e”*	Recommended Min. Load in “d”**
II	0.1 g	0.05 g	5 g	1 g
II	0.1 g	0.02 g	5 g	0.4 g
III***	0.1 oz	1 oz	0.5 oz	10 oz
III***	0.1 oz	0.5 oz	0.5 oz	5 oz
*Calculated based on proposed amendments to Table 8				
**Calculated based on current Table 8 specified values				
***Weight Classifier				

NIST OWM participated in the Verification Scale Division Task Group and is of the opinion that after more than 3 years of intensive work, the proposal for the amendment of several sections in the Scale Code has been thoroughly vetted and is ready to be adopted.

More background information regarding e and d can be found on the website of NIST OWM under Weighing FAQs (<https://www.nist.gov/pml/owm/weighing-faqs>).

NIST OWM Detailed Technical Analysis:

In 1984, an initiative was taken by NCWM to harmonize NIST Handbook 44, Scale Code 2.20. with with OIML R 76, the international standard on non-automatic weighing instruments used in legal metrology applications. Although many aspects of OIML R 76 were adopted in NIST HB 44, the exact same wording was not incorporated directly which led to unintended deviations, including the application of “scale division” (d), and the “verification scale division” (e). Furthermore, the current text in NIST HB 44 section 2.20 contains some inconsistencies and contradictions. This leads to confusion and creates non-uniformity in application of NIST HB 44 to scales where the “scale division” (d) differs from the “verification scale division” (e).

To evaluate the proposal of the task group, it is important to understand the difference between the “scale division” (d) and the “verification scale division” (e) as they were intended to be implemented in the Scale Code of Handbook 44. These are the definitions of scale division and verification scale division:

scale division, value of (d). – The value of the scale division, expressed in units of mass, is the smallest subdivision of the scale for analog indication or the difference between two consecutively indicated or printed values for digital indication or printing.

In other words, d is the resolution of the indication of a weighing instrument (the displayed, printed, or recorded value).

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. ...

Note that the definition of e does not state anything about the resolution of the indication of the weighing instrument. The verification scale division is used to define the accuracy classes and the applicable tolerances. The value of e is therefore a measure for the accuracy of the instrument, regardless of the resolution of the indication.

All requirements related to tolerance values should refer to e, while all requirements related to the resolution of the indications should refer to d.

In order to avoid confusion in the field and create uniformity in the understanding of the terms “scale division” and “verification scale division”, it is important that the Scale Code is cleaned up.

The majority of these proposed amendments simply replace “d” with “e” in those specification requirements that deal with the accuracy classification of a scale and the requirements that specify tolerances. Some have been amended to clarify how “e” & “d” interact when they are not equal to each others, e.g., when “e” is less than “d”, as can be the case with weight classifiers, and when “d” is less than “e”, as is the case with some Class I & II devices.

One change of note, to Table 8 Recommended Minimum Load, has been proposed to provide uniformity when determining the minimum load applied to a scale. Table 8 now only references “e”. In those instances where “e is not equal to “d” the minimum recommended load, if determined using “d” would be different for scales that have the same value for “e”. This is illustrated in the following table:

Accuracy Class	Value of “e”	Value of “d”	Recommended Min. Load in “e”*	Recommended Min. Load in “d”**
II	0.1 g	0.05 g	5 g	1 g
II	0.1 g	0.02 g	5 g	0.4 g
III***	0.1 oz	1 oz	0.5 oz	10 oz
III***	0.1 oz	0.5 oz	0.5 oz	5 oz
*Calculated based on proposed amendments to Table 8				
**Calculated based on current Table 8 specified values				
***Weight Classifier				

NIST OWM participated in the Verification Scale Division Task Group and is of the opinion that after more than 3 years of intensive work, the proposal for the amendment of several sections in the Scale Code has been thoroughly vetted and is ready to be adopted.

Additional background information regarding e and d can be found at <https://www.nist.gov/pml/owm/weighing-faqs> under Weighing FAQs.

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:

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

During the 2023 NCWM Annual Meeting, the S&T Committee Chair stressed that the Task Group is currently without a Chair and asked for volunteers to chair the Task Group. Nobody volunteered. Charlie Rutherford stated that they are in contact with somebody who would be willing to chair the Verification Scale Division Task Group but did not disclose a name.

Regional Association Reporting:

Western Weights and Measures Association

At the WWMA 2022 Annual Meeting 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.

At the 2023 WWMA Annual Meeting, Loren Minnich (NIST OWM) stated the NCWM Verification Scale Division e Task Group now has a Chair and has met to begin cleaning up the language in the item. The task group will make changes to Table 8 so that it only references “verification scale division” (e). Requests this item be assigned an Informational status to receive feedback from the body of the NCWM.

Cory Hainy (SMA) supports further development of this item with the consideration all references to “verification scale division” be changed to “verification interval”. The SMA will reconvene in November 2023 and requested this item to continue further development.

Kevin Schnepp (California) echoed SMA with the request this item be assigned an Informational status.

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

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, there were no comments received on this item. The SWMA S&T Committee recommends this item remain as an Assigned Item.

At the 2023 SWMA Annual Meeting, the Committee heard no comments. The Committee recommends this item remain 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. Loren Minnich 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.

At the 2023 NEWMA Interim Meeting, Steve Timar (New York and a member of the Scale Verification TG) stated the TG has met a few times and there has been much progress, including cleaning up some

definitions and other language. The TG has changed all references of “verification scale division” to “verification scale interval” throughout the item, as requested by SMA. A regulator from Holliston, Massachusetts recommended a voting. A regulator from New Hampshire stated the change to Table 6 in this proposal is different than New Hampshire’s new proposal. Upon consensus of the body, the Committee recommends this item be Voting.

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.

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item remain Assigned.

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, they supported 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.

SCL-24.3 Table 6. Maintenance Tolerances

(This item was introduced at the 2023 NEWMA Interim Meeting)

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

Submitter’s Purpose and Justification:

Provide clarity to NIST HB 44, 2.20. Scales, Table 6. Maintenance Tolerances. Table 6. will be easier to read if the vertical and horizontal grid lines are included, as seen in other tables within Handbook 44. The additional remarks added to Class III L will clarify the tolerance requirement for both regulators and other users of the handbook. Understanding Table 6. can be resolved through more thorough training.

NIST OWM Executive Summary for SCL-24.3 – Table 6. Maintenance Tolerances	
NIST OWM Recommendation: Informational	
<ul style="list-style-type: none"> • OWM supports the effort to provide additional clarity to Table 6, specifically the interpretation of Class III L tolerances. • Our office supports an Informational status until the weights & measures community agrees which of the proposed versions of Table 6 accomplishes that goal. 	

**Table 2. Summary of Recommendations
 SCL-24.3 – Table 6. Maintenance Tolerances**

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Informational			
WWMA			4	
NEWMA	Developing			
SWMA			4	
CWMA			4	
NCWM				
	Number of Support Letters	Number of Opposition Letters	Comments	
Industry				
Manufacturers				
Retailers and Consumers				
Trade Association	1		Scale Manufacturers 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:

OPTION 1

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

Or

OPTION 2

Table 6. Maintenance Tolerances (All values in this table are in scale divisions)				
Tolerance in Scale Divisions				
Class	1	2	3	5
	Test Load			
I	0 - 50 000	50 001 - 200 000	200 001 +	
II	0 - 5 000	5 001 - 20 000	20 001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII	0 - 50	51 - 200	201 - 400	401 +
III L	<u>Determine Class III L tolerance by adding (add 1 d for each additional 500 d or fraction thereof</u> <u>(0 - 500 = 1 d, 501 - 1000 = 2 d, 1001 - 1500 = 3 d, 1501 - 2000 = 4 d, etc.)</u>			

Regional Association Reporting:

Western Weights and Measures Association

Southern Weights and Measures Association

Northeastern Weights and Measures Association

A presentation was provided by a regulator from the State of New Hampshire. The basis for the changes is to modify the appearance of table to be easier to read by adding horizontal and vertical lines and to add

clarification for Class III scales. Two options for modification of the table have been provided. The regulator believes this could be a simple editorial change. The State of New York and Commonwealth of Pennsylvania believe the proposed modifications add value and clarity. Upon consensus of the body, the Committee recommends a Developing status, with both options presented to the membership for further discussion.

Central Weights and Measures Association

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
¹NIST OWM Recommendation: Assigned
<ul style="list-style-type: none"> The proposed amendments to Table 7a are ambiguous. The weighing of all cannabis products is assigned to accuracy classes I, II and III. This will lead to confusion in the field. For this reason, OWM recommends this item remains assigned to the Task Group. OWM offers to assist the Cannabis Task Group in developing a more appropriate proposal for the amendment of Table 7a.
<p>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 legalization of 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.</p>

**Table 3. 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			
	Number of Support Letters	Number of Opposition Letters	Comments

Industry			
Manufacturers		1	A&D
Retailers and Consumers			
Trade Association	1		Scale Manufacturers Association
Regulatory	1		Florida Dept. of Ag & Consumer Services

***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 <u>and weighing of all Cannabis products</u>
II	Laboratory weighing, precious metals and gem weighing, grain test scales, <u>and weighing of all Cannabis products</u>
III	All commercial weighing not otherwise specified, grain test scales, retail precious metals and semi-precious gem weighing, grain-hopper scales, animal scales, postal scales, vehicle on-board weighing systems with a capacity less than or equal to 30 000 lb, and scales used to determine laundry charges, <u>and weighing of all Cannabis products</u>
III L	Vehicle scales (including weigh-in-motion vehicle scales), vehicle on-board weighing systems with a capacity greater than 30 000 lb, axle-load scales, livestock scales, railway track scales, crane scales, and hopper (other than grain hopper) scales
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 Cannabis TG - Scales Focus Group (a subgroup of the Cannabis TG), 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.

A certain application or category of products should be assigned to only one accuracy class in Table 7a. If the assignment of classes I, II and III in the proposal are meant for different types of transactions, then this should be made clear in the designations in Table 7a, e.g., “retail sale of cannabis products” and “wholesale distribution of cannabis products”.

- It is OWM’s understanding that some participants of the Cannabis TG 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 believes that Class II scales are the most suitable device for retail sale of cannabis products, which would place cannabis in the same accuracy class as precious metals and gems. If the Cannabis TG is of the opinion that a class III is sufficient for wholesale transactions of cannabis products then this should clearly be designated in Table 7a, e.g., using the language “wholesale distribution of cannabis products”.

- 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 a somewhat widerange of comments during open hearings.

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.

At the 2023 WWMA Annual Meeting, NCWM Cannabis Task Group Co-Chair Wolpert stated this item is still being developed by the task group and requested the item remain assigned to the task group.

Kevin Schnepf (California) questioned basing the suitability of a scale on the type of product. Recommended this item remain assigned to the task group. Steve Harrington (Oregon) echoed California.

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

Cory Hainy (SMA) recommended a change of language in Table 7a. class III devices, replace the word “All Cannabis” with “non-retail Cannabis”. Recommend adding a comment in Table 7a. for reference to Table 8. for scale selection.

Wendy Hahn (Stanislaus County, California) echoed Kurt Floren with an additional concern that the table is confusing and someone may select a class of device that may not be suitable.

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

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

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.

At the 2023 SWMA Annual Meeting, the Committee heard no comments on this item during Open Hearings.

The Committee recommends this item remain 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 from the 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. They 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.

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

Central Weights and Measures Association

During the 2021 CWMA Interim Meeting Open Hearing, the Committee heard comments from the floor. Loren Minnich (Kansas) is not sure of the intent and that it needs more developing. Eric Golden agreed with 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 SCL-22.2 (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) 1 g 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. Thomas Schuller (SMA) stated the SMA supported this item.

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

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item remain Assigned.

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 2023 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”.

AWS – Automatic Weighing Systems Code

AWS-24.1 N.1.5. Test Loads

Source: Marel Ltd.

Submitter’s Purpose and Justification:

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

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

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

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

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

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

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

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

The submitter requested Voting status in 2024.

Executive Summary for AWS-24.1 – N.1.5. Test Loads
<p>NIST OWM Recommendation: Voting, with recommended changes.</p> <ul style="list-style-type: none"> • OWM agrees with the submitter that the language in paragraph N.1.5. can be interpreted in different ways. • Paragraph N.1.5. and Table N.1.5. Test Loads apply to all Automatic Weighing Systems which includes: <ul style="list-style-type: none"> ○ Automatic weigh-labelers; ○ Combination automatic and non-automatic weigh-labelers; ○ Automatic checkweighers; ○ Combination automatic and non-automatic checkweighers; and ○ Automatic gravimetric filling machines that weigh discrete loads or single loads of loose materials and determine package and production lot compliance with net content representations. • The subsequent paragraphs, N.2. & N.3. apply to Weigh-Labelers and Automatic Checkweighers, respectively. • N.2. specifies how test loads are applied to Weigh-Labelers • N.3. specifies how test loads are applied to Checkweighers. • Because the application of test loads is specified in N.2. & N.3., OWM suggests amending N.1.5. as follows:

Executive Summary for AWS-24.1 – N.1.5. Test Loads
<p>N.1.5. Tests Loads. – A performance test shall consist of four separate test runs be conducted at <u>with a minimum of four</u> different test loads according to Table N.1.5. Test Loads.</p> <ul style="list-style-type: none"> This would clarify what test loads are required and would retain the current requirements pertaining to the application of test loads.

**Table 2. Summary of Recommendations
AWS-24.1 – N.1.5. Test Loads**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting	1	
WWMA	Developing		
NEWMA		5	
SWMA	Developing		
CWMA	Developing		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association	1		Scale Manufacturers 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 Automatic Weighing Systems Code as follows:

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

NIST OWM Detailed Technical Analysis:

As written paragraph N.1.5 is unclear in what it requires. Does it mean a test should consist of each of the test loads specified in Table N.1.5. being applied four times or does it mean four separate tests should be conducted at the test loads specified in Table N.1.5.? Depending on how the paragraph is read it could be interpreted both ways.

Because the paragraph is addressing test loads OWM believes the intent was to specify the minimum number of different test loads required to conduct a proper test and was not intended to specify the number of “runs” for each test load. How test loads are applied to Weigh-Labelers and Checkweighers is specified in N.2. and N.3. respectively and both include requirements for devices that operate non-automatically. For those devices there are no “test runs”, the test load is applied statically using test weights. Because N.2. & N.3. include tests that are conducted statically, specifying “test runs” in N.1.5. is incorrect.

For these reasons we support amending N.1.5. but not as originally proposed by the submitter. OWM believes the following amendments capture the intent of the paragraph and provides the clarity needed for uniform interpretation:

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

OWM contacted the submitter of the Item, Andrew Goddard, Marel Ltd, who supports these proposed changes to the item. With these changes OWM supports adoption of this item.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Developing and seeks input from industry stakeholders

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, a question was raised by the WWMA S&T Committee directed to the submitter if the intent of reference to the number of runs of test loads will introduce repeatability tolerances. The Committee did not receive a response during open hearings.

Steve Harrington (Oregon) supports this item for a Voting status. Cory Hainy (SMA) the association has not met on this item and intends to review it in the November 2023 SMA Meeting.

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

Loren Minnich (NIST OWM) stated the current language as written in existing code is confusing and this item is an attempt to clarify that language.

Kevin Schnepf (California) recommends this item be assigned a Developing status with pending review and position from the SMA.

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

Southern Weights and Measures Association

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

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

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

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, no comments were heard on this item and the Committee does not have a recommendation.

AWS-24.2 N.1.6. Influence Factor Testing.

Source: Marel Ltd.

Submitter's Purpose and Justification:

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

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

HB 44 AWS N.2

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

(Amended 2004)

HB 44 AWS

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

Pub 14 AWS 36

Influence factor testing shall be conducted:

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

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

The submitter requested Voting status in 2024.

NIST OWM Executive Summary for AWS-24.2 – N.1.6. Influence Factor Testing	
NIST OWM Recommendation: Voting	
<ul style="list-style-type: none"> • The effect of influence factors is evaluated under controlled conditions, typically only during NTEP evaluation. • As identified by the submitter, NCWM Publication 14 has procedures for evaluating influence factors when testing AWS either statically or dynamically, depending on the system’s capabilities. • A search of NIST Handbook 44 shows that only one other section, 5.58. Multiple Dimension Measuring Devices, has a note that mentions influence factors. Typically, NIST HB 44 specifies tolerances associated with influence factors but does not specify a test (N. paragraph or test note). • OWM agrees that this note is not needed and supports its removal. 	

**Table 2. Summary of Recommendations
 AWS-24.2 – N.1.6. Influence Factor Testing**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		
NEWMA		5	
SWMA	Developing		
CWMA	Developing		

NCWM	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association	1		Scale Manufacturers 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 Automatic Weighing Systems Code as follows:

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

NIST OWM Detailed Technical Analysis:

The effect of influence factors must be evaluated under controlled conditions, typically in a laboratory setting, and there are tolerances associated with the effect of these factors on devices. Section 2.24. includes tolerances for influence factors and NCWM Publication 14 has extensive procedures for evaluating the effect of influence factors on the performance of a device.

Only two sections in NIST Handbook 44 include the term “influence factor” in a note, 2.24. Automatic Weighing Systems and 5.58. Multiple Dimension Measuring Devices. In this instance the requirement that all influence factor testing be conducted statically is incorrect as not all AWS have the capability to operate in a static mode. OWM supports the removal and this note and supports a Voting status for this item.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Developing and seeks input from industry stakeholders.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, Cory Hainy (Representing the SMA) stated the association has not met on this item and intends to review it in the November 2023 SMA meeting.

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

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

Southern Weights and Measures Association

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

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

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, no comments were heard on this item and the Committee does not have a recommendation.

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

Source: Marel Ltd.

Submitter's Purpose and Justification:

Introduce dynamic shift test for automatic weigh labelers.

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

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

Pub 14 AWS

35.1. Static Tests

35.1.1. Increasing-load test...

35.1.2. Decreasing-load test...

35.1.3. Shift test...

35.1.4. Discrimination test...

35.1.5. Zero-load balance change...

35.1.6. Influence factor testing...

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

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

(1)
(2)

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

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

The submitter requested Voting status in 2024.

NIST OWM Executive Summary for AWS-24.3 – N.22.3. Shift Test (Dynamic)
<p>NIST OWM Recommendation: Voting</p> <ul style="list-style-type: none"> • NIST HB 44 currently has no shift test specified for devices that operate in the automatic mode only. Devices operating statically are tested for eccentricity with a test load equal to ½ capacity. OIML R-51 specifies conducting this test at 1/3 capacity. • Adoption of this item would align NIST Handbook 44 with OIML R-51, not only with the type of test but the test load required (1/3 capacity) • Adding this will facilitate field testing of these devices to ensure accuracy when off center loading occurs.

**Table 2. Summary of Recommendations
 AWS-24.3 – N.22.3. Shift Test (Dynamic)**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Developing		
NEWMA		5	
SWMA	Developing		
CWMA	Developing		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association	1		Scale Manufacturers 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 Automatic Weighing Systems Code as follows:

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

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

NIST OWM Detailed Technical Analysis:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Developing and seeks input from industry stakeholders.

Western Weights and Measures Association

At the 2023 WWMA Meeting, Cory Hainy (SMA) remarked association has not met on this item and intends to review it in the November 2023 SMA Meeting.

Kevin Schnepf (California) recommends this item be assigned a Developing status with pending review and position from the SMA.

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

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

Southern Weights and Measures Association

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

The Committee feels a separate shift test may not be practical for routine field testing and suggests incorporating the shift test into the existing test procedure. The Committee recommends the item move forward as a Developing item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, no comments were heard on this item and the Committee does not have a recommendation.

WIM – Weigh-in-Motion Systems – Tentative Code

WIM-23.1 | 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
<p>NIST OWM Recommendation: Informational</p> <ul style="list-style-type: none">• NIST OWM applauds the efforts of the submitter to address the concerns raised and incorporate the feedback received from the community into the item under consideration. Our office supports this most recent version of the item and is of the opinion that most major concerns have been sufficiently addressed by the submitters.• We agree that separating Section 2.25, which applies to WIM Systems used to screen and is a tentative code from this new proposed section, 2.26, which will apply to WIM Systems used to enforce highway load limits, is the best approach.• The only concern we still have is with paragraph N.1.3, Reference Scale, which allows the use of a single platform vehicle scale to weigh the axles or axle-groups of a reference vehicle

NIST OWM Executive Summary for WIM-23.1 – Remove Tentative Status and Amend Numerous Sections Throughout
<p>which are then summed to determine the gross vehicle weight. Using a single platform vehicle scale to weigh axles or axle-groups in isolation, as N.1.3.2 requires, is impractical. It would seem this is only possible using an axle-load scale.</p> <ul style="list-style-type: none"> • Even if N.1.3. didn't require the axles or axle-groups of a reference vehicle to be weighed in isolation, unless the approach for the scale is of sufficient length to ensure the reference vehicle is in the same plane as the vehicle scale while the reference values are being determined, there is concern that the values determined would be inaccurate. • Because this version of the item wasn't available for review by the regions in its entirety and due to the number of significant changes being proposed our office supports an Informational status to allow for further consideration.

**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	Informational		
NEWMA	Voting		
SWMA	Informational		
CWMA	Voting		
NCWM	Informational		
	Number of Support Letters	Number of Opposition Letters	Comments
Industry	2		Maryland DoT, C2SMART New York University, American Society of Civil Engineers, Rutgers (RIME)
Manufacturers	2		International Road Dynamics, Rekor
Retailers and Consumers			
Trade Association		1	Scale Manufacturers 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 Weigh-In-Motions Systems Code as follows:

(NIST OWM has applied the appropriate formatting according to NIST Handbooks)

TABLE OF CONTENTS TO BE INSERTED WHEN ADOPTED INTO THE HANDBOOK

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

A. Application

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

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

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

S. Specifications

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

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

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

(a) 1, 2, or 5; or

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

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

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

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

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

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

S.1.4. Value of Other Units of Measure.

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

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

- (a) meters and decimal submultiples of a meter;**
- (b) feet and inches; or**
- (c) feet and decimal submultiples of a foot.**

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

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

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

- (a) Vehicle speed is below the minimum or above the maximum system specified speed.**
- (b) The maximum number of vehicle axles as specified has been exceeded.**
- (c) A change in vehicle speed greater than that specified has been detected.**
- (d) Imbalanced weight between the left and right wheels has exceeded the specified values.**
- (e) Vehicle has changed lanes between or in the proximity of the first and the last sensors.**
- (f) Any axle or wheel, or part of each is not on the load-receiving element of the sensors.**
- (g) Vehicle direction of travel is not valid for the installation.**

S.1.7. Recorded Representations.

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

- (a) transaction identification number;**
- (b) station ID;**
- (c) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in motion);**
- (d) vehicle speed;**

- (e) number of axles;
- (f) weight of each axle;
- (g) identification and weight of axle groups;
- (h) axle spacing;
- (i) gross vehicle weight;
- (j) total vehicle length;
- (k) all fault conditions that occurred during the weighing of the vehicle, as identified in paragraph S.1.6. Identification of a Fault;
- (l) violations, as identified in paragraph S.2.1. Violation Parameters, which occurred during the weighing of the vehicle; and
- (m) time and date.

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

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

S.2. System Design Requirements.

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

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

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

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

S.3. Design of Weighing Elements.

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

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

S.4.1. Designation of Accuracy. – WIM systems meeting the requirements of this code shall be designated as accuracy Class E.

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

S.5. Design of Balance

S.5.2. Zero-Tracking Device. – A zero-tracking device shall have a range of 4% of the system capacity and operate only when:

- (a) the system is in a no-load condition;**
- (b) is in stable equilibrium; and**
- (c) the corrections are not more than 0.5 d per second; and**

S.5.3. Totalizing Device. – A WIM system may be provided with a totalizing device for determining gross vehicle weight which operates:

- (a) automatically, in which case the instrument shall be provided with a vehicle recognition device defined in S.5.4. Vehicle Recognition/Presence Device; or**
- (b) semi-automatically (e.g., it operates automatically following a manual command).**

S.5.4. Vehicle Recognition/Presence Device. – WIM system which are able to operate without the intervention of an operator shall be provided with a vehicle recognition device. The device shall detect the presence of a vehicle in the weigh zone and shall detect when the whole vehicle has been weighed. WIM system shall not indicate or print the vehicle mass unless all wheel loads of the vehicle have been weighed.

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

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

- (a) 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;**
- (h) minimum and maximum load; and**
- (i) any restrictions specified in the NTEP Certificate of Conformance.**

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

N. Notes

N.1. Test Procedures.

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

- (a) a two-axle, six-tire, single-unit truck or Federal Highway Administration (FHWA) Class 5; that is, a vehicle with two axles with the rear axle having dual wheels;**
- (b) a three-axle, single-unit truck or FHWA Class 6; and**
- (c) a five-axle, single-trailer truck or FHWA Class 9 (3S2 Type).**
- (d) The gross vehicle weights shall be as stated in N.1.2.2. Dynamic Test Loads.**

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

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

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

N.1.1.2. Determining Reference Weights for Axles, Axle Groups, and Gross Vehicle Weight. – The reference weights shall be the average weight value of a minimum of three

static weighments of all single axles, axle groups, and gross vehicle weight on a reference scale before being used to conduct the dynamic tests.

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

N.1.2. Test Loads.

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

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

- (a) a half load condition (60-80% of the legal load limit of the test vehicle) for a minimum of 10 runs per test vehicle type;
- (b) a full load condition (> 85% of the legal load limit for the test vehicle) for a minimum of 20 runs per test vehicle type; and
- (c) When it is anticipated that a system will be used to enforce weight limits for vehicles that may be unloaded, e.g., an unloaded Class 9 vehicle crossing a bridge with a 20 TN maximum capacity, tests shall include unloaded vehicles as part of the test load.

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

The scale shall be tested prior to using it to establish reference test loads per direction from the jurisdiction and in no case more than 4 weeks 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. Multi-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 one single axle or axle group for measurement shall be on the single platform, while other single axles or axle groups shall be off the platform. The gross vehicle weight shall be determined by summing all the single axles and axle groups.

N.1.3.3. 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 two designated speeds.

- (a) at a high speed – posted speed limit (Vmax); and**
- (b) at a low speed – site-specific minimum speed, not below manufacturer’s requirement (Vmin).**

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

N.1.6. Test Procedures.

N.1.6.1. Dynamic Load Test. – The dynamic test shall be conducted using the test vehicles defined in N.1.1. Selection of Test Vehicles and at the load condition as stated in N.1.2. Test Loads and at the speed as stated in N.1.4. Test Speeds. The number of runs shall be per Table N.1.5.

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

Note. Any vehicle records identified as fault conditions listed in S.1.6. Identification of a Fault or jurisdiction defined fault conditions shall be excluded from the minimum weight readings in N.1.5.1. Dynamic Load Test.

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

<u>Table N.1.6</u>	
<u>Minimum Number of Test Runs per Each Test Vehicle</u>	
<u>Load Condition</u>	<u>Speed</u>
<u>Half Load (10 runs)</u>	<u>High Speed Vmax (5 runs)</u>
	<u>Low Speed Vmin (5 runs)</u>
<u>Full Load (20 runs)</u>	<u>High Speed Vmax (10 runs)</u>
	<u>Low Speed Vmin (10 runs)</u>

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

T. Tolerances

T.1. Principles.

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

T.2. Tolerance Values for Accuracy.

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

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

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

<u>Table T.2.3.</u> <u>Maintenance Tolerances for Accuracy</u>	
<u>Load Description*</u>	<u>Tolerance as a Percentage of Applied Test Load</u>
<u>Axle Load</u>	<u>± 20 %</u>
<u>Axle Group Load (including bridge formula)</u>	<u>± 15 %</u>
<u>Gross Vehicle Weight</u>	<u>± 10 %</u>
<u>* All weight readings shall be 100% in compliance.</u>	

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

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

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

T.3.2. Temperature Effect on Zero-Load Balance. – The zero-load indication shall not vary by more than one division per 5°C (9°F) change in temperature.

T.3.3. Power Supply. – System shall satisfy the tolerance requirements in Table T.2.3. Maintenance Tolerance for Accuracy under voltage ranges of -15% to +10% of the marked nominal line voltage(s) at 60 Hz or the voltage range marked by the manufacturer at 60 Hz. The battery-operated systems shall satisfy the tolerance requirements in Table T.2.3.

Maintenance Tolerance for Accuracy when the battery power output is not excessive or deficient.

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

UR. User Requirements

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

UR.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.

<u>Table 1.</u> <u>Typical Class or Type of Device for Weighing Applications</u>	
<u>Class</u>	<u>Weighing Application</u>
<u>E</u>	<u>Enforcing of vehicles based on axle, axle group, and gross vehicle weight.</u>

UR.2. Installation and Maintenance.

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

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

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

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

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

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

Add the following definitions to Appendix D:

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. [2.26]**

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

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

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

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. [2.26]**

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

NIST OWM Detailed Technical Analysis:

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

This item was originally submitted in August 2022 and was given an Informational status at the 2023 Interim meeting. Since the submittal of the item in 2022, the submitters have worked with the S&T Committee and NIST OWM to address concerns heard from stakeholders.

During this time, NIST OWM provided the submitters with a list of concerns and a gap analysis comparing the proposal to the Scale code in Handbook 44 and OIML R 134 *Automatic instruments for weighing road vehicles in motion and measuring axle loads*. With the proposal under consideration, the submitters have addressed most major concerns identified by our office.

The proposal under consideration:

- Leaves the existing code for screening WIM systems in section 2.25. untouched.
- Includes tanker trucks and empty trucks as reference vehicles, where applicable (N.1.2.2.).

NIST OWM Analysis
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- Includes similar requirements (e.g., voltage variation, definition of acceptance tolerance) as are applicable to scales under section 2.20. of Handbook 44 (e.g., T.2. & T.3.).
- Includes guidance when considering penalties for overweight vehicles (UR.4.).
- Does not include any requirements regarding the provision of evidence to support unattended operation as this is deemed to fall outside the scope of Handbook 44. The requirement regarding the required evidence for unattended operation is left up to the state's enforcement body.
- Does not include multiple accuracy classes as that could hinder uniformity among the states that implement WIM systems for direct enforcement.

The remaining concern is with paragraph N.1.3. Reference Scale which allows the use of a single platform vehicle scale to establish the weight of the axles and axle-groups of the reference vehicle. This method would require an individual axles or axle-group to be isolated when determining their weight. This may work for a vehicle with two sets of axles or the front and rear axles of a vehicle with more than two axles but how would you isolate the remaining axles on vehicles with more than two sets of axles?

OWM understands the need for flexibility. Our concern is that it may introduce uncertainty into the process of determining reference weight values.

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. They 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. They 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. They

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. They confirmed this is for law enforcement and not commercial weighing and the submitters have worked with NIST and a multitude of states. They also 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 $\pm 10\%$ but it also says $\pm 6\%$.

Jess Helmlinger addressed Matt Douglas's comments and clarified the 6% is for gross vehicle weight with a 95% compliance. They 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 Manufacturers 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 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. They 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. They also 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.

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

At the 2023 WWMA Annual Meeting, a presentation was given from the submitters of this item regarding updated language provided for consideration and posted on the WWMA website, Events – Meeting Documents – WIM.23-1 Proposed Language. The submitters spoke to:

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

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

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

The committee posed the following questions:

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

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

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

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

- Can the submitter provide data to support the $\pm 10\%$ to 20% tolerance range?

The submitter response clarified the intent of the use of the device is for dynamic and not static weighing. Scales currently function at a lower range of 6% but the addition of the 100%

compliance is to justify the tolerance. It was expressed the intention of the proposed code is to enforce grossly overweight vehicles.

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

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

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

Cory Hainy (SMA) raised concern regarding tolerances specifically whether OIML R 134-1 standards were considered.

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

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

Tanvi Pandya (New York DOT) clarified this is a dynamic test and supports the tolerances as written.

Aaron Yanker (Colorado Dept. Ag Weights and Measures) questioned the note in Table 1. The submitter responded the note regarding the higher accuracy class is original language of the item.

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

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

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) supported this item.

Tim Chesser (Arkansas) stated that he liked the language on page 167 lines 25-28. They asked why strike paragraph B and they also cited some errors on page 170.

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

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.

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

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

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

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

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

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

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

John Stokes (South Carolina) agreed with Arkansas in opposition to the item. Robert Huff (Delaware) stated this item will result in numerous complaints that they will not be able to handle.

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

The Committee recommends the item remain as an Informational item.

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. They 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 the system will be tested to a 6 % tolerance and fines would be issued at 10 %.

Jim Willis (New York) stated their 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. Roy Czinku (International Road Dynamics) 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 and 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 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.

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

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, Hani 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 C.F.R. 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 and formatting needs fixed. Don't get rid of the current screening aspect of the tentative code. They supported this item moving on its own and not take away the ability of jurisdictions to use the tentative code for screening. They suggested adding 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 SMA opposed this item with the following concerns:

- Highway weight enforcement scales are already defined as Class III 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 III 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.

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

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

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

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

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 III 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 III 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-24.1 N.4. Normal Tests

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

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

Submitter’s Purpose and Justification:

Provide clarity to 3.30. Liquid—Measuring Devices, N.4.1. Normal Tests. The existing code requirement is very wordy and difficult to understand without an example and a formula. This proposal adds an example and formula that will give clarity to N.4.1. Normal Tests.

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

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

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

The submitter requested Voting status in 2024.

NIST OWM Executive Summary for LMD-24.1 – N.4. Normal Tests
<p>NIST OWM Recommendation: Voting with recommended changes.</p> <ul style="list-style-type: none">For the 2024 edition of NIST Handbook 44, OWM made editorial changes to this paragraph based on a request from the submitter of this item. This is the how the paragraph now appears in the handbook: <p>N.4.1. Normal Tests. – The “normal” test of a device shall be made at the maximum discharge flow rate developed under the conditions of installation. Any additional tests conducted at flow rates down to and including one-half of the sum of the maximum discharge flow rate (MDRF) and the rated minimum discharge flow rate (RMDFR) shall be considered normal tests. As a formula, this is stated as:</p> $\frac{MDFR+RMDFR}{2} = \text{minimum discharge flowrate for additional tests}$ <p>(Amended 1991 and 2023)</p> <ul style="list-style-type: none">For added clarification we suggest adding the word “normal” between the words “additional” and “tests” in the formula so it would appear as follows:

$$\frac{MDFR+RMDFR}{2} = \text{minimum discharge flowrate for additional } \textit{normal} \text{ tests}$$

- To be consistent with other examples currently in NIST Handbook 44, OWM suggests the following format for the example proposed by the submitter:

Example: If, under the conditions of installation, a device has a maximum discharge flow rate (MDFR) of 9 gpm and a rated minimum discharge flow rate (RMDFR) of 0.5 gpm, using the above formula the minimum discharge flow rate for additional normal tests is calculated as follows:

$$\frac{9 \text{ gpm} + 0.5 \text{ gpm}}{2} = 4.75 \text{ gpm}$$

For this device any test conducted at a flow rate of 9 gpm down to and including 4.75 gpm is considered a normal test and the acceptance or maintenance tolerances referenced in Table T.2. Accuracy Classes and Tolerances for Liquid Measuring Devices covered in NIST Handbook 44, Section 3.30. are applicable.

Tests conducted below the minimum discharge flow rate for additional normal tests are considered “special” tests and shall be conducted as described in N.4.2. Special Tests. The special test tolerances referenced in Table T.2. Accuracy Classes and Tolerances for Liquid Measuring Devices covered in NIST Handbook 44, Section 3.30. are applicable.

- If the S&T Committee accepts the format for the example suggested by OWM, our office will support this item for adoption.
- OWM notes that in the Item Under Consideration the proposed new language is in in bold type and should be edited as such so it is clear to the reader that this is new language.

**Table 2. Summary of Recommendations
 LMD-24.1 – N.4. Normal Tests**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		With suggested edits
WWMA		4	
NEWMA	Voting		
SWMA		4	
CWMA		4	
NCWM			
	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 Liquid Measuring Devices Code as follows:

N.4. Testing Procedures.

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

(Amended 1991)

Example:

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

$$\frac{\text{Max discharge flow rate} + \text{rated min discharge flow rate}}{2} = \text{minimum discharge flow rate}$$
- **In this example $\frac{9 \text{ gpm} + 0.5 \text{ gpm}}{2} = 4.75 \text{ gpm}$. Therefore, flow rates of 9 gpm down to and including 4.75 gpm are considered normal tests.**
(Added 202X)

Regional Association Reporting:

Western Weights and Measures Association

Central Weights and Measures Association

Southern Weights and Measures Association

Northeastern Weights and Measures Association

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

VTM – Vehicle Tank Meters

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
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<p>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.</p>
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| <ul style="list-style-type: none">• One of the concerns raised 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.• Aaron Yanker (Colorado) is listed on the NCWM website as the Milk Meter Task Group Chair. NIST OWM will look forward to more discussion of this item during task group meetings. |
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Table 2. Summary of Recommendations
VTM-20.2 – Table T.2. Tolerances for Vehicle Mounted Milk Meters

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Assigned		
WWMA	Assigned		
NEWMA	Withdrawn		
SWMA	Assigned		
CWMA	Assigned		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments
Industry		4	Agri-Mark, Dean Foods, Dairy Farmers of America, Danone North America
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 and 20XX)

Table 2. Tolerances for Vehicle-Mounted Milk Meters

Indication (gallons)	Maintenance Tolerance (gallons)	Acceptance Tolerance (gallons)
100	0.5	0.3
200	0.7	0.4
300	0.9	0.5
400	1.1	0.6

Indication (gallons)	Maintenance Tolerance (gallons)	Acceptance Tolerance (gallons)
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:

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

Collected volume	Proposed Tolerance		Current NIST Tolerance		Proposed Tolerance		Current NIST Tolerance	
	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 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 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 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 metering systems?

During the 2019 NCWM Interim Meeting another company stated that they met the current tolerances in NIST 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 and 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 **and 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 processor (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:

Aaron Yanker

Program Administrator

aaron.yanker@state.co.us

Phone number: (719) 250-1851 Fax number: (303) 466-2860

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 today's 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.

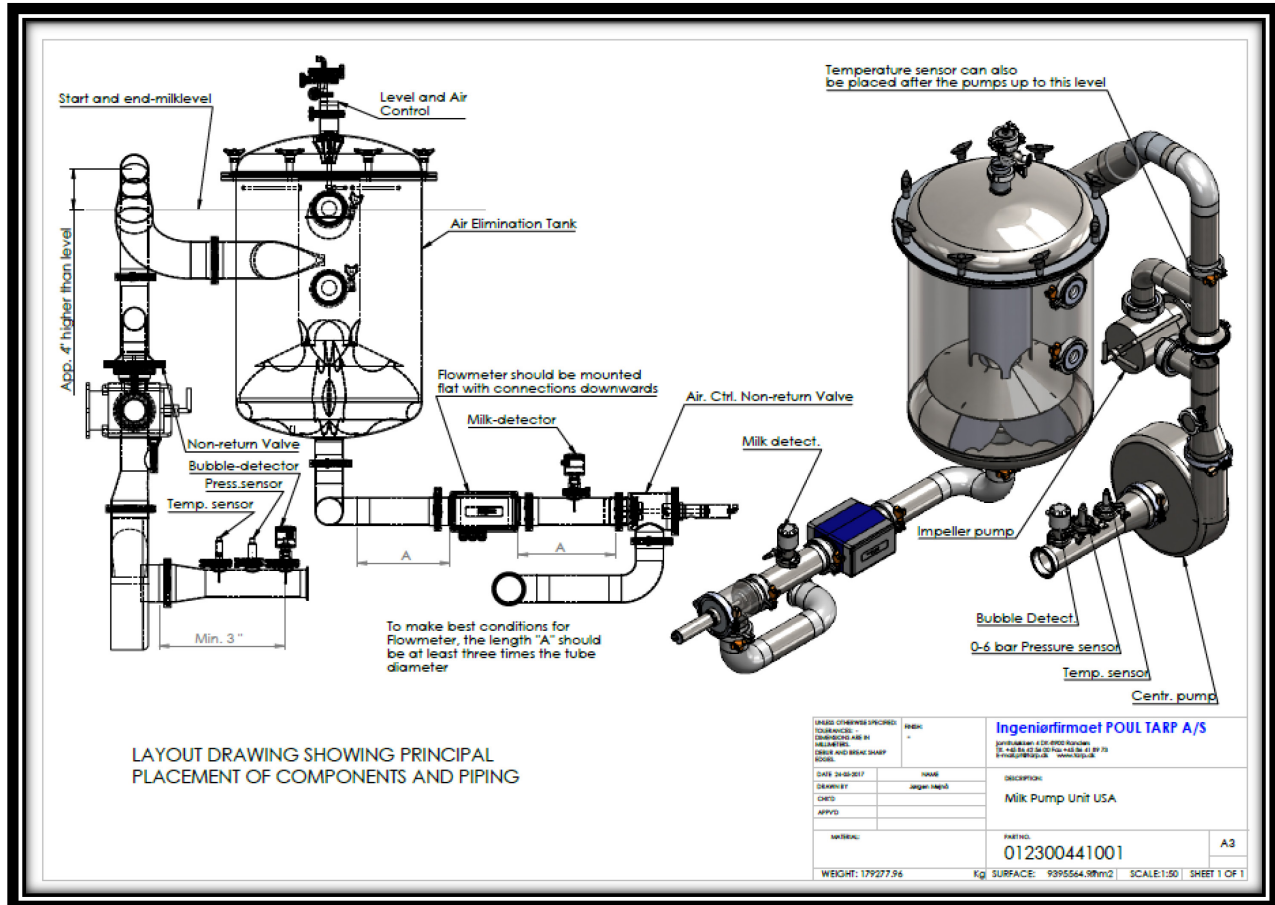
We hope that the NCWM will consider our proposal and we will be more than happy to meet with you and answer any questions you may have. We believe that a change of Tolerance is necessary in order for the Handbook 44 to reflect today's milk collection and the technical progress within milk collection.

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

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 their company's VTM milk metering system advocating for expanding tolerances for these systems.

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Leigh Hamilton (Piper) provided a presentation concerning the piper system and stated in their presentation that Piper currently has an approved NTEP certificate for their device that is in service in the U.S. Leigh Hamilton opposed this item to increase the tolerances for milk meters and noted in their 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) 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. They also noted that Piper's certificate should be amended to qualify the system for draft sizes up to 300 gallons. Michael Keilty (Endress + Hauser) commented with 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 NIST 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 may 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 Schnepf (California) stated that although they are opposed to relaxing existing tolerances, they supported 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 TG 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. They 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. They 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. They 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 <u>0.6</u>	0.3 <u>0.5</u>
200	0.7 <u>1.2</u>	0.4 <u>1.0</u>
300	0.9 <u>1.8</u>	0.5 <u>1.5</u>
400	1.1 <u>2.4</u>	0.6 <u>2.0</u>
500	1.3 <u>3.0</u>	0.7 <u>2.5</u>
Over 500	Add 0.002 <u>0.006</u> gallons per indicated gallon over 500	Add 0.001 <u>0.005</u> gallons per indicated gallon over 500

At the NCWM 2022 Interim Meeting, Charlie Stutesman (Chair of the Milk Meter TG) requested that this item be assigned back to the TG for further development. They provided an update on the TG 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 TG’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 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. They noted that the active four have a range of 0.12 % to 0.6 %. They 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 TG should work toward making all test methods uniform. Diane Lee also suggested that the TG 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. They mentioned the TG continues to support proposed tolerances as provided in the Item Under Consideration. They also noted that the goal is consistency of the tolerances for milk meter measuring. TG Chair Stutesman 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, 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 WWMA Annual Meeting, Diane Lee provided an update from the NCWM meeting. Diane Lee noted that the Milk Meter Task Group is still in the process of reviewing the item. The item was put forth for a vote at the NCWM but a last-minute change to make it non retroactive was made. Questions were raised as to what would happen to devices that are currently in the field? During the NCWM Annual Meeting this item was removed from the voting calendar and given a Developing status and NIST supported the Developing status.

The WWMA S&T Committee recommended the status remain Developing. During the 2021 S&T Work Session Diane Lee was asked for further clarification on their testimony and 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 WG.

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.

At the 2023 WWMA Annual Meeting, Aaron Yanker (Milk Meter Tolerance Task Group) updated the body, there is currently no Chairman of the Task Group and no updates provided.

The WWMA 2023 S&T Committee recommends this item remain Assigned to the NCWM Milk Meter Tolerance Task Group for further development and look forward to a Chair being assigned and an update provided. This Committee also recommends this item be blocked with MLK-23.2.

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, Matt Curran (Florida) stated they had concern 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 TG 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? 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 TG and they indicated that the TG 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 TG 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.

During the 2023 Interim Meeting the State of New Jersey stated that the Task Group still does not have a Chair, despite several requests from the NCWM S&T Committee, that manufacturers can meet the tolerances currently in the handbook, they recommended withdrawal. Massachusetts, Pennsylvania, and New York concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

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 Ammonia Liquid-Measuring Devices

LPG-23.1 | 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
<p>NIST OWM Recommendation: Withdrawn</p> <ul style="list-style-type: none">• Zero set-back interlock ensures that a device is returned to zero before another customer or services person uses the device for another transaction thus preventing the facilitation of fraud per G-S.2. Facilitation of Fraud.

NIST OWM Executive Summary for LPG-23.1 – S.2.5. Zero-Set-Back Interlock	
<ul style="list-style-type: none"> • 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 “<i><u>Devices Used Exclusively as</u></i>” 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 or diesel. The devices that dispense these products are required to have a zero-setback interlock and are sometimes used to fill containers used for filling gasoline or diesel-powered equipment. Granted, the majority of these 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? 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 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	Withdrawn		

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

WWMA	Withdrawn		
NEWMA	Informational		
SWMA	Withdrawn		
CWMA	Withdrawn		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association			
Regulatory		1	California Dept. of Ag, Div. of Measurement Services

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

[Nonretroactive as January 1, 2021]

(Added 2019) (Amended 2021 **and 20XX**)

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

(Added 20XX)

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

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the

indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;

- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and*
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.*
[Nonretroactive as of January 1, 2017]

(Added 2016)

(Amended 20XX)

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. They 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 Schnepf (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.

At the 2023 NCWM Annual Meeting, Konrad Pilatowicz (U-Haul International) explained that U-Haul submitted this item to create a balance and to have consistency among motor fuel dispensers. They feel the item makes sense and suggested it be made retroactive instead of non-retroactive.

Loren Minnich (NIST OWM) recommended downgrading to Informational status to allow additional discussion, if adopted would exempt any LPG RMFD not used exclusively for fueling vehicles, electronic or analog, which may effectively exempt all LPG meters. In the justification the submitter states “existing dispenser systems... 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. This is a nonretroactive (NR) requirement, so it only applies to those devices manufactured after the NR date, new or used device brought into a state after the NR date, devices placed into commercial service after NR date (previously noncommercial), or devices going through the NTEP evaluation after NR date. Is this proposal equitable to RMFD that dispense other products? If the item remains voting OWM does not support its adoption.

Scott Johnson said U-Haul supports the proposed changes and has approximately 1200 locations that fill motor fuel and cylinders. They believe that at some point in the future, customers will be able to fill their own cylinders. Automotive applications are about 3 % of U-Haul’s business. Their opinion is the word “exclusive” suggests that it is a dedicated system. They also stated that the nozzles used do not allow cylinder to be filled.

Stephen Benjamin (North Carolina) stated they are opposed to the item and agrees with NIST OWM that it should be downgraded to Informational status. They also stated that there are currently products on the market that can meet requirements. This is a carve out for a specific product and has not gone through the NTEP process. They agreed that the nozzle cannot be used to fill a cylinder currently but that could change in the future.

Matt Douglas (California Division of Measurement Standards) shares the concerns stated by NIST OWM and North Carolina.

Scott Simmons supports adoption, LPG is “clean” fuel and has infrastructure in place, NIST HB 44 prohibits diversion of (measured) liquid, the devices that this requirement applies to is evident to inspectors.

Bruce Swiecicki (National Propane Gas Association) supports adoption. Konrad Pilatowicz will provide clarifying language to the committee. They are not aware of any instances of fraud and that this helps the industry move forward to support the use of alternative fuels.

Dmitri Karimov agrees with NIST OWM that the item should be downgraded to Informational status. Dmitri Karimov (representing Liquid Controls) understands issue and why U-Haul & NPGA have concerns.

Steve Timar (New York) echoes comments made by NIST OWM and supports moving to Informational status.

Based on the comments heard during open hearings regarding the lack of clarity related to the phrase “Devices Used Exclusively as” and the application of this item if adopted, Bruce Swiecicki provided the Committee the following language and requested it replace the Note under S.2.5.1. in the item under consideration:

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

The Committee discussed this during the Committee work session and agreed to update the item with the new Note and retained the Voting status of the item. The item appeared in the Addendum as follows:

S.2.5. Zero-Set-Back Interlock.

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

[Nonretroactive as January 1, 2021]

(Added 2019) (Amended 2021)

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

(Added 20XX)

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

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;*
- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and*
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.*
[Nonretroactive as of January 1, 2017]
(Added 2016)

During the discussion of the item during the voting session, Matt Douglas stated that the item might be interpreted to either require the K15 connection for devices used to fuel vehicles or to only apply to devices that have the K15 connection. Matt requested that the status of the item be changed to Informational to allow further consideration.

Scott Simmons said he supported the item as presented.

Loren Minnich expressed appreciation for the additional clarification the note now provides but agreed with Matt Douglas that it would potentially limit the application of this paragraph to those devices with a K15 connection and not devices that are used to exclusively fuel vehicles. Because this could change both the application and scope of the paragraph, Loren also requested the status of the item be changed to Informational.

The Committee requested a short recess to confer and decided to change the status of the item to Informational.

Regional Association Reporting:

Western Weights and Measures Association

During the 2022 WWMA Annual Meeting, Konrad Philatowicz 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 and they asked that this be a Voting item at the NCWM 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.

At the 2023 WWMA Annual Meeting comments were heard from California, Colorado, and Oregon supporting a Withdraw of this item in lieu of LPG-24.1, LPG-24.2, and OTH 24.1.

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

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.

At the 2023 SWMA Annual Meeting, Stephen Benjamin stated they opposed this item. The Committee recommends this Item be Withdrawn.

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 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.

At the 2023 NEWMA Interim Meeting, Pennsylvania, Massachusetts, New York, and New Jersey recommend this item be informational. Upon consensus of the body, the Committee recommends this item be Informational.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, there were 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.

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Withdrawn as we believe the attempted revision of this item was actually a resubmission listed under item LPG 24.2. The Committee recommends that the discussion history for this item be moved to LPG 24.2. These recommendations are intended to clean up what we perceive to be an administrative error in that LPG 24.2 should not have been created but should have been an update to this item (LPG 23.1).

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

Source: National Propane Gas Association

Submitter’s Purpose and Justification:

The proposal is a companion to the main proposal to modify 3.32, S.2.5.1 and S.2.5.2, and the proposal to change the definition of Liquefied Petroleum Gas Retail Motor-Fuel Device. The purpose of this proposal is to correlate the terminology in 3.32 for LP-gas and use only the defined term as proposed in the companion proposal.

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

The submitter requested Voting status for these items in 2024.

<p><u>NIST OWM Executive Summary for LPG-24.1 – S.1.5.7. Retail Motor Fuel Dispenser Liquefied Petroleum Gas Retail Motor Fuel Device</u>, S.2.6.1. Electronic Stationary (Other than Stationary Retail Motor Fuel Dispensers Liquefied Petroleum Gas Retail Motor Fuel Device). S.6.2. Automatic Timeout Pay-at-Pump Retail Motor Fuels Devices Liquefied Petroleum Gas Retail Motor Fuel Device, and S.4.3. Location of Marking Information: Retail Motor Fuel Dispensers Liquefied Petroleum Gas Retail Motor Fuel Device.</p>
<p>NIST OWM Recommendation: Withdraw</p> <ul style="list-style-type: none">• The definition of “liquefied petroleum gas retail motor-fuel device” was added in 2022 for inclusion in the 2023 edition of NIST Handbook 44. Currently the definition recognizes the terms “retail motor-fuel dispenser” and “retail motor-fuel device” to be the same as and interchangeable with “liquefied petroleum gas retail motor-fuel device”.• OTH-24.1. proposes amending this definition to apply only to those devices with a K15 nozzle. OWM <u>does not</u> support this change.• If OTH-24.1 is withdrawn, OWM could support these proposed changes as it would replace various terms with one term that is defined and applies to this section of the handbook.• This item should be blocked with LPG-24.2 and OTH-24.1 if they remain on the agenda.

Table 2. Summary of Recommendations
LPG-24.1 – S.1.5.7. ~~Retail Motor Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor Fuel Device, S.2.6.1. ~~Electronic Stationary (Other than Stationary Retail Motor Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor Fuel Device), S.6.2. ~~Automatic Timeout Pay-at-Pump Retail Motor Fuels Devices~~ Liquefied Petroleum Gas Retail Motor Fuel Device, and S.4.3. ~~Location of Marking Information: Retail Motor Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor Fuel Device.

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Withdrawn			
WWMA	Developing			
NEWMA	Developing			
SWMA	Developing			
CWMA	Voting			
NCWM				
	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, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices Code as follows:

S.1.5.7. Totalizers for ~~Retail Motor Fuel Dispensers~~ Liquefied petroleum gas retail motor-fuel device. – ~~Retail motor-fuel dispensers~~ Liquefied Petroleum Gas Retail Motor-Fuel Device shall be equipped with a nonresettable totalizer for the quantity delivered through the metering device. [Nonretroactive as of January 1, 2017]

(Added 2016) (**Amended 20XX**)

S.2.6.1. ~~Electronic Stationary (Other than Stationary Retail Motor Fuel Dispensers~~ Liquefied Petroleum Gas Retail Motor-Fuel Device). – 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 Liquefied Petroleum Gas Retail Motor-Fuel Device – *Once a device has been authorized, it must deauthorize within three minutes if not activated. Reauthorization of the device must be performed before any product can be dispensed. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than three minutes.*

[Nonretroactive as of January 1, 2022]

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

S.4.3. Location of Marking Information; Retail Motor-Fuel Dispensers Liquefied Petroleum Gas Retail Motor-Fuel Device. – *The marking information required in General Code, paragraph G-S.1. Identification shall appear as follows:*

- (a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;*
- (b) either internally and/or externally provided the information is permanent and easily read;
and*
- (c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).*

The use of a dispenser key or tool to access internal marking information is permitted for ~~retail motor-fuel dispensers~~ **liquefied petroleum gas retail motor-fuel device.**

[Nonretroactive as of January 1, 2003]

(Added 2006) (**Amended 20XX**)

NIST OWM Detailed Technical Analysis:

NIST OWM did not provide a detailed analysis for this item.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Greg VanderPlaats (Minnesota) asked if LPG 23.1 needs to pass before this item can be considered. The Committee recommends this item as a Voting item blocked with item OTH 24.1.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively. There was consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in HB 44 which some find

confusing, and possibly merging S.2.5.1 and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be Blocked with LPG-24.2 and OTH-24.1 and that the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter to address the comments heard during open hearings.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, Steve Benjamin (North Carolina) stated they see this item as cleanup and that a follow up item will be needed next year.

The Committee recommends blocking this item with LPG-24.2 and OTH-24.1.

The Committee recommends this item move forward as a Developing item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, New York opposes this item and does not see the need for the changes. Upon consensus of the body, the Committee recommends this item be Developing.

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

Source: National Propane Gas Association

Submitter's Purpose and Justification:

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

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

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

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

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

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

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

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

NIST OWM Executive Summary for LPG-24.2 – S.2.5. Zero-Set-Back Interlock. S.2.5. Zero-Set-Back Interlock

NIST OWM Recommendation: Withdrawn/Developing

- If the item remains as proposed it should be withdrawn or be assigned a developing status.
- OTH-24.1. proposes amending the definition of "liquefied petroleum gas retail motor-fuel device" to apply only to those devices with a K15 nozzle. OWM does not support this change until the K15 connector is the standard for all LPG powered vehicles.
- This item should be blocked with LPG-24.1 & OTH-24.1 if they remain on the agenda.

NIST OWM Executive Summary for LPG-24.2 – S.2.5. Zero-Set-Back Interlock. S.2.5. Zero-Set-Back Interlock	
<ul style="list-style-type: none"> • S.2.5. (later amended and renumbered as S.2.5.2.) was adopted as a nonretroactive requirement taking into consideration that the devices in service prior to adoption could not meet this requirement. • In the justification of this item the submitter asserts that “costly industry-wide retrofits of existing, functioning multi-use equipment” are required. S.2.5.1. and S.2.5.2. were adopted as a nonretroactive requirements to prevent this. • The weights & measures community should carefully consider the impact of making S.2.5.1. retroactive as it was adopted in 2019 with an effective date of January 1, 2021. There may be devices that cannot comply with this requirement which would need to be retrofitted if this item is adopted as proposed. • A search of the NCWM website indicates that there are various retail motor-fuel devices designed to dispense LPG that have an NTEP CC. Those installed after 1/1/2017 are required to have a zero-set-back interlock. • Zero set-back interlock prevents the facilitation of fraud in accordance with G-S.2. Facilitation of Fraud by ensuring a dispenser returns to zero before the next transaction can be initiated whether the transaction is initiated by trained service personnel or a customer filling their own vehicle. • In the justification for OTH-24.1. the submitter acknowledges that not all propane powered vehicles have the K15 connection. Per the U.S. Department of Energy’s website “The National Fire Protection Association (NFPA) Code 58 (beginning with the 2017 version) requires all new vehicles to be equipped with the quick-release “Type K15” connector as of January 1, 2020. The ACME QCC screw-on connector has been used since 1994 for both vehicles and bottle filling.” • Those vehicles that have the older style connection may have no choice but to fill at a station that may not have a device that has a zero-setback interlock. 	

Table 2. Summary of Recommendations
LPG-24.2 – ~~S.2.5. Zero-Set-Back Interlock.~~ S.2.5. Zero-Set-Back Interlock

	Status Recommendation	Note*	Comments
Submitter			No status specified by submitter
OWM	Withdrawn		
WWMA	Developing		
NEWMA	Developing		
SWMA	Developing		
CWMA	Voting		
NCWM			

	Number of Support Letters	Number of Opposition Letters	Comments
Industry			
Manufacturers			
Retailers and Consumers			
Trade Association	1		NPGA (submitter)

***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 Stationary Retail Motor Fuel Dispensers Liquefied Petroleum Gas Retail Motor Fuel Device) and Electronic Vehicle Mounted Meters.— A device shall be constructed so that after an individual delivery or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating element and, if equipped, recording element have been returned to their zero positions.**~~

~~**[Nonretroactive as January 1, 2021]**~~

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

- ~~**(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;**~~
 - ~~**(b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero set-back interlock has been engaged; and**~~
 - ~~**(c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.**~~
- ~~**[Nonretroactive as of January 1, 2017]**~~

S.2.5. Zero-Set-Back Interlock

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

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

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;**
- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and**
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.**

NIST OWM Detailed Technical Analysis:

Both S.2.5.1. and S.2.5.2. were adopted as nonretroactive requirements. Per G-A.6. these paragraphs are only applicable to devices that are:

- (a) manufactured within a state after the effective date;
- (b) both new and used, brought into a state after the effective date;
- (c) used in noncommercial applications which are placed into commercial use after the effective date; and
- (d) undergoing type evaluation, including devices that have been modified to the extent that a new NTEP Certificate of Conformance (CC) is required.

In the Introduction to NIST Handbook 44, Section E. Classification of Requirements. It is stated that “The classification of requirements into “retroactive” and “nonretroactive” status is made in order that the requirements may be put into force and effect without unnecessary hardship and without wholesale condemnation of apparatus...Nonretroactive requirements are those that, while clearly desirable, are not so vital that they should at once be enforced with respect to all apparatus.”

Any LPG dispensing device that was in commercial service prior to January 1, 2017, whether analog, digital, mechanical, or electric, is not required to have a zero-setback interlock whether it is used to fill

tanks, cylinders or vehicles. Analog devices used to only fill cylinders or tanks are not required to have a zero set-back interlock as these specifications are not applicable to these devices. The assertion by the submitter that “costly industry-wide retrofits of existing, functioning multi-use equipment” are required is inaccurate.

Those stationary devices placed into commercial service after January 1, 2017, which are used to dispense LPG into vehicles (retail motor-fuel devices) are required to have a zero set-back interlock. Stationary meters and vehicle tank meters that are electronic and were placed in service after January 1, 2021, are required to have a zero set-back interlock no matter the application. The weights & measures community should carefully consider the impact of making S.2.5.1. as there may be devices that cannot comply with this requirement which would need to be retrofitted if this item is adopted as proposed.

This item is directly affected by the change proposed to the definition of liquefied petroleum gas retail motor-fuel device. OWM does not support limiting this definition to apply only to devices with a K15 nozzle. While LPG powered vehicles manufactured after January 1, 2020 are required to have the “Type K15” connector it is not required on all LPG powered vehicles. Adoption of this item along with OTH-24.1. would create an inequitable situation for owners of LPG powered vehicles. Those without a K15 connector would be unable to use those devices with the K15 nozzle to fuel their vehicles which would be the only devices required to have a zero set-back interlock. Until the K15 connector is required on all LPG powered vehicles OWM cannot support this proposed change.

Zero set-back interlock ensures that a device is returned to zero before the next transaction is initiated. This feature is required on other retail devices including liquid measuring devices, mass flow meters, hydrogen measuring devices, and electric vehicle supply equipment. This would include devices that dispense kerosene which is not considered a fuel typically suitable for vehicles and is used in ways similar to LPG such as heating and cooking.

This is a new item on the S&T agenda. No prior discussion has occurred.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Greg VanderPlaats (Minnesota) asked if there is a concern with one of the LPG items passing and not the others. Should they be blocked together? The Committee recommends this item as a voting item.

The Committee believes that this item is an attempted revision of item LPG 23.1 and should not have been submitted. Now that this item has been submitted, the committee recommends that the discussion history for LPG 23.1 be moved to LPG 24.2. These recommendations are intended to clean up what we perceive to be an administrative error in that LPG 24.2 should not have been created but should have been an update to item LPG 23.1.

Western Weights and Measures Association

During the WWMA 2023 Annual Meeting, comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively.

There was consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in HB 44 which some find confusing, and possibly merging S.2.5.1 and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be Blocked with LPG-24.1 and OTH-24.1 and that the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter to address the comments heard during open hearings.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, Steven Benjamin, North Carolina, asked the Committee to double-check the language used in the agenda because he believed it to be incorrect. The Committee found that the language format was incorrect compared to the language used in the Form 15. The Committee has decided to consider the language and formatting used in the items Form 15.

This language is as follows:

S.2.5. Zero-Set-Back Interlock.

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

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

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;*
- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and*
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the*

indicating elements on that dispenser are in a correct zero position.
~~*{Nonretroactive as of January 1, 2017}*~~

The Committee recommends this item move forward as a Developing item, with the language and formatting used in the Form 15 and suggests blocking the item with LPG-24.1 and OTH-24.1.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, the State of New York opposes this item and does not see the need for the changes, the new wording is no longer in italics and questions if the submitters are suggesting it be retroactive as it is not stated in justification. It was pointed out that this item is similar to LPG-23.1 but does not include U-Haul and the National Propane Gas Association requested withdrawal of LPG-23.1 in this proposal. Upon consensus of the body, the Committee recommends this item be Developing.

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
<p>NIST OWM Recommendation: A review of this item by the Milk Meter Task Group will be useful. We agree with the regions that recommended this item remain Assigned to the Milk Meter Task Group, and when the task group meets the item should be fully vetted by industry and the weights and measures community.</p> <ul style="list-style-type: none">• The Milk Meter Task Group reviewed all the varying tolerances in NIST HB 44 for Milk meters. Instead of keeping a decreasing tolerance as the test draft increases, the Task Group is proposing

NIST OWM Executive Summary for MLK-23.2 – Table T.1. Tolerances for Milk Meters
<p>that the tolerances, as included in the 2024 Interim Meeting Agenda for VTM-20.2 for milk meters, also be adopted in the Milk Meter code.</p> <ul style="list-style-type: none"> • Aaron Yanker (Colorado) is listed on the NCWM website as the Milk Meter Task Group Chair. When the Task Group meets, a review of the item to include a review from affected industry and weights and measures jurisdictions is recommended. • NIST OWM recognizes the comment made by the submitter to consider blocking item MLK-23.1 with VTM-20.2 and a comment to withdraw item MLK-23.1. VTM-20.2 was discussed by the Milk Meter Task Group which included comments from industry and weights and measures jurisdictions and also appeared as a voting item on the S&T agenda. If the items are combined, a recommendation to withdraw MLK-23.2 may affect VTM-20.2.

**Table 2. Summary of Recommendations
MLK-23.2 – Table T.1. Tolerances for Milk Meters**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Assigned		
WWMA	Assigned		
NEWMA	Withdrawn		
SWMA	Assigned		
CWMA	Assigned		
NCWM			
	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, Milk Meters Code, as follows:

T.2. Tolerance Values. – Tolerances shall be as shown in Table 1. Tolerances for Milk Meters.
 (Amended 1989 and 20XX)

Table 1. Tolerances for Milk Meters

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

~~(Added 1989)~~

Table 1. Tolerances for Milk Meters

	<u>Acceptance Tolerance</u>	<u>Maintenance Tolerance</u>
<u>Complete Measuring System</u>	<u>0.5 %</u>	<u>0.5 %</u>
<u>Meter Only</u>	<u>0.3 %</u>	<u>0.3 %</u>

~~(Amended 20XX)~~

NIST OWM Detailed Technical Analysis:

The Milk Meter Task Group reviewed all the varying tolerances in NIST HB 44 for Milk Meters. Instead of keeping a Milk Meters code that is decreasing in tolerance as the test draft increases, the Task Group is proposing that the tolerances as included in the 2024 Interim Meeting Agenda for VTM-20.2 Milk Meter also be adopted in the Milk Meter code.

In accordance with the NCWM website Aaron Yanker (Colorado) is listed as the Milk Meter Task Group Chair. The Task Group should review the proposed changes to the tolerances to ensure full vetting by industry and the weights and measures community.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2022 Annual Meeting, Michael Keilty (Endress+Hauser) alerted the Committee that the TG Chair 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

At 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.

At the 2023 NEWMA Interim Meeting, the State of New Jersey stated that the Task Group still does not have a chair, despite several requests from the NCWM S&T Committee, that manufacturers can meet the tolerances currently in the handbook and recommends withdrawal. The Commonwealths of Massachusetts and Pennsylvania, and the State of New York concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

Central Weights and Measures Association

At the 2022 CWMA 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.

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 fueled correctly and safely.

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

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

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

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

The submitter provided the following links:

- SAE J2601: https://www.sae.org/standards/content/j2601_202005/ (copyrighted)
- ANSI/CSA HGV 4.3 (<https://www.csagroup.org/store/product/CSA%25100ANSI%20HGV%204.3%3A22/>) (copyrighted)

- California Air Resources Board: Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development
- <https://ww2.arb.ca.gov/resources/documents/annual-hydrogen-evaluation> (many reports available, latest is too large to attach)
- EVSE Pre_Rule Wkshop Shared Deck.pdf

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

NIST OWM Executive Summary for NIST HGM-23.1 – UR.3.8. Safety Requirement
<p>NIST OWM Recommendation: OWM has no recommendation until additional data is submitted.</p> <ul style="list-style-type: none"> • 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 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. • NIST OWM looks forward to the reporting from CA DMS and CARB as well as any updates from the submitter to clarify the types of test data available that are the result of compliance testing to the SAE J2601 standard.

**Table 2. Summary of Recommendations
HGM-23.1 – UR.3.8. Safety Requirement**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM		5	More information requested on the impact on dispenser performance and required investment outlay for the proposed test
WWMA	Voting		
NEWMA	Withdrawn		
SWMA	Developing		
CWMA	Withdraw		
NCWM			
	Number of Support Letters	Number of Opposition Letters	Comments

NIST OWM Analysis
 2024 NCWM Interim S&T Agenda Items

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 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 Surface Vehicles, as determined by the latest version of ANSI/CSA HGV 4.3 “Test Methods for Hydrogen Fueling Parameter Evaluation.”
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM looks forward to the reporting from CA DMS and CARB as well as any updates from the submitter to clarify the types of test data available that are the result of compliance testing to the SAE J2601 standard. Also of interest are the logistics and other background information on the testing program. On initial consideration this proposal appears to 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 HB 44, 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 Schnepf (California Division of Measurement Standards) stated California has 68 stations that all require this standard and 33 private stations that do not have this requirement that facilitates accurate and safe fueling. Supports item. Kevin Schnepf 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. They do not question the need but do question if NIST Handbook 44 is the right place for this. Matt Curran 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 2022 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 restated its earlier recommendation for clarifying the term "verification" and that this item remain Developing.

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item be Withdrawn. The Committee questions the merit of this information being provided in Handbook 44 and have not received answers to questions outlined in the historical comments for this item.

Western Weights and Measures Association

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

Kevin Schnepf has worked with the submitter and SAE 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. They 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.

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

During the WWMA 2023 Annual Meeting, Kevin Schnepf (stated that data is being collected by CDFA DMS and CARB. Kevin Schnepf requested that this item remain developing until the data can be provided.

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

Southern Weights and Measures Association

At 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.

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

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

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.

At the 2023 NEWMA Interim Meeting comments were heard that no additional data has been provided as to what the effects on the metrological parameters are. New York, New Jersey, and Holliston, Massachusetts recommended withdrawal.

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

EVF – Electric Vehicle Fueling Systems

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

Source: Siemens Industry Inc.'s Smart Infrastructure eMobility

Submitter's Purpose and Justification:

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

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

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

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

NIST OWM Executive Summary for EVF-24.1 – S.1.3. Mobile Device as Indicating Element for AC Chargers

<p>NIST OWM Recommendation: Withdraw. The EVSE primary display must meet a more comprehensive set of requirements in multiple codes to provide clear, legible, and verifiable transaction information and other metrological data in an appropriate manner.</p>
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| <ul style="list-style-type: none">• NIST OWM does not believe the proposed exceptions are appropriate without more detailed work to fully vet the permissible metrological features and functions for the wide range of software based remote devices to be recognized as the primary indicating elements for these commercial electrical energy measuring systems.• The list of requirements referenced in the proposal (S.1.1., S.1.2., S.2.4.1, S.2.6, S.2.7, UR.1.1., and UR.3.1.) is not all inclusive of the paragraphs in NIST HB 44 applicable to |
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NIST OWM Executive Summary for EVF-24.1 – S.1.3. Mobile Device as Indicating Element for AC Chargers

indicating elements. There are additional requirements in Sections 1.10. General Code, 3.40. Electric Vehicle Fueling Systems and 5.55 Timing Devices that apply to an EVSE display that is an integral part of the electrical energy dispensing system or when a single display is used by multiple EVSEs. Therefore, additional accompanying requirements need to be developed for clarity and to fully recognize the proposed options for primary displays.

- It was suggested prior to the code’s adoption in 2016, to identify those paragraphs which are posing difficulties for some manufacturers to meet and possibly making those paragraphs non-retroactive, with an eventual sunset date, rather than proposing an exception to the entire code.
- Likewise, OWM also suggested that exceptions are sometimes made for certain applications which are able to meet a requirement in a different way through other mechanisms such as a contract or other price agreement or fleet sales.
- An additional concern, with regard to equity, is that companies have spent money to comply with display requirements and after 2024 would be competing with a population of existing noncompliant equipment and new equipment which will not have to be equipped in the same manner with a primary display.
- The proposal is unclear if the devices running those apps are a necessity for the operation of the charging equipment although the proposal specifies the location of the handheld device or vehicle as “being in the immediate vicinity of the EVSE” and yet there is no mention of their availability over the entire course of the transaction given a session can take twenty minutes or multiple hours to complete.
- The open-ended nature of the types of devices that fall under this category means a wide variety of handheld devices or vehicles would be part of the type evaluation process where their accuracy and clarity become more critical to the measurement transaction.
- If they are the only EVSE primary display these newly recognized devices will be the means for accessing the device/system metrological security information which can be sizable, and determining fuel quantity totals.
- With some further work “Apps” installed on a mobile device might provide the best opportunity for allowing for innovation since there is a mechanism for reviewing the display provided by the app and ensuring its operation provides the necessary information.
- The vehicle user interface, on the other hand, is somewhat problematic. They can vary from manufacturer to manufacturer and will undoubtedly change from year to year. How will the operator or regulatory official verify transaction information if vehicle user interface is the only means available for verification of this information? Will drivers be asked to voluntarily assist in inspections and complaint investigations, or will a car be provided as part of the official’s tool kit? The code will need to address this, and it will be necessary to ensure type evaluation can adequately address this.
- How would the overall provisions of the General Code regarding legibility, clarity, and appropriateness of indications be applied when there is no display unique to a given EVSE on-

NIST OWM Executive Summary for EVF-24.1 – S.1.3. Mobile Device as Indicating Element for AC Chargers	
<p>site? The code addresses the EVSE as the intended point at which commercial measurements of electrical energy and related time fees are being made rather than the handheld device or EV.</p> <ul style="list-style-type: none"> • Will there be unique or common vulnerabilities to factors such as levels of service, temperature, connectivity, etc. For traditional vehicle fuel dispensers and other alternative vehicle fuel dispensers weather and normal wear issues are managed through equipment and station design and maintenance programs. • The submitter cites the concept of “Plug and Charge” that is part of ISO 15118 but has not provided information on the exact relevance/application to legal metrology requirements that apply. • Currently EVF-24.1 is a proposal for a new requirement but the letter-number paragraph designation of S.1.3. is already part of the existing code and is titled EVSE Units. Does the submitter intend the proposal to replace existing code; be part of indicating element requirements already included in the code; or have a new letter-number designation? 	

**Table 2. Summary of Recommendations
EVF-24.1 – S.1.3. Mobile Device as Indicating Element for AC Chargers.**

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Withdraw			Expand to fully address all other interconnected display requirements
WWMA	Developing			
NEWMA	Developing			
SWMA	Withdrawn			
CWMA	Developing			
NCWM				
	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, Electric Vehicle Fueling Systems as follows:

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

(Added 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM does not believe the proposed exceptions are appropriate without more detailed work to fully vet the permissible metrological features and functions for the wide range of software based remote devices to be recognized as the primary indicating elements for these commercial electrical energy measuring systems. The proposal lists five design requirements and two requirements the operator of the EVSE currently must meet for the display (indicating element) to function properly and to provide sales transaction and power level information at specific points during the transaction for an electrical energy charging session. Given some categories of these handheld/vehicle devices will be running other apps, vehicle information, etc. whereas currently commercial measuring equipment was required to maintain weights and measures functions and information separate from other programs running or stored on the device/system. This list of requirements is not all inclusive of the NIST HB 44 Section 1.10 General Code and remaining Section 3.40 EVSE code requirements that currently make up the minimum handbook requirements for an EVSE display when an integral part of the electrical energy dispensing system or single display used by multiple EVSEs. Those code paragraphs required to be met in the proposal do not encompass the entire range of display capability and features assessed during type evaluation based on the General Code nor the 5.55 Timing Devices Code for EVSEs that assess fees for time related services that are associated with electrical energy charging sessions. Therefore, additional accompanying requirements need to be developed for clarity and to fully recognize the proposed options for primary displays. The proposal would make it permissible for a software application when in use on either a handheld device or in the vehicle refueling with electrical energy in proximity to the EVSE to be used to meet seven requirements for display and or recording as well as computing specific transaction information.

Handheld devices and vehicle displays would currently be recognized as supplemental ways of displaying transaction information but not as the primary display. Agenda Item EVF-24.1 is a new 2024 proposal which if adopted by the July 2024 NCWM would from that point onward be enforceable for all AC EVSE systems regardless of when they were manufactured or placed into commercial use. Handheld devices and vehicle displays would be recognized for use to a limited degree as primary displays for AC EVSEs. It was suggested several times to the Subgroup that developed the EVSE code requirements when the code was first proposed for adoption in 2016, to identify those paragraphs which are posing difficulties to some manufacturers to meet and proposing they be made non-retroactive, with an eventual sunset date rather than proposing an exception to the entire code. Likewise, OWM also suggested that exceptions are sometimes made for certain applications which are able to meet a requirement in a different way through other mechanisms such as a contract or other price agreement or fleet sales. An additional concern is that

companies spent money to comply with display requirements and after 2024 would be competing with a population of existing noncompliant equipment and new equipment which will not have to be equipped in the same manner with a primary display.

The proposal is unclear if the devices running those apps are a necessity for the operation of the equipment although the proposal specifies the location of the handheld/vehicle device “being in the immediate vicinity of the EVSE” and yet there is no mention of their availability over the entire course of the transaction given a session can take twenty minutes or multiple hours to complete.

The concept of recognizing a remote type of indicating element other than a display that is either an integral part of the dispenser or is part of system and used to provide information for multiple EVSEs has been discussed but not as part of national discussions. Currently, the proposal presents a short list of remote devices, but might this proposal be an opening for much broader interpretation on what constitutes a handheld device. The open-ended nature of the types of devices that fall under this category means a wide variety of handheld devices would be part of the type evaluation process where their accuracy and clarity become more critical to the measurement transaction. If they are the only EVSE primary display these newly recognized devices will be the means for accessing the device/system metrological security information which can be sizable and determining fuel quantity totals.

With some further work “Apps” installed on a mobile device might provide the best opportunity for allowing for innovation since there is a mechanism for reviewing the display provided by the app and ensuring its operation provides the necessary information. The vehicle user interface, on the other hand, is somewhat problematic. They can vary from manufacturer to manufacturer and will undoubtedly change from year to year. They are not included in type evaluations nor are they realistic for regulatory officials to control to ensure clarity, accuracy, and transparency in the measurement transaction. If a user interface is to be used as a primary display (rather than simply an additional display), the code will need to address this, and it will be necessary to ensure type evaluation can adequately address this. How will the visibility and clarity of the primary display be verified since this can vary from vehicle manufacturer to vehicle manufacturer? The vehicle interface should not be provided as an option to satisfy the requirements for the primary display. How would the overall provisions of the General Code regarding legibility, clarity, appropriateness of indications be applied when there is no display unique to a given EVSE on-site? The code addresses the EVSE as the intended point at which commercial measurements of electrical energy and related time fees are being made rather than the handheld device or EV.

The device codes are developed with the equipment manufacturer, regulatory official, customer, and seller in mind. How will the operator or regulatory official verify transaction information if vehicle user interface is the only means available for verification of this information? Will drivers be asked to voluntarily assist in inspections and complaint investigations, or will a car be provided as part of the official’s tool kit? In some respects, the indicating element is no longer in the possession of the owner/operator of the device.

Will there be unique or common vulnerabilities to factors such as levels of service, temperature, connectivity, etc. It should be noted that other alternative vehicle fuel dispensers provide a primary display which are maintained under weather conditions and normal wear. For traditional fuel and alternative fuel dispensers weather issues are managed through equipment and station design and maintenance programs. EVSEs have moved from home charging into the marketplace where there may not be a station attendant on duty during all operating hours to address environment and wear on frequently used parts of the system. The submitter cites an international standard which introduced the concept of “Plug and Charge” that is not in effect nationally, as part of the justification for recognizing handheld/vehicle devices with apps as the primary display for EVSEs but has not provided information on

the exact relevance/application of ISO 15118 to legal metrology requirements that apply. The submitter has provided no details on the standard's effect on how the regulatory official and manufacturer will determine, based on compliance with this international standard, the electric vehicle fueling system's compliance to requirements in the General Code, EVFS, and Timing Devices Codes.

Currently EVF-24.1 is a proposal for a new requirement but the letter-number paragraph designation of S.1.3. is already part of the existing code and is titled EVSE Units. Does the submitter intend the proposal to replace existing code; be part of indicating element requirements already included in the code; or have a new letter-number designation?

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Developing and seeks input from industry stakeholders.

During the WWMA 2023 Annual Meeting, general comments were heard on the floor from Chris King (Siemens), Francesca Wahl (Tesla), Kevin Schnepf (CA Division of Measurement Standards), Jose Arriaga (Orange County Agriculture Weights and Measures, CA), Mike Brooks (Arizona Department of Agriculture Weights and Measures Services Division), Brent Ricks (Montana Department of Labor and Industry) supporting Developing status for this item.

Francesca Wahl stated that Tesla is already using a display in vehicle not one located on the charger and these systems hold a California Type Evaluation Program Certificate for these chargers. Comments were also heard on the floor regarding from three regulatory official indicating concern with this item, in particular:

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

In response to an inquiry about the type of technology being used to connect the indication to the charger, Chris King indicated RFID and Bluetooth are used by these devices to identify the user. Francesca Wahl noted that in European regulation there must be encryption on the backend that requires a key to link them.

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

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, Tim Chesser (Arkansas) recommended the item be withdrawn because they were not going to enforce indicating element requirements on cell phones of customers.

Dr. Matt Curran (Florida) echoed those same comments and raised concern about privacy with the use of customers' cell phones.

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

John Stokes (South Carolina) was not in support of this item.

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

The Committee recommends the item be Withdrawn.

Northeastern Weights and Measures Association

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

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

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

Submitter's Purpose and Justification:

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

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

2024, establishing a 2025 effective is reasonable and provides a uniform, transparent, and equitable marketplace for both consumers and competing businesses.

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

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

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

NIST OWM Executive Summary for EVF-24.2 – S.2.7. Indication of Delivery, N.3.2. Accuracy Testing, and T.2.1. EVSE Load Test ~~Differences~~ Tolerances

NIST OWM Recommendation: Voting to allow fundamental requirements such as accuracy to be met uniformly across the marketplace.

- The proposal modifies the 2028 enforcement date to become 2025 for DC Systems (1) automatic display of the start at zero and the final quantity of the electrical energy delivery, (2) performance test procedures, and (3) associated test tolerances.
- The 2028 enforcement dates were adopted July 2022 as part of an emergency agenda item to make the NIST HB 44 EVFS Code permanent and in response to a lack of test equipment.
- The lack of access until 2028 to fundamental requirements, such as these for indications, accuracy tests, and tolerances, might possibly lead to nonuniformity in the application of those three sections of the EVFS code.
- Paragraph G-A.3. Special and Unclassified Equipment exists for use by jurisdictions wishing to inspect and test existing equipment in order to approve it for commercial use.
- We recognize that commercially available testing devices for high powered chargers are slated to become more widely available shortly and essential to verify DC fast charging equipment.
- The Committee should correct the letter number designation for the test note to become N.3.2. not N.5.2. and the title of the tolerance requirement to become T.2.1. EVSE Load Test Tolerances not EVSE Load Test Differences. Should the submitter further modify the proposal to make the requirements enforceable to equipment only after the effective date, then the text should be changed to *italic* type.

Table 2. Summary of Recommendations
EVF-24.2 – S.2.7. Indication of Delivery, N.3.2. Accuracy Testing, and T.2.1. EVSE Load Test
Differences Tolerances

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Voting			
WWMA	Voting			
NEWMA	Voting			
SWMA	Voting			
CWMA	Voting			
NCWM				
	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 Electric Vehicle Fueling Systems Code 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.
(Amended 2022 and 20XX)

And

N.5.2. Accuracy Testing. – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard.

- (a) For AC systems:

- (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.
 - (2) Accuracy test of the EVSE system at a load of not greater than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least the minimum measured quantity (MMQ).
- (a) For DC systems (see note):
- (1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes current (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard for a total energy delivered of at least twice the minimum measured quantity (MMQ).
 - (2) Accuracy test of the EVSE system at a load of not more than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard for a total energy delivered of at least the minimum measured quantity (MMQ).

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

And

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

- (a) Acceptance Tolerance: 1.0 %; and
- (b) Maintenance Tolerance: 2.0 %.

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

NIST OWM Detailed Technical Analysis:

The code requirements under consideration in this proposal are exempted from enforcement until 2028 and apply to the automatic display of the start at zero and the final quantity of electrical energy delivered by a DC EVSE and performance test procedures and the associated test tolerances applicable to DC systems. The current three requirements addressed in the proposal were the only parts of Section 3.40 EVFS Code adopted in July 2022 to become a permanent code with an effective date of January 1, 2028. This occurred as part of a late June 2022 weights and measures regulators' proposal assigned emergency status for upgrading the tentative NIST HB 44 EVSE code from trial and experimental status (held since July 2015) to become permanent and enforceable in 2023 for all commercial EVSEs. This action was also due in part to 2022 concerns about the available supply of adequate DC EVSE test equipment.

The lack of access until 2028 to fundamental requirements, such as these for indications, accuracy tests, and tolerances, might possibly lead to nonuniformity in the application of those three sections of the EVSE code. There is a willingness to consider making specific portions of the code nonretroactive in order to allow some industry to bring their equipment into compliance, but typically this is not the case for accuracy requirements. As an additional general comment, OWM notes that the NIST Handbook 44 General Code will continue to apply to existing equipment, including paragraph G-A.3. Special and Unclassified Equipment. Jurisdictions wishing to inspect and test existing equipment in order to approve it for commercial use would be left to use this provision.

We also recognize that commercially available testing devices for high powered chargers are slated to become more widely available shortly; however, to the best of our knowledge, we understand that at least two companies are currently offering this test equipment for sale. The routine availability of validated test equipment will promote the ability to type-certify direct current fast charging (DCFC) equipment, which is also essential for industry to verify the performance of such equipment prior to use in commercial service. Validated equipment prior to commercial operations is vital to ensure the accuracy and transparency of measurements on which electric vehicle fueling charges will be based and to ensure marketplace equity for competing manufacturers and sellers.

Currently in EVF-24.2 paragraphs S.2.7., N.5.2., and T.2.1. are specified as requirements that become enforceable on January 1, 2028 with respect to all DC EVSE systems. Should the submitter further modify the proposal as indicated by the WWMA with the intent to make the requirements enforceable to equipment only after the effective date, then the text should be changed to *italic* type. Although this may create confusion in the marketplace.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

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

Theo Brillhart (Fluke) supported this modification in anticipating the equipment will be sufficiently available to inspectors using this timeline.

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

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

The Committee recommends this item as a Voting item.

Western Weights and Measures Association

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

At the 2023 WWMA Annual Meeting, due to the S&T Chair Douglas, being a submitter of this item, they abstained from the Committee during Open Hearings and Committee Work Group. General comments from representatives of California and manufactures of the test equipment were heard on the floor in support of this item being moved forward as a Voting item.

ScheLeese Goudy questioned the meaning of the availability and lead time of the test equipment. Expressed the concern of how to address legacy devices that are already installed and being used.

Francesca Wahl (Tesla) echoed Electrify America regarding the legacy device issue. Recommend this item be Developing status. Perry Lawton clarified the availability of test equipment will be in the first quarter of 2024.

Kevin Schnepf (California) stated legacy devices can be addressed with adding the term “Nonretroactive”.

Chris King (Siemens) is concerned about the availability of the test equipment and recommends this item be Developing status.

The WWMA S&T Committee initially recommended the item be assigned Developing status to allow the submitter the opportunity to consider comments heard. After entering into deliberations and hearing from Kevin Schnepf that the proposal was fully developed and merited voting status. The Committee agreed with a motion to make this a Voting item with specific instructions that industry concerns about legacy devices be addressed and to include a nonretroactive date. This Committee notes this makes two items on the 2023 WWMA S&T agenda that propose changes to paragraph T.2. Load Test Tolerances (EVF-23.6).

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, Perry Lawton, Tim Chesser (Arkansas), Mauricio Mejia (Florida), Gene Robertson (Mississippi), were in support of this item.

ScheLeese Goudy raised concerns what would happen with legacy equipment. Alex Beaton (EVgo) echoed the statements of ScheLeese Goudy. Patrick Bean (Tesla) agreed with Alex and ScheLeese’s comments and suggested waiting for test equipment to change the date.

The Committee recommends this item move forward as a Voting item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, a representative from TESCO commented in support of the date change to 2025 as equipment is readily available to allow testing. A representative from Electrify America expressed concerns on how the date change would affect legacy devices. New Hampshire, Vermont, New York, New Jersey, and Massachusetts supports as voting. Upon consensus of the body, the Committee recommends this item be Voting.

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 HB 44 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 50 kW) 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 HB 44 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 3.40. 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:

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

- i. A point between 10 % and 20 % of the maximum deliverable amperes, but not exceeding 8 A,
- ii. A point between 45 % and 55 % of the maximum deliverable amperes,
- 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 HB 44 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 HB 44 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 800 VDC two voltage test points are included. Both voltage classes are capable of charging at 400 V so a point between 350 VDC and 400 VDC is required for both. For systems that can also operate at 800 VDC 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: Developing to resolve the ambiguity of the language that prescribes the conditions for performing the test.

- NIST acknowledges that although not reflected in the Item Under Consideration the submitters will recommend a return to the pre 2023 requirement for marking of the MCD not the MDA (i.e., S.5.2.(b)) to clarify the appropriate terminology to be used for specifying the EVSE manufacturer’s highest amperage load rating for operation of the equipment under test and to be marked on the device.
- 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.
- The 2023 proposal created a new separate test requirement initially for laboratory evaluations which are now specified solely for type evaluation; 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?
- OWM notes that because of the 2028 enforcement date the NIST Handbook 44 General Code will continue to apply to existing equipment, including paragraph G-A.3. Special and Unclassified Equipment. Jurisdictions wishing to inspect and test existing equipment in order to approve it for commercial use would be left to use this provision.
- 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 proposals that address other types of EVFS marking requirements.
- In May 2023 the EVFE Subgroup tasked its Test Procedure Subcommittee (TPS) to undertake the project of combining Items EVF-23.4 and EVF-23.7 into a single proposal. After input from the submitters of both proposals and other U.S. stakeholders, and multiple meeting deliberations (June through December 2023) the TPS arrived at a draft that combines elements of both proposals under EVF-23.4 that it will send to the EVFE Subgroup mid-December 2023 for its consideration. Simultaneously the co-submitters agreed in late August to combine the

NIST OWM Executive Summary for EVF-23.4 – S.5. Markings and N.5. Test of an EVSE System
<p>desired elements from both proposals under a single agenda item and to also recommend withdrawing of EVF-23.7.</p> <ul style="list-style-type: none"> • Multiple paragraphs appearing under the heading “Item Under Consideration” no longer reflect the exact wording or paragraph designations of these requirements as a result of actions which occurred during the 31JUL2023-03AUG2023 NCWM Annual Meeting. • The NIST Technical Advisor to the TPS has noted there are five places in the submitters’ August 2023 alternate test procedures and new definitions needing further refinement to ensure uniform interpretation and application of the test procedure requirements (see the NIST OWM Detailed Technical Analysis). NIST OWM recommended further edits to clarify test procedures where requirements include the <i>terms/phrases</i>: (1) <i>maximum power level</i>; (2) using the <i>test equipment available</i>; (3) current levels should be <i>separated to the extent the test equipment will allow</i>; (4) installed under <i>optimum conditions</i> (in the definition of MCD); and (5) <u>determined by the signal or communication between the EVSE and EV or test equipment</u> (in the definition of MDA). 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?

**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		Include August 2023 further modifications
OWM	Developing	1	Modify August 2023 co-submitter’s draft further to clarify terminology
WWMA	Developing		Revise per 22AUG2023 submitters’ letter
NEWMA	Voting		Voting with NEWMA’s fall 2023 changes
SWMA	Voting		Item needs updates from the submitters
CWMA	Voting		Voting with its Appendix C changes
NCWM			
	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, Electric Vehicle Fueling Systems as follows:

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

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

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

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

- (a) voltage rating;
- (b) maximum-~~current~~ deliverable amperes;
(Amended 2023 and 20XX)
- (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.
(Amended 20XX)

And

N.5. Test of an EVSE System.

N.5.12. Performance Verification in the Field. – Testing in the field is intended to validate the transactional accuracy of the EVSE system. **Provided the EVSE under test has a valid type approval certificate, then t**The 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.5.21. Laboratory Accuracy Testing. – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard. **Each test shall be performed for at least the minimum measured quantity (MMQ).**

(a) For AC systems:

- ~~(1) Accuracy tests of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW. Shall be performed at the following current levels:~~**
 - (i) A point between 10 % and 20 % of the maximum deliverable amperes, but not exceeding 8A;**
 - (ii) A point between 45 % and 55 % of the maximum deliverable amperes; and**
 - (iii) A point between 70 % and 100 % of the maximum deliverable amperes.**
- ~~(2) Accuracy test of the EVSE system at a load of not greater than 10 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot~~**

~~signal for a total energy delivered of at least the minimum measured quantity (MMQ).~~

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

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

(i) A point at less than 30A;

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

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

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

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

(Amended 2022 and 2023)

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

NIST OWM Detailed Technical Analysis:

Most notably, the submitter of this proposal and a corresponding proposal under Item EVF-23.7 collaborated in August 2023 to combine and further modify portions of both proposals which are not reflected in the Item Under Consideration for this item. The co-submitters provided the national and regional S&T Committees with these latest alternate modifications to EVF-23.4 in a letter dated August 28, 2023. Given the effort since May 2023 by the cosubmitters and others within the community to combine the two test procedure proposals to address later generations of EVSEs under Item EVF-23.4, there appears to be a general consensus to recommend that Item EVF 23.7 be withdrawn from the agenda. Additionally, multiple paragraphs appearing under the heading "Item Under Consideration" no longer reflect the exact wording or paragraph designations of these requirements as a result of actions which occurred during the 31JUL2023-03AUG2023 NCWM Annual Meeting. The EVFS Code modifications adopted by the NCWM in early August 2023 for NIST HB 44 Section 3.40 resulted in the: (1) renumbering of the test notes (N.), the N.5 test procedure paragraphs were renumbered to become N.3.;

(2) requirement for marking of the MDA rather than the MCD (i.e., S.5.2.(b)); and (3) no longer recognizing the abbreviation for “joule” while establishing an abbreviation for “kilowatt-hour” (i.e., S.5.3.(d)). 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 specific code paragraphs 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.

Adoption of EVF-23.1 resulted in the No Load Test and Starting Load Test no longer being part of the minimum test procedures for EVSEs (i.e., previously N.1. and N.2. respectively). The unit of measurement “joule” was removed from the code because it is not presently in use for expressing electrical energy quantity values in commercial EVSE applications.

Furthermore, the originally suggested modification of paragraph N.5.1. Performance Verification in the Field (currently N.3.1.) for testing to be conditional on the EVSE under test having “a valid type approval certificate” was removed from the proposal.

Although the community has more knowledge on the operations of EVFSs, test equipment, and installation sites there did not seem to be a general consensus on the minimum test criteria to apply to the latest 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 to include the use of an EV as the test load. 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 commercial device is designed. This proposal: (1) removes from the test procedures any reference to the feature (i.e., signal or digital communication) used to determine the MDA percentage level achieved during accuracy tests; (2) expands the range for performing the light load test; (3) sets the minimum current load when a vehicle is the test load for field verification of DC EVFSs; (4) establishes a new mid load test; and (5) specifies a new laboratory test (which will become the type evaluation test).

The 2028 exemption included in the DC system test procedure amended paragraph N.5.2., a general set of test procedures, was adopted as part of the July 2022 priority item that made Section 3.40 a permanent code. S&T Agenda Item EVF-23.4, a 2023 carryover proposal, will by May 2023 will be further modified by the submitters to add a separate set of test procedures for type evaluation rather than for laboratory conditions which would be a substantive change to the 2024 edition of the handbook. Therefore a 2028 exemption, if appropriate, would also be new text that requires being underscored to clearly designate the 2028 effective date as part of this newly proposed test procedure.

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? The lack of access until 2028 to fundamental requirements, such as these for accuracy tests might possibly lead to nonuniformity in the application of DC systems test procedures of the EVSE code. There is a willingness to consider making specific portions of the code nonretroactive in order to allow some industry to bring their equipment into compliance. As an additional general comment, OWM notes that the NIST Handbook 44 General Code will continue to apply to existing equipment, including paragraph G-A.3. Special and Unclassified Equipment. Jurisdictions wishing to inspect and test existing equipment in order to approve it for commercial use would be left to use this provision.

In May 2023 the Electric Vehicle Fueling Equipment (EVFE) Subgroup of the U.S. National Work Group (USNWG) on Electric Vehicle Fueling & Submetering (EVF&S) tasked its Test Procedure Subcommittee

(TPS) with reviewing and providing input on proposed modifications to current NIST Handbook 44 EVFE accuracy test procedures under Items EVF-23.4 and EVF-23.7. The performance of accuracy tests are based in part on the suitability of the test standard and rated operating conditions for the commercial device. NIST OWM in the interest of ensuring uniformity and clarity in the interpretation of the co-submitters' alternate August 2023 revisions to proposed new paragraph N.3.3. and new definitions (MDA and MCD) has made the USNWG's TPS aware there are several terms and phrases that appear somewhat ambiguous and/or out of context with typical handbook language. To provide clarity on the conditions that apply in the conduct of an official test NIST OWM has recommended further edits to the co-submitters' proposal to clarify test procedure where requirements include the *terms/phrases*: (1) *maximum power level*; (2) using the *test equipment available*; (3) current levels should be *separated to the extent the test equipment will allow*; (4) installed under *optimum conditions* (in the definition of MCD); and (5) determined by the signal or communication between the EVSE and EV or test equipment (in the definition of MDA).

NIST OWM suggests further modification for clarifying:

(1) and (2) The phrase “maximum power level” cited in paragraph N.3.3.(b) applies to the kilowatt rating of the EVSE and to assign a value to the power level, either a numerical value or a percentage range in relationship to the manufacturer's power capacity rating for the EVSE with respect to the maximum load level acceptable for a valid test rather than basing the test on the capacity of the test standard (note the test apparatus should be referred to as a standard not equipment). Suggested modifications would be for proposed new paragraph N.3.3.(d) to read: (d) A point between 25 % and 100 % of the maximum deliverable amperes with the recommendation ~~to that this~~ test be at the maximum power level within a that range of ± kW or % kW capacity of the EVSE that is possible using the test equipment available.

(3) A proposed new paragraph N.3.3. Note that will apply to test points in subparagraphs N.3.3.(a) and (b) so as to not recommend reliance on *any available* test equipment to achieve a sufficient separation or spread between the current levels for the light load test and full load test. The test should be the minimum procedures applied to demonstrate compliance of the EVSE to legal metrology requirements across the systems entire performance curve. The procedure should specify the spread between the two test points that is adequate to be recognized as completing the minimum procedures for a valid test. NIST OWM recommends options for the new Note that follows subparagraph N.3.3.(d) to include guidelines that read:

Note: The test points in (a) and (b) above must not be at the same current level. ~~It is recommended that the current levels should be separated to the extent that the test equipment will allow~~The range of the difference between the maximum deliverable amperes for test points (a) and (b) shall be greater than XX % of the OR at no less than XX.X % of the maximum current load capacity of the EVSE. OR XX.% for systems not marked with an accuracy class and XX.% for systems marked with an accuracy class. If there are dual accuracy classes of EVSEs in the marketplace.

(4) The proposed new definition of the term “maximum current deliverable” which includes the phrase “optimum conditions” include more descriptive text which to be clear to all stakeholders. The definition should not provide an exemption for operating conditions where either the site or the system are unsuitable since the EVSE should be properly installed, maintained, and used in a manner intended by the manufacturer.

Recommended optional modifications to the proposed new definition for the term “maximum current deliverable” for consideration:

maximum current deliverable. – The maximum current that the EVSE can deliver as specified by the EVSE manufacturer when installed under optimum conditions. [3.40]

Note: The installation site shall be adequate for the charging load required by the EVSE and does not exceed the maximum current specified by the EVSE manufacturer.

OR

maximum current deliverable. – The maximum current that the EVSE can deliver as **installed developed** under **optimum** conditions **of installation.** [3.40]

Note: The installation site shall be adequate for the charging load required by the EVSE and does not exceed the maximum current specified by the EVSE manufacturer.

OR

Either of the above options and a new User Requirement to read:

UR.2.6. Charging Load. - The installation site shall be adequate for the charging load required by the EVSE.

(5) Distinguish that the current load delivered from the EVSE during the test is determined by calibrated test standard apparatus and not determined by off the shelf equipment.

Recommended modification to the proposed new definition for the term “maximum deliverable amperage” for consideration:

maximum deliverable amperage. – The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE ~~and EV~~ or test ~~equipment~~ standard. [3.40]

(Added 202X)

Additionally, NIST OWM was made aware during September-November 2023 USNWG TPS discussions on this proposal that several meeting participants have indicated that some of the recently proposed modifications to the test procedures that exist in Handbook 44 may not be suitable for the next generation of DC systems that would most likely reach the marketplace. Those comments would need to be addressed. It is unknown if the solution would be to add a separate set of requirements for the next generation low capacity DC systems, or if there's some other means to remedy that concern and to avoid modifications which become barriers to performing accuracy testing.

U.S. National Work Group’s Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

In May 2023 the EVFE Subgroup’s Test Procedures Subcommittee (TPS) was tasked with working through a May 2023 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 test procedure proposals in Items EVF 23.4 and EVF-23.7. TPS discussions about modifications of the test procedures and defining new terms having special and open-ended meaning were focused on input from stakeholders (active in type evaluation and routine field testing), the NCWM, regional weights and measures associations, and NIST OWM. Based on the TPS's May through December 2023 deliberations

the TPS has agreed to forward the combined August 2023 proposal derived from both EVF-23.4 and EVF-23.7 for the EVFE Subgroup’s consideration.

Summary of Discussions and Actions:

At the 2023 NCWM Interim Meeting, Kevin Schnepf (CDFA DMS) recommended a developing status, recognizing the item has merit but needs more development. They recommended 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. They 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. 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.

At the 2023 NCWM Annual Meeting, Bill Hardy indicated the NIST USNWG Subgroup is working on updated language.

The submitter of this proposal and a corresponding proposal under Item EVF-23.7 collaborated in August 2023 to combine and further modify portions of both proposals which are not reflected in the Item Under Consideration shown above for this item. The co-submitters provided the national and regional S&T Committees with these latest alternate modifications to EVF-23.4 in a letter dated August 28, 2023. The August 2023 collaborations modify the 2024 edition of NIST HB 44 Section 3.40 EVFS Code paragraphs S.5.2.(b), N.3., N.3.1., and N.3.2., and add new paragraphs N.3.3. and S.5.3.(e) and definitions of the **terms** “maximum current deliverable” and “maximum deliverable amperage”. There was also a later modification* of the combined proposal by the submitters in December 2023 to remove the reference to performing tests in new paragraph N.3.3. at “any convenient voltage.” The co-submitters proposal is shown below:

<p>August 28, 2023 Alternate EVSE Test Procedure & Related Terminology Proposal Developed by the Submitters of EVF-23.4 and EVF-23.7 (*includes December 2023 modification)</p>
<p>➤ Modify paragraphs S.5.2.(b), N.3., N.3.1., and N.3.2., and add new paragraphs N.3.3. and S.5.3.(e) as follows:</p> <p>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:</p> <ul style="list-style-type: none"> (a) voltage rating; (b) maximum current deliverable amperes; (Amended 2023 and 202X) (c) type of current (AC or DC or, if capable of both, both shall be listed);

- (d) minimum measured quantity (MMQ); and
- (e) temperature limits, if narrower than and within $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$ to $+185\text{ }^{\circ}\text{F}$).
(Amended 2021)

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

- (a) VAC = volts alternating current;
- (b) VDC = volts direct current;
- (c) MDA = maximum deliverable amperes;
- (d) kWh = kilowatt hour.
(Amended 2023)

(e) MCD = maximum current deliverable
(Added 202X)

N.3. Test of an EVSE System. – The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard. Each test shall be performed for at least the minimum measured quantity (MMQ).

N.3.1. Performance Verification in the Field Testing of an AC EVSE. – Testing in the field is intended to validate the transactional accuracy of the EVSE system. The following testing is deemed sufficient for a field validation. Accuracy tests shall be performed at the following current levels:

- (a) **A point between 4 A and 10 A;**
- (b) **A point between 40 % and 60 % of the maximum deliverable amperes; and**
- (c) **A point between 70 % and 100 % of the maximum deliverable amperes.**

N.3.2. Accuracy Type Evaluation Testing of a DC EVSE. – 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. Tests shall be performed at the following voltage points one between 350 VDC and 450 VDC and if supported by the EVSE a second between 700 VDC and 900 VDC:

Accuracy tests shall be performed at the following current levels:

- (a) **A point between 10 % and 20 % of the maximum deliverable amperes, but not less than 30 A;**
- (b) **A point between 40 % and 60 % of the maximum deliverable amperes; and**
- (c) **A point between 70 % and 100 % of the maximum deliverable amperes.**
- (a) ~~For AC systems:~~

~~(1) Accuracy test of the EVSE system at a load of not less than 85 % of the maximum deliverable amperes (expressed as MDA) as determined from the pilot signal for a total energy delivered of at least twice the minimum measured quantity (MMQ). If the MDA~~

~~would result in maximum deliverable power of greater than 7.2 kW, then the test may be performed at 7.2 kW.~~

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

~~(b) For DC systems (see note):~~

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

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

N.3.3. Performance Verification in the Field of a DC EVSE. – Accuracy test shall be performed at any convenient voltage and the following current levels:

(a) A point between 10 % and 20 % of the maximum deliverable amperes, but not less than 30 A; and

(b) A point between 25 % and 100 % of the maximum deliverable amperes with the recommendation to test at the maximum power level within that range that is possible using the test equipment available.

Note: The test points (a) and (b) above must not be at the same current level. It is recommended that the current levels should be separated to the extent that the test equipment will allow.

For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient for field verification provided that it is greater than 40 % of the maximum deliverable amperes and no less than 30 A .

All DC EVSE are exempt from this requirement until January 1, 2028.
(Amended 2022)

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

(Amended 202X)

Include new definitions in NIST HB 44 Appendix D. Definitions for the terms “maximum current deliverable” and “maximum deliverable amperage” as follows:

maximum current deliverable. – The maximum current that the EVSE can deliver as installed under optimum conditions. [3.40]

(Added 202X)

maximum deliverable amperage. – The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE and EV or test equipment. [3.40]

(Added 202X)

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 opposes due to 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 and to 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 Items EVF-23.4 and EVF-23.7 is still being reviewed for technical accuracy.

The CWMA S&T Committee recommended in May 2023 that this item remain Developing.

At the CWMA 2023 Interim Meeting, the Committee heard comments on this item and Item EVF-23.7 concurrently.

Theo Brillhart (Fluke) presented material regarding the merging of Items EVF-23.4 and EVF-23.7 by the submitters as well as the passing of item EVF 23.1 at the 2023 NCWM Annual Meeting. The passing of Item EVF 23.1 has forced a renumbering of sections within this current proposal. The submitters of Items EVF-23.4 and EVF-23.7 have reflected those changes in their proposal. With these changes (letter submitted), the submitter recommends this item as voting.

ScheLeese Goudy - agrees with the proposal because it makes testing easier. Language regarding '10 amps or above' fixes the concerns between Item EVF 23.4 and Item EVF 23.7. Perry Lawton (TESCO) applauds the work achieved between Items EVF-23.4 and EVF-23.7. Steve Peter (Wisconsin) supported this item.

The Committee recommends this item moving forward as a voting item with the proposed changes by the submitter which are attached to the bottom of this report in Appendix C.

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 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 Schnepf (California Division of Measurement Standards) commented there is some concern about the language for specifications and tolerances. Kevin Schnepf recommended this item be assigned to a work group. Kevin Schnepf recommended a Developing status.

During open hearings, comments were heard that contents in this item were previously discussed in the USNWG, but no official position has been taken by the USNWG. There were also comments during open hearing taking the position the item is not fully developed. The WWMA S&T Committee 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 Item 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.

During the WWMA 2023 Annual Meeting, the Committee heard comments regarding Item EVF-23.7 and this item. The WWMA S&T Committee received a letter with updated proposed language for this item and Item EVF-23.7. The letter has been posted to the WWMA website [Events – Meeting Documents – Letter from the Submitters EVF-23.4 and EVF-23.7]. This letter has also been provided to the NCWM S&T Committee.

Comments were heard from Theodore Brillhart, ScheLeese Goudy, Perry Lawton (TESCO), Francesca Wahl, and Chris King supporting the proposed language in the joint letter dated August 22, 2023.

Kevin Schnepf supported this item with an additional proposed revision of changing the Exemption Date from 2028 to 2025.

The WWMA 2023 S&T Committee recommends this item be revised to reflect all proposed language in the Joint Letter dated August 22, 2023, and that the item remain Developing to allow all stakeholders the ability to review all proposed changes. This Committee recommends the withdrawal of item EVF-23.7 in favor of this item with the revisions per the letter. The letter will be posted on the NCWM website.

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.

At the 2023 SWMA Annual Meeting, ScheLeese Goudy stated this was a joint proposal and will take the place of Item EVF-23.7. Perry Lawton supported this Item. Juana Williams (NIST OWM) stated the Test Procedures Subcommittee was asked to provide feedback on an earlier combined proposal as well as an earlier proposal. They came back with 10 items they would like addressed and terms like optimal test load, convenient voltage, and optimal conditions.

The Committee considered the proposed joint language from a letter dated August 22, 2023 from the submitters of both items (EVF-23.4 and EVF-23.7). The item itself still needs to be updated with this new language.

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 believed this item had merit and requested 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 50 kW 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 HB 44 up to date. The submitters of this proposal and Item 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 Items 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 Item EVF-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 Items EVF-23.4 and EVF-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. Cheryl Ayer (New Hampshire) concurs with moving this item forward. Perry Lawton 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 July 2023 NCWM 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.

At the 2023 NEWMA Interim Meeting, a representative from Electrify America provided a presentation on updates with this proposal. Comments were heard that the submitters of Items EVF-23.4 and EVF--23.7 worked together on a joint proposal to come to a consensus on low end testing and specify minimum loads on DC meters. A representative from TESCO commented that the new proposal provides realistic testing constraints that will last and establishes minimums and parameters for “man in the middle” testing. Upon consensus of the body, the Committee recommends this item be Voting with the following changes:

Strike the entirety of paragraph N.3 and replace with:

N.3. Test of an EVSE System.

The testing methodology compares the total energy delivered in a transaction and the total cost charged as displayed/reported by the EVSE with that measured by the measurement standard. Each test shall be performed for at least the minimum measured quantity (MMQ).

N.3.1. Testing of an AC EVSE

Accuracy tests shall be performed at the following current levels:

- (i) A point between 4 A and 10 A; and
- (ii) A point between 40 % and 60 % of the MDA; and
- (iii) A point between 70 % and 100 % of the MDA.

N.3.2. Type Evaluation Testing of a DC EVSE

Tests shall be performed at the following voltage points one between 350 VDC and 450 VDC and if supported by the EVSE a second at between 700 VDC and 900 VDC:

Accuracy tests shall be performed at the following current levels:

- (i) A point between 10% and 20% of the MDA, but not less than 30 A;
- (ii) A point between 40 % and 60% of the MDA; and
- (iii) A point between 70 % and 100 % of the MDA.

N.3.3. Performance Verification in the Field of a DC EVSE

Accuracy tests shall be performed at any convenient voltage and the following current levels:

- (i) A point between 10% and 20% of the MDA, but not less than 30 A; and
- (ii) A point between 25 % and 100 % of the MDA, with the recommendation to test at the maximum power level within that range that is possible using the test equipment available.

Note: The test points (i) and (ii) above must not be at the same current level. It is recommended that the current levels should be separated to the extent that the test equipment will allow.

For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient for field verification provided that it is greater than 40 % of the MDA and no less than 30 A.

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

Change S.3.2 (b) to read:

(b) Maximum current deliverable

Add S.3.3 (e) to read.

(e) MCD = Maximum current deliverable

Add the following definitions to Appendix D:

Maximum current deliverable: The maximum current that the EVSE can deliver as installed under optimum conditions.

Maximum deliverable amperage: The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE and EV or test equipment.

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

Source: Florida Department of Agriculture and Consumer Services; Electrify America; Tesla; EVgo, Siemens

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 devices installed before that date, the tolerances would be 5 % (acceptance and maintenance).
2. For the sake of clarity and transparency for customers and inspectors, a device subject to the 5 % tolerance would have to be marked as such. The proposal would require specific language for the marking.
3. If a manufacturer has achieved 1 % capable chargers earlier than the January 2024 timeframe, users of those chargers might prefer not to mark the chargers as 5% chargers; and then those chargers would be subject to the 1 %/2 % tolerance. The proposal includes language to establish this treatment.

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 be marked as 5 % devices; but if they are not marked that way, they would of course be subject to the 1 % / 2 % level as for new chargers.

B. The basic justification

DC and AC chargers are fundamentally different—in technology, in customer use, and in metering capabilities. AC charging technology, the older form, delivers energy in the same form—voltages and currents oscillating at 60 Hertz (in the United States) as utilities have provided it for a century. Because a vehicle has to convert AC energy to DC for charging the battery, AC charging stations operate at no more than 19.7 kW, and most no more than 6-7 kW. These charging rates will add 24-80 miles of range in an hour of charging a typical car, and consequently AC charging involves extended sessions—the median time that a customer uses an AC station is 22 hours.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 ultimately needs it. Using voltages of 400 to 950 volts DC and currents up to 500 amps DC (higher levels are coming in the future for applications like charging heavy trucks), they are able to deliver 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

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 DCFs) 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.

a weights and measures standard would work. One indication of the relatively mature state of AC metering is that NIST has long provided ordinary-course calibration services for AC watt-hour meters that operate at 60 Hertz, within ranges of 69 to 480 volts and 0.5 to 30 amps (sufficient to cover typical AC chargers).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 amps⁶—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 measures standards at all until 2033. DC chargers installed after January 2023 (and before January 2033) are subject to a maintenance tolerance of 5.0 % (and acceptance tolerance of 2.5 %). Consequently, in California, which represents roughly 30 % of the currently-existing base of DC chargers, the maintenance tolerance will be 5.0 % for the coming decade. A maintenance tolerance of 5.0 % for legacy chargers in section 3.40 will be stricter overall than the California regulation (because it will apply to all legacy chargers, whereas the California standard applies only to post-2023 chargers) but will align with the numerical tolerance used in California. Although a 5.0 % tolerance is among the larger tolerances used in Handbook 44, it is not unprecedented. And the fact that 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

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

tolerance (acceptance and maintenance) will be 3.0%, not the 1 % acceptance in Handbook 44. The cost of a typical charging session is \$15 to \$20. A 5.0% maintenance standard would mean a variation, beyond that, of an additional plus *or minus* 40 cents. As with any tolerance, that variation could at any given charger be for or against either side to the transaction.

2. The industry submitters have studied carefully their existing chargers, measurement devices and existing models now available. They believe the 5 % maintenance tolerance is achievable at a manageable cost in the future, because it will generally not require extensive reconfiguring of cabinets and the installation of four-wire cables.
3. The cost of bringing legacy chargers into line with the 1 % / 2 % standard would be extreme. Although equipment is not available to test DC fast chargers in the field, some operators have found in tests of existing devices that they can be brought to a 5 % tolerance but cannot meet the 1 % / 2 % standard without replacing the meters or implementing an entirely new measurement system, which means a physical reconfiguration at each station and/or replacing the cables for delivering the energy to vehicles. Section 3.40. standards are based on the energy delivered at the connector to the car; in other words, a charger must account for losses in the cables. The most straightforward way to account for losses is to measure the voltage at the vehicle connector; that means the cable must have two additional high-voltage leads, to carry that voltage back to the meter⁷. 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.

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.

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" 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.¹²The 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.
5. 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.
6. 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

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 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.

for clarity in type evaluations, which ordinarily evaluate device models against the applicable acceptance tolerance.

7. 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 NIST 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

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).

Handbook 44 tolerances. The proposal shifts the line between differing tolerances, but the situation of differing tolerances for the same application is already in place without the proposal.

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

This proposal arrives without the formal approval of the USNWG 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: Developing to allow for deliberations on the enforcement dates and establishing parameters for use of an electronic display.

- Initially NIST OWM suggested a review of Items EVF-23.5 and EVF-23.6 where both items 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 in 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 required more work and vetting as suggested by two of the four regional associations. Voting Item EVF-23.6 needs further refinement.
- OWM believes this *preliminary* work would have been done in the USNWG SG as recommended during the WWMA meeting and recommended the Committee designate these items as Developing in 2023 and asked the SG for assistance in vetting the proposals. Adoption should occur only after fully vetting proposals by the entire community as the submitter(s) may be too close to the subject or take too wide a berth in the development of new or modification of existing requirements resulting in either overlooking or oversimplifying the lessons learned in the marketplace which can lead to misreading the complexities of commercial applications which have necessitated legal metrology controls. It has been reported that when addressing the level of confidence that buyers and sellers have, and the accuracy with which these transactions are performed that: The consumer has no way to verify the accuracy of the transaction and must rely on the accuracy of the fuel dispenser.

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- In anticipation that the Committee believed there was an urgent need to move one of these proposals forward, OWM encouraged 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 that are enforceable 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.
- As shared in its comments in Item EVF-23.5, OWM believes the proposed changes in Item EVF-23.5 was much clearer in language, format, and application and are closer to language agreed to by the USNWG SG for ballot in June 2022 than are the proposed changes in Item EVF-23.6. OWM is aware of the Committee’s decision to withdraw Item EVF-23.5.
 - The USNWG EVFE Subgroup gained momentum as the result of 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 the history on Item EVF-23.5.
- There were differences between the language recommended in that June 2022 SG ballot and that proposed in Item EVF-23.6. The language recommended in the June 2022 ballot:
 - Permitted DC devices installed before 2024 to have a wider tolerance if they were clearly marked to designate their accuracy.
 - Included a wider tolerance of 5 % for DC systems installed before 2024 when accuracy is marked, which several OEMs identified as achievable. Note: The June 2022 SG’s language did not include an exemption for DC systems from accuracy tolerances up through 2028 to sunset in 2034 and was a more suitable option.
 - Recognized the EVFE Subgroup would further refine the requirement’s text.
- OWM acknowledged 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

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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 convenors of the Subgroup will continue to provide written and verbal input as explicitly directed by the group.
- It also is written that the components of the weights and measures infrastructure help to ensure the accuracy and validity of commercial transactions based upon weight, measure, or count and to ensure that the quality of products meets required quality standards. Another purpose of these components is to ensure consumers are informed so that they can make value comparisons. A robust infrastructure ensures equity in the marketplace, meaning that consumers receive the correct quantity and quality of products and services for which they pay, and businesses receive fair payment for the products and services that they deliver. By ensuring that they operate according to a consistent set of weights and measures standards and practices, businesses are also protected from unfair competition.
- Below are some additional comments for the Committee and other stakeholders to have considered in their review of Item EVF-23.6:
 - Use of the terms “load” and “accuracy” should be reviewed for consistency in their use in the titles of the two T.2. subparagraphs.
 - The community should revisit past national discussions on the electronic formatting of required marking information and also consider April 2023 comments raised in the EVFE Subgroup ballot for specifying a minimum time for the duration of the displayed accuracy statement and the statement be capable of being viewed in entirety prior to use of the EVSE.
- 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 appropriate 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.
- Where commercial equipment is known to operate at dual tolerances the proposed marking and performance requirements should be retroactive. Although there is likely to be some

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discussion as to what nonweights and measures agencies designate as a “public” station; the DOE EERE Alternative Fuels Data Center provides the number and location (stations/ports/charging levels) of alternative fueling installations in each state on the EERE website available at: <https://afdc.energy.gov/stations/states>.

- NIST OWM acknowledges that the EVFE Subgroup met on December 8, 2022 and March 2 and 6, 2023 to address proposals under consideration for the 2023 standards development cycle and the SG provided a July 12, 2023 memorandum on its position in support of the Item Under Consideration for Item EVF-23.6 as it appears in the Committee’s Interim Meeting Report (PUB 16).
- 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 has reviewed 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.
- 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 establishing a sunset date of 2034 for the entire country, given the pace at which technology has already advanced, is nineteen years after the tentative code was first adopted by the NCWM.
- There were differences between the language recommended in that June 2022 SG ballot and that proposed in Item EVF-23.6. The language recommended in the June 2022 ballot:
 - Permitted DC devices installed before 2024 to have a wider tolerance if they were clearly marked to designate their accuracy.
 - Included a wider tolerance of 5 % for DC systems installed before 2024 when accuracy is marked, which several OEMs identified as achievable. Note: The June 2022 SG’s

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<p>language did not include an exemption for DC systems from accuracy tolerances up through 2028 to sunset in 2034 and was a more suitable option.</p> <ul style="list-style-type: none"> ○ Recognized the EVFE Subgroup would further refine the requirement’s text. ● OWM acknowledged 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. <ul style="list-style-type: none"> ○ 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. <p>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 convenors of the Subgroup will continue to provide written and verbal input as explicitly directed by the group.</p> <p>Due to time constraints the Subgroup has not met on this issue in 2023.</p> <ul style="list-style-type: none"> ● Should the community agree to the numerical designation of an Accuracy Class for DC systems which meet the wider tolerance, then additional requirements should be developed to include: (1) a new standardized accuracy class table; (2) requirements specifying the appropriate “Accuracy Class” identifier; and (3) requiring the accuracy classification be marked on the EVSE. ● Notice to consumers will need to adequate as to the information they provide that accuracy assurance varies from one site to another. 	

**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		Recommending further modification
OWM	Developing		Recommend deliberations on enforcement dates and establishing parameters for use of an electronic display
WWMA	Developing		
NEWMA	Developing		
SWMA	Voting		Recommend October 2023 modifications
CWMA	Voting		Recommend modifications

NCWM	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, 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. The indicating element may be used to display this notice, provided the notice is presented to the customer prior to the beginning of the transaction.

This marking requirement does not apply to DC EVSEs that are capable of meeting an

acceptance tolerance of ± 1 percent and a maintenance tolerance of ± 2 percent.
(Added 202X)

T.2. Test Tolerances

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

- (a) Acceptance Tolerance: 1.0 %; and
- (b) Maintenance Tolerance: 2.0 %.

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

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

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

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

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

NIST OWM Detailed Technical Analysis:

The proposal outlined in agenda item EVF-23.6 is not exactly the same as an alternative proposal the EVFE SG was working toward in the group's June 2022 ballot of its voting membership. 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 was made 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 was not to be construed as supporting the specific changes proposed in EVF-23.6. There were some key differences between the Subgroup's June 2022 balloted proposal and EVF-23.6. Specifically, the Subgroup's proposal did *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 had no reference to certification to the tighter of the dual tolerances. The convenors also clarified that the Subgroup would provide written and verbal input as explicitly directed by the group (outlined below in the section 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 operation at the proposed maximum 5 percent accuracy. Device tolerances should not hinge 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. However, in many device codes there is only a single accuracy class for vehicle refueling applications.

Proposed new 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 in 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. There appears to be mixed opinions on the service life of EVSEs installed up through December 31, 2023 which would contribute further to the confusion about timelines for phasing out noncompliant equipment.

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. It has been said when addressing the level of confidence that buyers and sellers have, and the accuracy with which these transactions are performed that: The consumer has no way to verify the accuracy of the transaction and must rely on the accuracy of the fuel dispenser.

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 having met October 6, 18, and December 8, 2022 and March 2 and 6, 2023 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 18 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. The EVFE SG in July 2022 gained momentum on moving 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 more stringent tolerances would also apply to pre 2024 DC system models designed to meet the tighter tolerances and all other 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. Use of the terms "load" and "accuracy" should be reviewed for consistency in their use in the titles of the two T.2. subparagraphs. 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. And the proposed sunset for equipment of 2034 is 20 years after the code's adoption.

NIST OWM acknowledges that the EVFE Subgroup met on December 8, 2022 and March 2 and 6, 2023 to address proposals under consideration for the 2023 standards development cycle and the SG provided a July 12, 2023 memorandum on its position in support of the Item Under Consideration for Item EVF-23.6 as it appears in the Committee's Interim Meeting Report (NCWM Pub. 16). The SG has not had the opportunity to meet to discuss this item during the second half of 2023.

Should the community agree to the numerical designation of an Accuracy Class for DC systems which meet the wider tolerance, then additional requirements should be developed which address: (1) including a new standardized accuracy class table (i.e., Table XX. Accuracy Classes and Tolerances for Electric Vehicle Fueling Systems) in the code; (2) requirements specifying the appropriate "Accuracy Class" identifier for the accuracy class marking on the device to lessen the likelihood of this prefix being mistaken for representing alternating current (i.e., a proposed new subparagraph S.5.2.(f)(1)); and (3) requiring the accuracy classification be marked on the EVSE under a proposed new subparagraph to read: S.5.2.(f) EVSE Identification and Marking Requirements; Accuracy Class the accuracy class of the EVSE as specified by the manufacturer consistent with Table XX. Accuracy Classes and Tolerances for Electric Vehicle Fueling Systems in NIST Handbook 44, Section 3.40 Electric Vehicle Fueling Systems (Added 20XX). Commercial EVFSs are dissimilar in their design, relatively new to the marketplace, and used by customers who never encountered dual accuracy tolerances traditional fuel and alternative fuel dispensing systems. Notice to consumers will need to adequate as to the information they provide that accuracy assurance varies from one site to another.

U.S. National Work Group's Electric Vehicle Fueling Equipment Subgroup (EVFE SG)

- The EVFE 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 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 EVFS Code. The SG asked that the Committee consider the SG's recommendations presented below as it deliberated on S&T Agenda Items EVF-23.5 and EVF-23.6 which include proposed changes to these same handbook code paragraphs. The changes the SG was working towards 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.

Proposal Balloted the June 2022 EVFE SG read:

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 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)

A July 12, 2023 memorandum reported on the March 2, 2023 ballot results of 6 Public Sector and 7 Private Sector members of the EVFE Subgroup resulting in 12 Approvals and 1 (Private Sector) vote in opposition to the Committee’s draft proposal for EVF-23.6 as it appears in the 2023 Interim Meeting Report (PUB 16). Voting results including all comments were made available May 5, 2023. Voting guidelines required 12 votes of approval from the 23 voting members on the subgroup roster. An April 6, 2023 EVFE SG ballot on the recognition of a digital accuracy statement was not approved by the SG.

Summary of Discussions and Actions:

The submitters 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 vote did 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: March 2023 deliberations of the EVFE SG resulted in a vote approving the proposal in Item EVF-23.6 as published in the 2023 NCWM Interim Meeting Report, followed by a July 12, 2023 memorandum indicating the group's support of the proposal being sent to the NCWM S&T Committee. The series of events that lead to this conclusion were as follows: 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 12 votes of approval from the 23 voting members on the subgroup roster met the threshold of 12 for approval. 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. An April 2023 ballot on a digitally formatted accuracy marking statement resulted in six Votes [three Public/three Private] to Approve and six Votes [two Public/four Private] in opposition which did not meet the threshold (12 of 23 voting members) for the Subgroup's approving further modification of EVF-23.6 at that time. The Weight and Measures Community during its Standards Development Process has previously considered proposals for presenting required marking information in a digital format; therefore, for everyone continuing on with the development of similar requirements it is suggested those national discussions be revisited along with reviewing the comments received in the April 2023 EVFE Subgroup ballot that recommended specifying a minimum time of 30 seconds for the duration of the displayed accuracy statement and the statement be viewed in entirety prior to use of the EVSE.

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 to all "other" unmarked systems operating at more stringent tolerances which resulted in the removal of any reference to "newer" charging equipment.
 - providing more information about 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 to include the text that further quantifies that point in time as when the equipment has been “placed into service” prior to January 1, 2024.

At the 2023 NCWM Annual Meeting, the Committee considered comments from the floor and modified the item to match that proposed by the CWMA to include additional wording in proposed new paragraph S.5.2.1. that reads “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.” to recognize a digitally formatted display of the accuracy statement notice. The Committee agreed to make the item voting not changing any dates in the proposal. The item did not receive enough votes to pass or fail. The item was returned to Committee.

Regional 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) remarked 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 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 and this is 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 if 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.

At the CWMA 2023 Interim Meeting the following comments were received:

ScheLeese Goudy from Electrify America presented on this item. ScheLeese recommends this as a voting item with revisions. Mike Harrington (Iowa) supports item with changes and that we should not put accuracy markings regarding tolerances on the meter because we might need to then do that for all devices. Tolerances are currently public information and consumers can find them if needed. Accuracy Class marking will help inspectors know what tests/tolerances to apply and should be on the devices. Mike supports this item as voting. Greg VanderPlaats (Minnesota) supported this item at the 2023 NCWM Annual Meeting. The language in this updated proposal is better than the previous

version. Greg supports as a voting item. The Committee recommends this item as a voting item with the following changes:

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

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

S.5.2.1. Marking of Accuracy Class, DC EVSEs Placed in Service Prior to 2024. – A DC EVSE that was placed into service prior to 2024 and is subject to the tolerances of T.2.2(a) is an accuracy Class 5 EVSE and shall be marked with Class 5. The marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used for the marking, provided the marking is visible to the customer prior to the beginning of the transaction.

(Added 202X)

T.2. Test Tolerances.

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

- (a) Acceptance Tolerance: 1.0 %; and
- (b) Maintenance Tolerance: 2.0 %.

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

(a) For a DC system that was placed in service prior to January 1, 2024, and that is marked Class 5, acceptance and maintenance tolerances are: 5.0 %. This paragraph T.2.2(a) shall expire on January 1, 2034; after that date, all DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).

(b) For any DC system not subject to paragraph T.2.2(a), tolerances are:

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

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

Western Weights and Measures Association

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

ScheLeese Goudy 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 to 1 in favor of the item in the assigned work group. The one 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 Schnepf (California Division of Measurement Standards) commented this was discussed in the national workgroup. Kevin Schnepf recommended that a task group be assigned to verify which items were in a consensus and which were not. Kevin Schnepf proposed a hard stop date for legacy devices is necessary and that there isn't one with the current language. Kevin Schnepf commented on his disagreement with the "or" statement in the current language.

Francesca Wahl (Tesla) commented they agree 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. 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.

During the WWMA 2023 Annual Meeting updated language to this item was provided to the WWMA S&T Committee and posted to the WWMA website at: {Events – Meeting Documents – EVF-23.6 Proposal}. A presentation was given by the submitters of this item. The submitters spoke to: (1) 5 % tolerance for legacy devices and (2) Marking requirement of Class 5 based on comments received during the 2023 NCWM Annual Meeting. General comments from industry supported a Voting status with the updated language. Kevin Schnepf (California, Division of Measurement Standards) supports this item with a recommended revision of the Exemption Date from 2028 to 2025. Mahesh Albuquerque (Colorado, Division of Oil and Public Safety) supports this item as Voting status. Comments from regulatory officials were heard regarding the concern of the language "placed into service" and the removal of the language of "Install" with the potential effect to "legacy devices" being used in the marketplace. Lenny Vang (EV Testing Solutions) questioned where the data on the 5% tolerance resulted from and requested from the submitter the data to justify the 5% tolerance. ScheLeese Goudy (Electrify America) clarified that the tolerances were aligned originally with California standards and existing

devices in use. Questions were raised about whether the marking requirement of “Class 5” is fully informative to a consumer.

The WWMA 2023 S&T Committee recommends this item be assigned a Developing status with the recommendation the submitter consider comments heard on the floor. The Committee notes there are two items on the 2023 WWMA S&T agenda that propose changes to section T.2 Load Test Tolerances (also see EVF-24.2). Updated language will be included in the WWMA S&T Committee 2023 Final Report as an Appendix to the item.

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Hal Prince (Florida) spoke in favor of this item being a satisfactory compromise. Paul Floyd (Louisiana) 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 they 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.

At the 2022 SWMA Annual Meeting, Paul Floyd, Louisiana, supports the revised item. ScheLeese Goudy gave a presentation of this item and supports the revision along with the other submitter and requests the NCWM S&T committee revise the item to the included language. She also stated the 5% tolerance because the 2% tolerance is unobtainable for legacy devices. She suggested the date change 2028 to 2025 remain a separate item. ScheLeese Goudy also stated that industry would roll out the marking requirements via the indicating element. Mauricio Meija (Florida) supported this item. Tim Chesser (Arkansas) supported this item. Steve Benjamin (North Carolina) stated support for this item. John Stokes (South Carolina) asked whether jurisdictions had considered treating EVF as a service rather than a motor fuel. Tim Chesser responded to John Stokes that Arkansas views it as both, and both would fall under Weights and Measures jurisdiction. Paul Floyd (Louisiana) responded to John Stokes, that Louisiana has redefined retail electricity meters as a commercial weighing and measuring device. Alex Beaton (EVgo) stated that they will work hand in glove with the manufacturer to make adding the marking requirement seamless and requested a voting status for the item. Juana Williams (NIST OWM) stated that that NIST has some concern that the use of multiple dates will cause confusion and cautioned moving forward without considering past discussions on digital markings. Perry Lawton (TESCO) supported changing the date from 2028 to 2025.

The Committee recommends the following language as a replacement for the above item:

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

- (a) voltage rating;
- (b) maximum current deliverable;
- (c) type of current (AC or DC or, if capable of both, both shall be listed);
- (d) minimum measured quantity (MMQ); and

(e) temperature limits, if narrower than and within -40°C to $+85^{\circ}\text{C}$ (40 F to $+185^{\circ}\text{F}$).

S.5.2.1. Marking of Accuracy Class, DC EVSEs Placed in Service Prior to 2024. – A DC EVSE that was placed into service prior to 2024 and is subject to the tolerances of T.2.2(a) is a Class 5 EVSE, and shall be marked with Class 5. The marking shall be conspicuously and legibly displayed in a position plainly visible to a person accessing a charging port of the EVSE. The indicating element may be used for the marking, provided the marking is visible to the customer prior to the beginning of the transaction.

(Added 202X)

T.2. ~~Load~~ Accuracy Test Tolerances.

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

- (a) Acceptance Tolerance: 1.0 %; and
- (b) Maintenance Tolerance: 2.0 %.

T.2.2. EVSE Accuracy Test Tolerances for DC Systems. – The tolerances for EVSE load tests on DC systems shall be as follows:

(a) For a DC system that was placed in service prior to January 1, 2024, and that is marked Class 5, acceptance and maintenance tolerances are: 5.0 %. This paragraph T.2.2.(a) shall expire on January 1, 2034; after that date, all DC EVSEs shall be subject to the tolerances of paragraph T.2.2(b).

(b) For any DC system not subject to paragraph T.2.2(a), tolerances are:

(1) Acceptance Tolerance: 1.0 %; and

(2) Maintenance Tolerance: 2.0 %.

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

The Committee recommends this item move forward as a Voting item using the above language.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, Keith Bradley (Electrify America) recognizes that when the code was originally adopted there were 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 Items 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 paragraph 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 paragraph 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 July 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), 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.

At the 2023 NEWMA Interim Meeting, a presentation was given by a representative from Electrify America which described that this proposal would create a Class 5 EVSE device, which would alleviate concerns of having a tolerance percentage on the face of the device and requested a voting status. Regulators from the Commonwealths of Pennsylvania, Massachusetts, Vermont, and New Jersey support the changes as they would address the legacy devices. A regulator from the State of New Hampshire commented that there are concerns with “placed in service” vs “installed”. When something is placed in service, it may have been installed 10 years prior. A regulator from Holliston, Massachusetts questioned if the 2034 date is more of a convenience of manufacturers or a benefit to consumers and how are they supposed to know what a Class 5 means. They also questioned if the number is to be in Arabic or Roman numeral form. Regulators from the New York commented that they have the same concerns as New Hampshire. They prefer installed date, not placed in service, do not think Class 5 is transparent to consumers, and questioned if it should be a user requirement instead of design requirement. Upon consensus of the body, the Committee recommends this item be Developing.

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: Withdraw due to work in progress nearing completion to incorporate this proposal into EVF-23.7.

- 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.
- 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? Please be advised that as a result of actions which occurred during the 31JUL2023-03AUG2023 NCWM Annual Meeting modifications to NIST HB 44 3.40 were adopted and resulted in the renumbering of the test notes (N.), the N.5 test procedure paragraphs were renumbered to become N.3. Additionally, that action by the NCWM deleted and no longer recognizes paragraphs N.1. No Load Test and N.2 Starting Load Test as part of the minimum test procedures for EVSEs.
- 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.
- 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.
- In May 2023 the EVFE Subgroup’s Test Procedures Subcommittee (TPS) was tasked with working through a May 2023 version of the test procedures addressed in Item EVF 23.4. This

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
<p>latest modified version of the test procedures is the result of the collaborative effort of the submitters of both test procedure proposals in Items EVF 23.4 and EVF-23.7. TPS discussions about modifications of the test procedures and defining new terms having special and open-ended meaning were focused on input from stakeholders (type and routine field testing), the NCWM, regional weights and measures associations, and NIST OWM. Based on the TPS's May through December 2023 deliberations the TPS has agreed to forward a combined proposal derived from both EVF-23.4 and EVF-23.7 for the EVFE Subgroup's consideration.</p>

**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	Withdraw		See EVF-23.4 which combines text from EVF-23.7 as part of an ongoing effort to merge both proposals within the 2024 cycle
WWMA	Withdraw		
NEWMA	Withdrawn		
SWMA	Withdrawn		
CWMA	Voting		Same proposal as shown in EVF-23.4
NCWM			
	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 Electric Vehicle Fueling Systems Code as follows:

~~N.1. No Load Test. A no load test may be conducted on an EVSE measuring system by applying rated voltage to the system under test and no load applied.~~

~~N.2. Starting Load Test. – A system starting load test may be conducted by applying rated voltage and 0.5 ampereload.~~

...

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~~ 10 % and 20% of the maximum deliverable amperes ~~(expressed as MDA) as determined from the digital communication message from the DC EVSE to the test standard~~ for a total energy delivered of at least the minimum measured quantity (MMQ).

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.

(Amended 20XX)

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.

(Added 20XX)

NIST OWM Detailed Technical Analysis:

There are other 2023 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..32. Accuracy Testing that remain under consideration in the 2024 cycle. One reoccurring recommendation that is not part of this proposal 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 2024 edition of the HB 44. This proposal (1) no longer specifies the means used to determine the MDA percentage level achieved during accuracy tests, (2) establishes a new MDA range for performing the light load test and the MDA level that must be achieved for tests of DC systems when a vehicle is the test load for verifying the EVFS, and (3) establishes a new definition of MDA. The proposal continues to recommend removing N.1. No Load Test and N.2 Starting Load Test when the August 2023 NCWM took similar action after adopting Agenda Item EVF-23.1.

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 2014 USNWG completed its development of 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 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 both closing in on filling the last gaps in the EVSE weights and measures infrastructure. It becomes 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” that is 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.” 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 numerical section designation in brackets (i.e., [3.40]) at the end of the definition rather cite a single applicable 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 appeared to have incorrectly renumbered paragraph N.5. Accuracy Testing to become N.5.2.1.. Previous publications of the proposal did not show paragraph N.5.2 in entirety, so there was question as to whether the submitter was proposing to remove the 2028 enforcement date?

The 2023 NCWM requested this proposal along with Item EVF-23.4 which took a different approach to updating the test procedures be considered and possibly be consolidated by the USNWG EVFE Subgroup. In May 2023 the EVFE Subgroup tasked its Test Procedure Subcommittee (TPS) to undertake this project. After input from the submitters of both proposals and other U.S. stakeholders, and multiple meeting deliberations (June through December 2023) the TPS arrived at a draft (see the NIST OWM analysis section for EVF-23.4) that combines elements of both proposals under EVF-23.4 that it will send to the EVFE Subgroup mid-December 2023 for its consideration. The NIST Technical Advisor has noted there are five places in the modified test procedures and new definitions needing further refinement to ensure uniform interpretation and application of the test procedure requirements. The Submitters agreed in late August to combine the desired elements from both proposals under a single agenda item and to also recommend withdrawing of EVF-23.7.

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 had not 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. The proposals in 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 (TPS) was tasked in May 2023 by the EVFE Subgroup to consider 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 TPS's findings the Subgroup has targeted the upcoming 2024 standards development cycle to develop and provide input on both Items EVF-23.4 and EVF-23.7. Input received June 2023 in the outreach to stakeholders and over the course of TPS deliberations from July through November have resulted in further refinement to an August 2023 proposal that is a combination of both items. After input from the submitters of both proposals and other U.S. stakeholders, and multiple meeting deliberations (June through December 2023) the TPS arrived at a draft (see the NIST OWM analysis section for EVF-23.4) that combines elements of both proposals under EVF-23.4 that it will send to the EVFE Subgroup mid-December 2023 for its consideration. The NIST Technical Advisor has noted there are five places in the modified test procedures and new definitions needing further refinement to ensure uniform interpretation and application of the test procedure requirements. The Submitters agreed in late August to combine the desired elements from both proposals under a single agenda item and to also recommend withdrawing of 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 Schnepf (State of California, Division of Measurement Standards) agrees with Tina Butcher's comments and recommends the submitter work with the NIST USNWG EVFE Subgroup for item development. Tina Butcher (NIST OWM) referred to the written comments submitted by NIST OWM. They 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.

During the 2023 NCWM Annual Meeting the Committee heard input from Keith Bradley indicating work was taking place on updates to the proposal.

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 Minnich (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 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) reports that a draft combination of Items EVF-23.4 and EVF-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.

At the 2023 CWMA Interim Meeting, the Committee heard comments on this item and item EVF-23.4 concurrently. Comments made about this item will also be found in the comments section on item EVF-23.4.

Theo Brillhart (Fluke) presented material regarding the merge of EVF-23.4 and EVF-23.7 by the submitters as well as the passing of item EVF-23.1 at the 2023 Annual NCWM Meeting. The passing of item EVF-23.1 has forced a renumbering of sections within this current proposal. The submitters of EVF-23.4 and EVF-23.7 have reflected those changes in their proposal. With these changes (letter submitted), the submitter recommends this item as voting.

ScheLeese Goudy agrees with the proposal because it makes testing easier. Language regarding '10 amps or above' fixes the concerns between item EVF-23.4 and item EVF-23.7.

Perry Lawton (TESCO) applauds the work achieved between EVF-23.4 and EVF-23.7. Steve Peter (Wisconsin) supported this item.

The Committee recommends this item moving forward as a voting item with the proposed changes by the submitter which are attached to the bottom of this report (same proposal referenced in item EVF-23.4). [Appendix C]

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 Schnepf (California Division of Measurement Standards) commented in full support of recommendations to strike the no load and starting load tests. Kevin Schnepf commented he doesn't think there is consensus from the Work Group. Kevin Schnepf recommended that this item be discussed with the U.S. National Working Group to make sure that it is highly agreed upon. Kevin Schnepf proposed if two vehicles are charging at once it cuts the 10 % in half. Kevin Schnepf commented in favor the range between 10 and 20%. Kevin Schnepf recommended a Developing status.

During open hearings, comments were heard that contents in this item were previously discussed in the USNWG, but no official position has been taken by the USNWG. There were also comments during open hearing taking the position the item is not fully developed. The WWMA S&T Committee 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.

At the 2023 WWMA Annual Meeting, the Committee heard comments regarding item EVF-23.4 and this item. The WWMA S&T Committee received a letter with updated proposed language for this item and

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EVF-23.4. The letter has been posted to the WWMA website, Events – Meeting Documents – Letter From the Submitters EVF-23.4 and EVF-23.7. This letter has also been provided to NCWM S&T Committee. Comments were heard supporting the proposed language in the Joint Letter dated August 22, 2023.

Kevin Schnepf supports this item with an additional proposed revision of changing the Exemption Date from 2028 to 2025.

The WWMA 2023 S&T Committee recommends this item be assigned a Withdrawn status in favor of item EVF-23.4. Based on comments heard during open hearings from industry and consideration of the Letter from the Submitters this committee recommends that EVF-23.4 be updated with the proposed language in the letter and EVF-23.7 be Withdrawn.

Southern Weights and Measures Association

At 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.

At the 2023 SWMA Annual Meeting, the Committee recommended incorporating this item into EVF-23.4, and withdrawing this item based upon the proposed joint language provided in a letter dated August 22, 2023, from William Hardy and Keith Bradley the submitters of these two items.

The Committee recommends this item be Withdrawn.

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. Juana 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. Juana 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, Alicia 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.

At the 2023 NEWMA Interim Meeting, after hearing comments on EVF-23.4 and upon consensus of the body, the Committee recommends this item be Withdrawn.

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 they 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	
<p>NIST OWM Recommendation: NIST OWM supports the Grain Analyzer Sector’s decision to Withdraw this item recognizing that if additional data is received the proposed tolerance changes may be resubmitted for consideration.</p> <ul style="list-style-type: none"> • 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. • The Grain Analyzer Sector has not received additional data needed to further assess their proposed tolerances changes to NIST HB 44, Section 5.56(b) The GA Sector will keep this as an open item on their Sector agenda, but as the submitter of this item, the GA Sector recommends that this item be withdrawn. If or when additional data is received, the Grain Analyzer Sector may resubmit the item. 	

**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	Withdrawn			
OWM	Withdrawn			
WWMA	Developing			
NEWMA	Withdrawn			
SWMA	Withdrawn			
CWMA	Developing			
NCWM				
	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, Grain Moisture Meter Code 5.56 (a) as follows:

T.2.1. Air Oven Reference Method. – Maintenance and acceptance tolerances shall be as shown in Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method. Tolerances are expressed as a fraction of the percent moisture content of the official grain sample, together with a minimum tolerance.

(Amended 2001)

Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method

Type of Grain, Class, or Seed	Tolerance	Minimum Tolerance
Corn, oats, rice, sorghum, sunflower	0.05 of the percent moisture content	0.8 % in moisture content
All other cereal grains and oil seeds	0.04 of the percent moisture content	0.7 % in moisture content

Table T.2.1. Acceptance and Maintenance Tolerances Air Oven Reference Method for All Grains and Oil Seeds

<u>Tolerance</u>	<u>Minimum Tolerance</u>
<u>0.03 of the percent moisture content</u>	<u>0.5 % in moisture content</u>

(Amended 2001 and 20XX)

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.

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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.

At the 2023 Grain Analyzer Sector meeting, Sector members noted that no additional data had been received. As such the GA sector recommended that the item be withdrawn. The Sector will keep this item on their agenda and resubmit the proposal to the S&T if or when additional data is submitted that can be used to support the recommended tolerance changes.

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, 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.

At the 2023 WWMA Annual Meeting, no comments were received from the body on this item.

The WWMA 2023 S&T Committee recommends this item remain a Developing status based on comments heard and included in the 2023 NCWM S&T Committee Annual Report; those comments indicate data is being collected and reviewed.

Southern Weights and Measures Association

During the 2022 SWMA Annual Meeting open hearing the Committee heard no comments.

At the 2023 SWMA Annual Meeting, Jason Glass (Kentucky) recommended withdrawing the item due to lack of feedback from the submitter.

Aaron Webb (Maryland) stated that the current tolerances were already difficult to achieve and would not support changing them.

The Committee recommends Withdrawal of this item, due to no comments in support, feedback, or development of this item over several years.

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.

At the 2023 NEWMA Interim Meeting, a regulator from the Pennsylvania commented that the Task Group was still waiting for additional data to move forward with this item. A regulator from Holliston, Massachusetts recommended this item be withdrawn as it has been on the agenda for four years without data collection being completed, and once it has been collected and analyzed, it can be reintroduced. New Hampshire, Vermont, Connecticut, Pennsylvania, and Massachusetts concur. Upon consensus of the body, the Committee recommends this item be Withdrawn.

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 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.

OTH – Other Items

OTH-16.1 | 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 (WHE) 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
NIST OWM Recommendation: Informational with an upgrade in status should the stakeholders reach agreement by March 2024. <ul style="list-style-type: none">• The title of this Item should read “Non-Utility Electricity-Measuring Systems (NUEMS) – Tentative Code”.

NIST OWM Executive Summary for OTH-16.1 – Electric Watthour Meters Code Under Development	
<ul style="list-style-type: none"> • Most members supported the proposed language as it currently appeared in the 2023 S&T Agenda (NCWM Pub. 16), although regulatory members of the SG disagreed with the proposed language. • In addition, the regulatory members provided a detailed list to the WHE 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 WHE 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 WHE SG voted on to move forward to the S&T Committee for consideration. Due to limited time, the WHE SG was not able to address all the items, and the work continues. 	
Crosswalk	
Watthour Type Electric Submeters 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
<p>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.</p>	<p>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 (<u>also referred to as “NRTL”</u>) and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code.</p> <p>Clean version:</p> <p>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.</p>
<p>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</p>	<p>S.1.3.2. Test Output. – Each <u>A</u> NUEMS within a system shall have either: (1) a location for the reading of the accumulated value <u>a rotating disk indicator</u>; (2) an electrical pulse output (visible and/or infrared pulse), <u>or (3)</u> an electrical pulse output (in the form of</p>

Crosswalk		
Watt-hour Type Electric Submeters submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watt-hour 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	
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.	<p>a closure (relay or electronic means), which provides a pulse at 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 <u>specific</u> test condition.</p> <p>Clean version:</p> <p>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.</p>	
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.	<p>S.1.3.6. NUEMS With External Sensors Located Remotely from the <u>Pulse Test Output</u> 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 <u>Pulse Test Output</u> or Display, means shall be provided to allow either the pulse test output or display to be remotely used.</p> <p>Clean Version</p> <p>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.</p>	
Add into Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS		
	Physical Marking	Electronic
<u>Sensor True Ratio (12) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>K_h or K_t (1213)</u>	<u>O</u>	<u>D</u>

Crosswalk		
Watt-hour Type Electric Submeters submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watt-hour 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	
Bi-directional (1314)	O	D
Temperature Range if narrower than -20 °C to + 50 °C (- 4 °F to + 122 °F) (1415)	O	D
<p>Add into Table S.3.2.3.b. Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS</p>		
<p>12. True Ratio.</p> <p>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.</p> <p><u>Examples of sensor ratio markings include:</u> <u>200A:5A</u> <u>400A:0.3V</u> <u>480V:120V</u></p>		
<p>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.</p>	<p>T.2. No-Load Test. – For <u>A</u> 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.</p> <p>Clean Version</p> <p>T.2. No-Load Test. – A NUEMS shall not emit more than one test pulse output.</p>	
<p>N.3. Minimum Test Duration. – Full and light load tests shall require at least a one-minute test and at least one watt-hour test constant.</p>	<p>N.3. NUEMS Minimum Test Duration. – <u>A</u> NUEMS full load test shall consist of a minimum of 10 watt-hour test constants and a light load tests shall require at least a one-minute test and at least consist of a minimum of one watt-hour test constant.</p> <p>Clean Version</p> <p>N.3. NUEMS Minimum Test Duration. – A NUEMS full load test shall consist of a minimum of 10</p>	

Crosswalk	
Watt-hour Type Electric Submeters submitted recommendations to S&T Agenda Item OTH-16.1. Electric Watt-hour 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
	watt-hour test constants and a light load test shall consist of a minimum of one watt-hour test constant.
<p>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.</p>	<p>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.</p> <p>Clean Version</p> <p>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.</p>
Appendix D. Definitions	
	<p><u>bidirectional.</u> – A NUEMS equipped to register the accumulation of energy in both directions (i.e., for delivered and received energy):</p> <p><u>A bidirectional NUEMS shall fall into at least one of the following categories:</u></p> <ul style="list-style-type: none"> (a) <u>Single register or net meter that displays the difference between the delivered and received energy; or</u> (b) <u>Separate register(s) for delivered or received energy. [3.XX]</u>

Crosswalk	
Wathour Type Electric Submeters submitted recommendations to S&T Agenda Item OTH-16.1. Electric Wathour 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
	<u>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]</u>
	<u>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]</u>
	<u>non-integral. – Used to describe external sensors that can be disconnected from the meter body. [3.XX]</u>

**Table 2. Summary of Recommendations
 OTH-16.1 – Electric Wathour Meters Code Under Development**

	Status Recommendation	Note*	Comments
Submitter			
OWM	Informational		Status upgrade if stakeholders have reached agreement
WWMA	Informational		
NEWMA		5	No recommendation
SWMA	Informational		
CWMA	Informational		
NCWM			
	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:

Add Non-Utility Electricity-Measuring Systems Code to Handbook 44, as follows:

**NIST Handbook 44 Device Code Requirements for
Non-Utility Electricity-Measuring Systems**

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**SECTION 3.XX. - NON-UTILITY ELECTRICITY-MEASURING SYSTEMS –
TENTATIVE CODE**

This tentative code has only a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code. Officials

wanting to conduct an official examination of a Non-Utility Electricity-Measuring System (NUEMS) are advised to see paragraph G-A.3. Special and Unclassified Equipment.

(Tentative Code Added 20XX)

NUEMS Acronym and Definition: As used throughout this code, a Non-Utility Electricity-Measuring System or “NUEMS” is defined as an electricity measuring system comprised of all the metrologically relevant components required to measure electrical energy, store the result, and report the result used in non-utility sales of electricity wherein the sale is based in whole or in part on one or more measured quantities.

Safety Note: This code does not specifically discuss Safety. It is essential that all personnel working with the devices covered by this code and associated electrical equipment be properly trained and adhere to all applicable safety standards, regulations, and codes. See also General Code Paragraph G-N.1. Conflict of Laws and Regulations.

A. Application

A.1. General. – This code applies to measuring systems used in non-utility sales of electric energy wherein the sale is based in whole or in part on one or more measured quantities.

A.2. Exceptions. – This code does not apply to:

- (a) **The use of any measuring system owned, maintained, and/or used by a utility.**
- (b) **Measuring systems used solely for delivering electric energy in connection with operations in which the amount delivered does not affect customer charges or compensation.**
- (c) **Electric vehicle fueling systems. (See 3.40. Electric Vehicle Fueling Systems Code)**
- (d) **Transactions not subject to weights and measures authority.**

A.3. Additional Code Requirements. – In addition to the requirements of this code, Non-Utility Electricity-Measuring Systems shall meet the requirements of Section 1.10. General Code.

A.4. Type Evaluation. – The National Type Evaluation Program (NTEP) will accept for type evaluation only those measuring systems that have received safety certification by a nationally recognized testing laboratory (NRTL) and shall issue an NTEP Certificate of Conformance only to those measuring systems that comply with all requirements of this code.

A.5. NUEMS Type Notation. – Code sections and subsections with an [ES] notation apply to External Sensor NUEMS only. Code sections and subsections with a [IS] notation apply to Internal Sensor NUEMS only. Code sections and subsections without [ES] or [IS] notation apply to both NUEMS types.

S. Specifications

S.1. Indicating and Recording Elements.

S.1.1. Units. – Units for any indicated or recorded measurements shall be as follows:

Active Energy: kilowatt-hours (kWh)

S.1.1.1. Numerical Value of Quantity-Value Divisions. – The value of an increment shall be equal to a decimal multiple or submultiple of 1.

Examples: quantity-value divisions may be 10; or 0.01; or 0.1; etc.

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.

<u>Table S.2.3. Categories of Device and Methods of Sealing</u>	
<u>Categories of Device</u>	<u>Method of Sealing</u>
<u>Category 1: No remote configuration capability.</u>	<u>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</u>
<u>Category 2: Remote configuration capability, but access is controlled by physical hardware.</u> <u>The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</u>	<u>(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.</u>

<p><u>Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</u></p> <p><u>The device shall clearly indicate that it is in the remote configuration mode and record such message or shall not accumulate kWh while in this mode.</u></p>	<p><u>An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)</u></p>
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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:

- (f) **AC voltage range or rating in VAC;**
- (g) **Watt-hour test constant (K_h) or Watt-hour test constant (K_t);**
- (h) **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 ”;**
- (i) **Number of wires (W);**
- (j) **Form designation (FM) (for A-base and socket NUEMS only); and**
- (k) **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.**

<u>Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS</u>		
	<u>Physical Marking</u>	<u>Electronic Display^{*,**}</u>
<u>Manufacturer or Distributor name, initials, or trademark (1)</u>	<u>R</u>	<u>D</u>
<u>Model Prefix (2)</u>	<u>Q</u>	<u>D</u>
<u>Model (3)</u>	<u>R</u>	<u>D</u>
<u>Serial Number Prefix (4)</u>	<u>Q</u>	<u>D</u>
<u>Serial Number (5)</u>	<u>R</u>	<u>D</u>
<u>NTEP CC Number with Prefix (6)</u>	<u>R</u>	<u>D</u>
<u>NUEMS Voltage Input Rating (7) Nonretroactive as of January 1, 2024.</u>	<u>Q</u>	<u>D</u>

<u>Voltage Sensor Rating (8) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Voltage Sensor Ratio (9) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>NUEMS Current Input (10) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>Sensor Primary Current Rating (11) Nonretroactive as of January 1, 2024.</u>	<u>O</u>	<u>D</u>
<u>K_h or K_t(12)</u>	<u>O</u>	<u>D</u>
<u>Bi-directional (13)</u>	<u>O</u>	<u>D</u>
<u>Temperature Range if narrower than -20 °C to + 50 °C (- 4 °F to + 122 °F) (14)</u>	<u>O</u>	<u>D</u>
<p><u>R</u> Required to be marked on the NUEMS <u>O</u> Required to be marked on the NUEMS only if information is not available on a display <u>D</u> Alternate when information is not marked physically on the NUEMS. If device identification and marking is provided on an electronic display, then all fields must be provided.</p>		
<p>*“Electronic Display” includes, but is not limited to, displays of the required marking information through a NUEMS display, a mobile device, or other electronic means as specified by the manufacturer and retrievable through the NUEMS. This may include providing access directly from the meter to a webpage. If the information is provided via a mechanism other than the NUEMS display, the mechanism must be provided by the device owner/operator as specified in UR.2.4.10. Devices for Viewing Marking Information Provided Via an Electronic Display, External Sensor (ES) NUEMS.</p>		
<p>**Instructions on how to view required markings shall be marked on the device or provided in the NTEP CC. <u>General:</u></p> <ul style="list-style-type: none"> • <u>Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.2.2.b. Descriptors for Table S.3.2.3.a. Device Identification and Marking Requirements of External Sensor (ES) NUEMS.</u> • <u>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.</u> 		

<u>Table S.3.2.3.b.</u>	
<u>Descriptors for Device Identification and Markings Requirement of External Sensor (ES) NUEMS</u>	
<u>1. Manufacturer’s Identification. Marked per General Code paragraph G-S.1. Identification.</u>	
<u>2. Manufacturer’s Model Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the meter, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated NUEMS is not required to meet General Code paragraph G-S.1. Identification (b)(1).</u>	
<u>3. Manufacturer’s Model Identifier. Marked per General Code paragraph G-S.1. Identification.</u>	
<u>4. Serial Number Prefix. For an External Sensor (ES) NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the meter, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated NUEMS is not required to meet General Code paragraph G-S.1. Identification (c)(1).</u>	
<u>5. Serial Number. Also see General Code paragraph G-S.1. Identification.</u>	

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 $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $+122\text{ }^{\circ}\text{F}$): If the device is rated for use over a range that is narrower than and within $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $+122\text{ }^{\circ}\text{F}$), this must be physically and/or electronically marked.

S.3.3. Device Identification and Marking Requirements – External Sensors. – In addition to all the marking requirements of Section 1.10 General Code, paragraph G-S.1. Identification, each external sensor that is non-integral with the meter shall have the following conspicuously, legibly, and indelibly marked on a permanent identification label as shown in Table S.3.3.a. Device Identification and Marking Requirements - External Sensors and in Table S.3.3.b. Descriptors for Table S.3.3.a. Device Identification and Marking Requirements - External Sensors.

	<u>Physical Marking on Sensor</u>	<u>Electronic Display</u>	<u>Separate Document (Hard Copy or Electronic)</u>
<u>Manufacturer name, initials, trademark (1)</u>	<u>R</u>	<u>D</u>	<u>D</u>
<u>Model Prefix (2)</u>	<u>O</u>	<u>D</u>	<u>D</u>
<u>Model (3)</u>	<u>R</u>	<u>D</u>	<u>D</u>
<u>Serial Number Prefix “S/N” (4)</u>	<u>O ‡</u>	<u>D ‡</u>	<u>D ‡</u>
<u>Serial Number (5)</u>	<u>O ‡</u>	<u>D ‡</u>	<u>D ‡</u>
<u>NTEP CC Prefix and Number (6)</u>	<u>O †</u>	<u>D †</u>	<u>D †</u>
<u>True Ratio (7)</u>	<u>O</u>	<u>D</u>	<u>D</u>
<u>Maximum Primary Current (8)</u>	<u>O</u>	<u>D</u>	<u>D</u>

<u>Rated Frequency (Hz) (9)</u>	<u>O</u>	<u>D</u>	<u>D</u>
<u>Maximum Safety Voltage Rating (10)</u>	<u>O</u>	<u>D</u>	<u>D</u>
<u>Polarity (11)</u>	<u>O</u>	<u>D</u>	<u>D</u>
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 \ddagger Required only when a specific sensor must be matched to a specific meter input to meet accuracy specifications \dagger Required only when a sensor has separate approval from the metering system as a whole.			
Notes: <ul style="list-style-type: none"> • <u>Numbers appearing in parentheses (e.g., (1)) following each marking requirement above correspond to numbered descriptors in Table S.3.3.b. Descriptors for External Sensor Marking Requirements.</u> • <u>For requirements and details on application, see Table S.3.3.b. Descriptors for External Sensor Marking Requirements.</u> • <u>“Electronic” includes, but is not limited to, displays of the required marking information through a NUEMS display, a mobile device, or other electronic means as specified by the manufacturer.</u> 			
Summary: <u>When a NUEMS system is approved as a system, then the only hard marking required on sensors is the Manufacturer’s name and the Model Number, unless pairing a specific sensor to a specific NUEMS input is required, then the serial number is required.</u>			

<u>Table S.3.3.b.</u> <u>Descriptors for Device Identification and Marking Requirements - External Sensors</u>	
1.	<u>Manufacturer’s Identification. Marked per General Code paragraph G-S.1. Identification.</u>
2.	<u>Manufacturer’s Model Prefix. The General Code paragraph G-S.1. Identification (b)(1) model prefix marking requirement for the sensor(s) may be met with a physical marking. Alternatively, the marking requirement may be satisfied through an electronic display or in a separate document accompanying the NUEMS provided that the NUEMS has its NTEP number clearly identified, conspicuously and indelibly marked on the meter, where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings).</u>
3.	<u>Manufacturer’s Model. Marked per General Code paragraph G-S.1. Identification.</u>
4.	<u>Serial Number Prefix. For a NUEMS having its NTEP number clearly identified, conspicuously and indelibly marked on the sensor(s), where the NTEP certificate contains the complete marking details (including a description of the location and purpose of specific markings), the associated sensor is not required to meet General Code paragraph G-S.1. Identification (c)(1).</u>
5.	<u>Serial Number. Also see General Code paragraph G-S.1. Identification.</u>
6.	<u>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.</u>
7.	<u>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.</u>

<p><u>Examples of sensor ratio markings include:</u> <u>200A:5A</u> <u>400A:0.3V</u> <u>480V:120V</u> <u>CT Turns Ratio 4:1</u> <u>VT Ratio 4:1</u> <u>An example of a sensor ratio designation which includes a unit-less ratio:</u> <u>480V:120V = 4:1.</u></p>
<p>8. <u>Maximum Primary Current.</u> The maximum primary current at which the sensor can be safely and accurately operated.</p>
<p>9. <u>Rated Frequency.</u> A sensor shall be marked with its rated frequency if other than 40Hz to 400Hz.</p>
<p>10. <u>Maximum Safe Operating Voltage.</u> A sensor shall be marked with a Maximum Safe Operating Voltage if it is less than 600VAC. <u>Examples of sensor maximum safe operating voltage ratings:</u></p> <ul style="list-style-type: none">• <u>250 Vac</u>• <u>250 VAC</u>• <u>50 V</u> <p><u>Note: The maximum safe operating voltage rating marking may not be higher than the voltage to which the device was verified during type evaluation.</u></p>
<p>11. <u>Polarity Marking.</u> The sensor shall be marked to indicate proper orientation when the accuracy of the NUEMS is affected by orientation.</p>

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.

<u>Table T.4.</u> <u>Tolerances for NUEMS</u>		
	<u>Tests Conducted at Unity</u> <u>Power Factor</u>	<u>Tests Conducted at 0.5</u> <u>Lagging Power Factor</u>
<u>Acceptance Tolerances</u>	<u>1.0 %</u>	<u>2.0 %</u>
<u>Maintenance Tolerance</u>	<u>2.0 %</u>	<u>3.0 %</u>

T.5. Repeatability. – When multiple load tests are conducted at the same load condition, the range of the load test results shall not exceed 25 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance.

UR. User Requirements

UR.1. Selection Requirements.

UR.1.1. Customer Indicating Element, Accessibility. – For systems in which the primary indicating element is not reasonably accessible to the customer, such as one of the following shall be provided.

- (a) Console display which is accessible to the customer on which the customer can unambiguously select the NUEMS output associated with this load.**
- (b) Remote display which is provided to customer as a part of the system.**
- (c) At the option of the customer, through an application that provides readings in real time.**

UR.1.2. Submeter Required. – When a tenant is not directly served by the serving utility, and charges for electric energy are not included in the fixed periodic rent charges, a dedicated NUEMS that measures only the energy used at the discretion of the tenant shall be used.

UR.1.3. Suitability of Equipment. – A NUEMS shall be suitable for use on its electrical system.

UR.1.3.1. Service Applications. - A NUEMS shall accurately measure all loads 5 percent or greater of the electric service capacity of the tenant. Service capacity shall be determined by the master thermal overload protectors to the tenants’ service or by the rated capacity of the wiring and its circuits used to provide power from the service panel to the tenant.

$$Annual\ Max = \sum_{phases} [(Phase\ Voltage * Current\ Class)/1000] * HoursPerYear$$

UR.1.3.2. Maximum Quantity-Value Division. - The maximum quantity-value division shall not exceed the minimum increment to be used in billing.

UR.1.4. Current Sensor. – The current sensor output shall be correctly matched to the meter current input.

UR.2.Installation Requirements.

UR.2.1. Manufacturer’s Instructions. – A device shall be installed in accordance with the manufacturer’s instructions, and the installation shall be sufficiently secure and rigid to maintain this condition.

UR.2.2. Load Range. – A device shall be installed so that the current and voltage will not exceed the maximum continuous ratings of the NUEMS. Means to limit current and/or voltage shall be incorporated in the installation if necessary.

UR.2.3. Regulation Conflicts and Permit Compliance. – If any provision of this section (UR.2. Installation Requirements) is less stringent than that required of a similar installation by the National Electrical Code®, as amended and adopted by the Local Authority having Jurisdiction, the installation shall be in accordance with the National Electric Code.

The installer of any new NUEMS service shall obtain all necessary permits and shall conform to all applicable regulations.

UR.2.4. NUEMS Installation Requirements.

UR.2.4.1. Certification. – It is the responsibility of the owner of a NUEMS to obtain written certification for each device from the appropriate regulatory agency.

The required certification shall meet the requirements of that agency and should identify the address, space, or number, of the premise served by the NUEMS connection; be signed by an agency representative; and shall clearly state the:

- installation is on a tariff schedule that qualifies for NUEMS use,**
- billing format, rates, and charges conform to all applicable tariff rules,**
- date of such determination, and**
- designee’s name and title if performed by a designee, and**

The certification shall be provided prior to a NUEMS being used for commercial purposes.

UR.2.4.2. NUEMS Test Features. – All NUEMS shall be provided with test features to facilitate common tests methods used in the electrical submetering industry.

UR.2.4.3. Safety Mechanism. – NUEMS installations that are equipped with current transformers with a current output that is not self-limiting shall have a mechanism installed to allow the meter to be connected to or removed for safe testing without the risk of dangerous voltages that can result from secondary open circuit CTs.

UR.2.4.4. Metered Circuits (Submeter Load Service). – For NUEMS with separate line and load service connections, all electricity used by a tenant shall be taken exclusively from the load service of the tenant’s NUEMS. This service and its associated NUEMS shall accurately measure the tenant’s load and be capable of being used only at the discretion of the tenant.

UR.2.4.5. Dedicated Tenant NUEMS Service. – A NUEMS shall serve only the space, lot, building, room, suite, stall, slip, or premise occupied by the tenant.

UR.2.4.6. NUEMS Tenant Premise Identification. – Tenant premise identification shall be clearly and permanently shown on or at the NUEMS, and on all separate components of a NUEMS, including, but not limited to, current sensor(s), modem(s), and transmitter(s) if equipped. Remote indications and all printed indications shall be readily identifiable and readily associated with the tenant’s premise. Printed indications shall also include time and date information. For field configured systems the information shall be after actual configuration is established.

UR.2.4.7. Devices for Viewing Marking Information Provided Via an Electronic Display, External Sensor (ES) NUEMS. – When required markings are provided via an electronic display the owner/operator of the NUEMS is responsible for providing means for viewing this information on the site at the time of inspection or on request. See also Table S.3.2.3.a. Device Identification and Marking Requirements for External Sensor (ES) NUEMS.

UR.2.4.8. External Sensors Located Remotely From the Pulse Output or Display. - If the NUEMS is installed in such a way that testing cannot be conducted by a single inspector from a reasonable testing position, then means shall be provided to allow the pulse output or display to be remotely used at the sensor location. For example, a portable device that receives the pulse by radio/WiFi and provides the pulse as a dry contact closure to the test equipment.

UR.3. Use of Device.

UR.3.1. Recorded Representations. – A record, either printed or electronic, providing the following information on electrical energy usage shall be available at the end of the billable interval:

- (a) the total quantity of the energy delivered with unit of measure;**
- (b) the total computed price of the energy sale;**
- (c) the unit price of the energy.**

For systems capable of applying multiple unit prices for energy during the billable interval, the following additional information is required:

- (1) A schedule of the rate time periods and the unit price applied for each**
- (2) the total quantity of energy delivered during each;**
- (3) the total purchase price for the quantity of energy delivered during each rate time period.**

Appendix D. Definitions

The following definitions are proposed for addition to NIST Handbook 44 Appendix D, Definitions at the time when the status of this Tentative Code is changed from “tentative” to “permanent.” Until such time that the status of the code is designated as “permanent,” these proposed definitions will remain in this section of the Tentative Code.

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

A

active energy. – The integral of active power with respect to time. Typically measured in units of kilowatt-hours (kWh), or watt-hours.

$$E(T) = \int_0^T v(t) \cdot i(t) \cdot dt \quad \text{Eq. 1}$$

Where T is much greater than the period of the AC line frequency.

alternating current (AC). – An electric current that reverses direction in a circuit at regular intervals. [3.XX]

ampere. – The practical unit of electric current. It is the quantity of current caused to flow by a potential difference of one volt through a resistance of one ohm. One ampere is equal to the flow of one coulomb of charge per second. One coulomb is the unit of electric charge equal in magnitude to the charge of 6.24×10^{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 Watthour Type Electric Meters Subgroup (WHE SG).

Since 2016, the EWH SG has been developing a proposed NIST Handbook 44 code for WHE-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 WHE 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 WHE 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 WHE 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:

NIST OWM Analysis
2024 NCWM Interim S&T Agenda Items

- 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 WHE SG believes that designating this item with a Voting status is still an appropriate course of action.

At the WHE 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 WHE 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 at 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~~.

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_v/K_h output, the NUEMS shall not emit more than one K_v/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 full load test shall consist of a minimum of 10 watthour test constants and a light load tests 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) Watthour Type Electric Meters Subgroup (WHE 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 WHE 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 WHE 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 WHE SG voted on to move forward to the S&T Committee for consideration. Due to limited time, the WHE 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 installation. This device should allow for electronic data logger. Juana Williams commented that the subgroup had provided a draft code that is on the website. Juana Williams requested comments be submitted to Tina Butcher (NIST OWM) or Lisa Warfield by March 22, 2022. Juana 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 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. They 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. Tina 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 Watthour Type Electric 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.

At the NCWM 2023 Annual Meeting, Henry Alton (METERGY) spoke as a member of industry and a member of the workgroup. They stated the item is ready for a vote and it has been worked on by the members of the workgroup, including regulators. The commentator referred to a letter of support submitted to the committee which was posted on NCWM website.

Andrew Kimura (Santa Cruz County, CA) requested the de-escalation of the item from voting to developing. The commentator noted the regulators on the work group were not in agreement with the final draft of the agenda item. Andrew provided feedback on specific areas and presented a PowerPoint during open hearing. Andrew Kimura stated the final draft of the agenda item does not address concerns by regulators. The commentator requested the work group consult with regulators to address specific concerns as presented during open hearings and in a letter submitted by the California Agricultural Commissioner and Sealers Association (CACASA). Andrew commented there is no intent to delay the item any further but expressed the need to develop the item further to address regulators concerns.

Matthew Douglas (Division of Measurement Standards, California) referenced the letter submitted by California Agricultural Commissioner and Sealers Association (CACASA) and requested de-escalation of the item from voting to developing. Mathew requested the work group work with regulators for further development.

Jose Arriaga (Orange County, CA) and Austin Shepard (San Diego County, California) requested the de-escalation of the item from voting to developing and requested the work group work closely with regulators for further development.

The Committee agreed with many of the comments heard during open hearings and decided to downgrade the item to Informational prior to the Voting Session. The Committee was notified the Task Group was no longer working on this specific item as it has considered it fully developed. The Committee believes the Informational status will allow for further development of the item through the S&T Committee.

The Committee received written comments from Andrew Kimura, who presented during open hearings. Written comments included specific, proposed changes to the item which were referred to in open hearings and that were represented in the letter submitted by CACASA. The Committee heard from a member of industry in support of the item and considered the National Electrical Manufacturers Association (NEMA) presentation posted on NCWM's website.

The Committee considered the edits submitted by Andrew Kimura and cross-referenced those changes to the NIST OWM sponsored Watthour Type Electric Meters Subgroup – Recommended Crosswalk. The Committee has decided to incorporate the recommended edits from NIST OWM's crosswalk into the item under consideration to be forwarded to the regions. Additional changes recommended by Andrew Kimura are available for review on the NCWM website.

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.

At the 2023 WWMA Annual Meeting, the proposed language for consideration is posted on the WWMA website, Events – Meeting Documents – OTH-16.1 Recommended Edits Agenda Item. Comments heard on the floor were regarding the proposed updated language.

Austin Shepard (San Diego County California) supports this item moving forward as a Voting item with the proposed changes as posted on the WWMA website.

Due to the substantial changes to the proposed language the WWMA S&T Committee recommends this item remain Informational to allow the body of the NCWM the opportunity to review those proposed changes and provide feedback to the NCWM S&T Committee. The Committee further recommends the NCWM S&T Committee consider the updates provided by Andrew Kimura (Santa Cruz County California) in their deliberations.

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

Southern Weights and Measures Association

At the 2022 SWMA Annual Meeting, Lisa 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.

At the 2023 SWMA Annual Meeting, they remarked that Andrew Kimura (Santa Cruz County, California) submitted a letter detailing many recent changes to this item ahead of our Annual Meeting.

Lisa Warfield, OWM, asked the Committee if they were considering the printed language or the language submitted by Andrew Kimura at the NCWM Interim.

The Committee will consider this item with Andrew Kimura's most recent revisions.

The Committee recommends this item remain an Informational item, so that the NCWM S&T Committee can continue to develop it with the opportunity to escalate it to Voting status after the NCWM Interim Meeting.

Northeastern Weights and Measures Association

At the 2022 NEWMA Interim Meeting, Lisa 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.

At the 2023 NEWMA Interim Meeting, no comments were heard on this item and the Committee does not have a recommendation.

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.

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Informational.

OTH-24.1 Appendix D, Definitions: liquefied petroleum gas retail motor-fuel device.

Source: National Propane Gas Association

Submitter's Purpose and Justification:

The proposal is a companion to the main proposal to modify 3.32, S.2.5.1 and S.2.5.2. There is another proposal that will substitute the term “liquefied petroleum gas retail motor-fuel device” for the terms “retail motor-fuel dispenser” and “retail motor-fuel device” throughout 3.32.

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.

This is a companion to this group's proposal to 3.32, S.2.5.1 and S.2.5.2. The proposed change to the definition will more precisely define what a liquefied petroleum gas retail motor-fuel device is. This is a UL-listed device that is electricity-powered and that has all of the features required by Handbook 44. It includes a safety nozzle that connects to the fill valve on the vehicle which will not flow gas unless a positive connection is made. These devices are required by NFPA 58 for all LP-gas dispensers installed at refueling facilities open to the public.

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

The submitter requested Voting status in 2024.

NIST OWM Executive Summary for OTH-24.1 – Appendix D, Definitions: liquefied petroleum gas retail motor-fuel device.
<p>NIST OWM Recommendation: Withdrawn</p> <ul style="list-style-type: none"> • If the item remains as proposed it should be withdrawn or be assigned a developing status. • The reference to Section 3.32. at the end of the definition should not be stricken. • OWM opposes limiting this definition to those devices that have a K15 nozzle as it is only required on “self-service engine fuel dispensers” per NFPA 58, 6.28.5.2. • Currently all dispensers used to deliver LPG as a motor vehicle fuel installed after January 1, 2017 are required to have a zero-setback interlock as required on devices that dispense other types of fuels into motor vehicles. • A search of the NCWM website indicates that there are various retail motor-fuel dispensers designed to dispense LPG that have an NTEP CC and are suitable for this purpose. Those installed after January 1, 2017 are currently required to have a zero-setback-interlock. • This item should be blocked with LPG-24.1 and LPG-24.2 if they remain on the agenda.

**Table 2. Summary of Recommendations
 OTH-24.1 – Appendix D, Definitions: liquefied petroleum gas retail motor-fuel device.**

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Withdrawn			
WWMA	Developing			
NEWMA	Developing			
SWMA	Developing			
CWMA	Voting			
NCWM				
	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 Appendix D, Definitions as follows:

liquefied petroleum gas retail motor-fuel device. – A device designed for the measurement and delivery of liquefied petroleum gas used as a fuel for internal combustion engines in vehicles bearing a state or federal license plate for use on public roads. The device can be operated either by trained personnel or the customer. ~~The term means the same as “retail motor fuel dispenser” and “retail motor fuel device” as it appears in section 3.32 LPG and Anhydrous Ammonia Liquid Measuring Devices. [3.32]~~

Note: These devices are required to be listed to UL 495 Power-Operated Dispensing Devices for LP-Gas and equipped with a Type K15 nozzle in accordance with ISO/DIS 19825, Road vehicles - Liquefied petroleum gas refueling connector.

(Amended 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM did not provide a detailed analysis for this item.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this item as Voting item blocked with Item LPG 24.1.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting comments were heard on LPG-24.1, LPG-24.2, and OTH-24.1 collectively:

There was consensus of support for the items and a request to Block the three items. There were comments that this may be an opportunity to clarify existing language in NIST HB 44 which some find confusing, and possibly merging S.2.5.1. and S.2.5.2. A question was also posed to the body to address the intent of the item by exempting analog devices from a Zero Set Back Interlock requirement.

Based on the comments heard during the open hearings, the WWMA S&T Committee recommends this item be Blocked with LPG-24.1 and LPG-24.2 and the Blocked items be assigned a Developing status to allow the body an opportunity to review the new language and allow the submitter to address the comments heard during open hearings.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, the Committee heard no comments on this item during Open Hearings.

The Committee supports the modification of the definition for Liquefied Petroleum Gas Retail Motor-Fuel Device and recommends blocking this item with LPG-24.1 and LPG-24.2. and moving this group of items forward with a Developing status.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, New York, New Jersey, and Massachusetts recommended this item be developing as it is a companion to LPG-24.1. Upon consensus of the body, the Committee recommends this item be Developing.

OTH-24.2 Appendix D, Definitions: National Type Evaluation Program (NTEP) and Certificate of Conformance (CC)

Source: Jerry Buendel

Submitter's Purpose and Justification:

Add a definition of Certificate of Conformance (CC) and a definition of National Type Evaluation Program (NTEP) to Handbook 44, Appendix D.

- The term National Type Evaluation Program (NTEP) is used in the General, Scales, Automatic Weighing System, Hydrogen Gas-Measuring, Electric Vehicle Fueling Systems, Grain Moisture Meter, Near-Infrared Grain Analyzers, and Multiple Dimension Measuring Devices codes, and in Appendix A. Fundamental Considerations.
- Some users of the Handbook, including regulatory officials, have little or no knowledge of NTEP and the significance of Certificates of Conformance.
- The terms NTEP and Certificate of Conformance appear in NCWM's Basic Competency, Professional Certification, and Service Agent examinations. Examinees are expected to be able to understand NTEP CCs and apply information found on the CCs.
- The definition for NTEP and CC are taken from NIST Handbook 130, Uniform Regulation for National Type Evaluation. The statements on inactive CCs are taken from the NCWM website, NTEP Frequently Asked Questions page.
- The absence of definitions could cause enforcement or other legal issues.

The submitter requested Voting status for 2024.

NIST OWM Executive Summary for OTH-24.2 – Appendix D, Definitions: National Type Evaluation Program (NTEP) and Certificate of Conformance (CC)

NIST OWM Recommendation: Voting with the following suggested edits:

- In the proposed definition of Certificate of Conformance (CC) OWM suggests the following editorial changes:
 - Replace “testing” with “evaluation” as labs do more than just test devices.
 - Replace “a Participating” with “an authorized” or similar terms to recognize that some CC’s will be issued by the NCWM NTEP lab.
 - Replace “test procedures” with “relevant provisions” as Pub 14 includes procedures for evaluation other than test procedures.
 - Remove “which the certificate holder maintains in active status under the National Type Evaluation Program (NTEP)” as inactive certificates are still recognized.
 - Replace “By maintaining the Certificate in active status, the Certificate holder declares the intent” with “An active Certificate represents the intent of the holder” and add “approved” before “type” in this sentence.
 - Remove the sentence “Some certificates may be designated as inactive.” as it is unnecessary.

- The definition then would appear as follows:

Certificate of Conformance (CC) – A document issued based on evaluation by an authorized laboratory. The document constitutes evidence of conformance of a model or models of a particular device, measurement system, instrument, or element that positively identifies the design with the requirements of this document, NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices,” and the relevant provisions contained in NCWM Publication 14. An active Certificate represents the intent of the holder to continue to manufacture or remanufacture the device consistent with the approved type and in conformance with the applicable requirements. A device is traceable to an active CC if: (a) it is of the same type identified on the Certificate, and (b) it was manufactured during the period that the Certificate was maintained in active status. For manufacturers of grain moisture meters, maintenance of active status also involves annual participation in the NTEP Laboratory On-going Calibration Program, OCP (Phase II). An inactive Certificate of Conformance is a Certificate which was previously active, but the devices are no longer being manufactured for commercial applications subject to local regulations or laws. However, devices already manufactured, installed or in inventory, but not yet sold, may be used, sold, repaired and resold under inactive Certificates of Conformance.

- In the definition of National Type Evaluation Program (NTEP) replace the term “operated” with “administered” as this is consistent with the description in Pub 14 Administrative Policy.

Table 2. Summary of Recommendations
OTH-24.2 – Appendix D, Definitions: National Type Evaluation Program (NTEP) and Certificate of Conformance (CC)

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		With suggested edits
WWMA	Developing		
NEWMA	Developing		
SWMA	Voting		
CWMA	Voting		
NCWM			
	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 Appendix D, Definitions as follows:

Certificate of Conformance (CC) – A document issued based on testing by a Participating Laboratory, which the certificate holder maintains in active status under the National Type Evaluation Program (NTEP). The document constitutes evidence of conformance of a model or models of a particular device, measurement system, instrument, or element that positively identifies the design with the requirements of this document, NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices,” and the test procedures contained in NCWM Publication 14. By maintaining the Certificate in active status, the Certificate holder declares the intent to continue to manufacture or remanufacture the device consistent with the type and in conformance with the applicable requirements. A device is traceable to an active CC if: (a) it is of the same type identified on the Certificate, and (b) it was manufactured during the period that the Certificate was maintained in active status. For manufacturers of grain moisture meters, maintenance of active status also involves annual participation in the NTEP Laboratory On-going Calibration Program, OCP (Phase II). Some certificates may be designated as inactive. An inactive Certificate of Conformance is a Certificate which was previously active, but the devices are no longer being

manufactured for commercial applications subject to local regulations or laws. However, devices already manufactured, installed or in inventory, but not yet sold, may be used, sold, repaired and resold under inactive Certificates of Conformance.

National Type Evaluation Program (NTEP) – A program operated by NCWM. NTEP is a program of cooperation between the NCWM, NIST, other federal agencies, the states, and the private sector for determining, on a uniform basis, conformance of a model or models of a particular device, measurement system, instrument, or element that positively identifies the design with the relevant provisions of NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices,” and NCWM, Publication 14, “National Type Evaluation Program, Technical Policy, Checklists, and Test Procedures.”

(Added 20XX)

NIST OWM Detailed Technical Analysis:

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, Greg VanderPlaats (Minnesota) stated that Jerry Buendel proposed this item because in developing tests for service agents on the national level it was discovered that those terms are not defined in NIST Handbook 44. Service people will have questions on these definitions. Recommend voting status for this item.

The Committee recommends this item as Voting.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, comments were heard from California, Arizona, and Oregon. The consensus was in support for the item as it is needed. Comments were also heard suggesting simplifying both definitions and possibly removing the language regarding policy.

Based on the comments heard during the open hearings the WWMA S&T Committee recommends this item be assigned a Developing status and recommends the submitter address the comments heard during the open hearings.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting the committee heard no comments on this item during Open Hearings.

The Committee approves of defining these terms but acknowledges the language could be cleaned up some in regard to the differences in Active and Inactive status. Clarifying that both active and inactive certificates are both Certificates of Conformance. We would suggest striking “which the certificate holder maintains in active status” from the first sentence of the Certificate of Conformance definition.

The Committee recommends this item move forward as a Voting item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, New York, New Jersey, and Massachusetts supported voting. Upon consensus of the body, the Committee recommends this item be Voting.

Item Block 1 (B1) Transfer Standard

- B1-LMD-24.1 ~~N.3.5.3. Field Standard Meter~~N.3.5.X. Transfer Standard Test.
- B1-VTM-24.1 ~~N.3.5.X. Field Standard Meter~~N.3.5.X. Transfer Standard Test.
- B1-LPG-24.3 ~~N.3.2. Field Standard Meter~~Transfer Standard Test.
- B1-MLK-24.1 ~~N.3.2. Field Standard Meter~~N.3.2. Transfer Standard Test.
- B1-MFM-24.1 ~~N.3.2. Field Standard Meter~~Transfer Standard Test.

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

Submitter’s Purpose and Justification:

Amend NIST Handbook 44, Liquid Measuring Devices Code, Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices, Vehicle Tank Meters Code, Milk Meter Code, and Mass Flow Meters.

Replace the undefined term “Field Standard Meter” with the defined term “Transfer Standard”, harmonize the language in the paragraph with existing language in other sections regarding tests using transfer standards, and remove the non-retroactive status from the section.

If the term “Field Standard Meter”, which is undefined, remains in NIST HB 44 this will lead to confusion regarding what a “Field Standard Meter” is. This proposal is intended to remove this confusion by replacing this term with one that is defined in NIST HB 44. The item is a test note which would only apply to tests of devices moving forward, the item also identifies when it was added to NIST HB 44, therefore a non-retroactive status is not necessary.

The section to be amended was recently added to NIST HB 44. There may be an additional purpose regarding the non-retroactive status of the section.

The submitter requested Voting status for this item in 2024 as a retroactive provision.

NIST OWM Executive Summary for Item Block 1 (B1) – Transfer Standard
<p>NIST OWM Recommendation: Voting</p> <ul style="list-style-type: none">• OWM supports amending these items to replace the term “Field Standard Meter” with “Transfer Standard”, which is now a defined term in NIST Handbook 44 and amend the language to be consistent with similar paragraphs in other sections.

NIST OWM Executive Summary for Item Block 1 (B1) – Transfer Standard
<ul style="list-style-type: none"> • Each of these Items Under Consideration in the S&T portion of Pub 15 should be edited to reflect the correct format prescribed by NCWM to identify changes to be made to the handbook as shown under the Item Under Consideration in this analysis as the intent is to amend these paragraphs and not replace them. • In addition, in the S&T portion of Pub 15, the description in the Item under Consideration for MFM-24.1 specifies the item will amend the “Handbook 44 Milk Meters Code”. This should be edited to reflect that this item is intended to amend the Mass Flow Meter Code of NIST Handbook 44.

**Table 2. Summary of Recommendations
Item Block 1 (B1) – Transfer Standard**

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA	Voting		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM			
	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, Liquid Measuring Devices Code as follows:

N.3.5.3. Field Transfer Standard Meter Test. – When comparing a meter with a calibrated transfer standard, ~~T~~the minimum quantity for any test draft shall be equal to or greater than the

amount delivered in one minute at the flow rate being tested.
~~*[Nonretroactive as of January 1, 2024]*~~
(Added 2023) (Amended 20XX)

B1-VTM-24.1 N.3.1. ~~Field Transfer Standard Meter~~ Test

Amend Handbook 44, Vehicle Tank Meters Code as follows:

**N.3.1. ~~Field Transfer Standard Meter~~ Test. – When comparing a meter with a calibrated transfer standard, ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
~~*[Nonretroactive as of January 1, 2024]*~~
(Added 2023) (Amended 20XX)**

B1-LPG-24.3 N.3.2. ~~Field Transfer Standard Meter~~ Test.

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

**N.3.2. ~~Field Transfer Standard Meter~~ Test. – When comparing a meter with a calibrated transfer standard, ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
(Added 2023) (Amended 20XX)**

B1-MLK-24.1 N.3.2. ~~Field Transfer Standard Meter~~ Test.

Amend NIST Handbook 44, Milk Meter Code as follows:

**N.3.2. ~~Field Transfer Standard Meter~~ Test. – When comparing a meter with a calibrated transfer standard, ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.
~~*[Nonretroactive as of January 1, 2024]*~~
(Added 2023) (Amended 20XX)**

B1-MFM-24.1 N.3.2. ~~Field Transfer Standard Meter~~ Test.

Amend NIST Handbook 44, Mass Flows Meters Code as follows:

**N.3.2. ~~Field Transfer Standard Meter~~ Test. – When comparing a meter with a calibrated transfer standard, ~~T~~the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested except for tests of the minimum measured quantity specified for the meter.
(Added 2023) (Amended 20XX)**

NIST OWM Detailed Technical Analysis:

NIST OWM did not provide a detailed analysis for this item.

Summary of Discussions and Actions:

Regional Association Reporting:

Central Weights and Measures Association

At the 2023 CWMA Interim Meeting, no comments were heard. The Committee recommends this Block as Voting.

Western Weights and Measures Association

At the 2023 WWMA Annual Meeting, due to the WWMA S&T Chair Douglas being a submitter of this item they abstained from the Committee during Open Hearings and Committee Work Group.

Matt Douglas (California Dept. of Food and Agriculture, Div. of Measurement Standards) clarified the intent of this item is to replace undefined terms with defined terms recently adopted at the 2023 NCWM Annual Conference. Based on comments from the floor there was consensus of the item moving forward as a Voting item. Clarifying questions were asked with sufficient responses during open hearing.

The WWMA S&T Committee recommends this item be assigned a Voting status. In review of this item and based on comments heard from the body, the Committee feels this item is fully developed, has merit, and meets the intended purpose of the item.

Southern Weights and Measures Association

At the 2023 SWMA Annual Meeting, the committee heard no comments on this item during Open Hearings. The Committee supports this item as it harmonizes the language used in these codes with existing language in other related sections of the handbook.

The Committee recommends this item move forward as a Voting item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, New Hampshire, New Jersey, and New York supports Voting status. Upon consensus of the body, the Committee recommends this item as Voting.

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

FHWA

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

HB

Handbook

LMD

Liquid Measuring Devices

LPG

Liquified Petroleum Gas

MMA

Meter Manufacturer Association

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

USNWG

U.S. National Work Group

VTM

Vehicle Tank Meter

WIM

Weigh-in-Motion

WWMA

Western Weights and Measures Association