OWM Technical Analysis

NIST | OFFICE OF WEIGHTS AND MEASURES

Specifications and Tolerances (S&T) Committee Agenda Items:

Full Analysis

In preparation for the 2025 Interim Meeting of the National Council on Weights and Measures (NCWM) on January 12 – 15, 2025

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NIST Office of Weights and Measures (OWM) Analysis
Specifications and Tolerances (S&T) Committee
2025 NCWM Interim Meeting Agenda

The NIST OWM Analysis is submitted to assist the Weights and Measures community as it deliberates on items before the Council. 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 **<u>underlining</u>** 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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Table 1. Reporting Structure

Note: The analysis considered information and comments submitted as of the date of this analysis and will not reflect any information presented after that date.
Source: Name and affiliation of submitter. **Submitter's Purpose and Justification:** The submitter's concise statement as to the intent or purpose of this proposal. The justification describes the national importance, background on the issue, and may contain references to supporting data or documents. The justification may be summarized by OWM. **NIST OWM Executive Summary:** High level points that summarize the Technical Aspects of the item and recommendations pertaining to the Item Under Consideration. **Table 2. Summary of Recommendations** **Item Under Consideration –** The latest language that the Committee has moved forward as the Item membership is considering. OWM has applied the appropriate formatting according to NIST Handbooks. **NIST OWM Detailed Technical Analysis** – A detailed analysis with background information and recommendations from the Office of Weights and Measures (OWM). **Summary of Discussions and Actions** – An OWM summary of details and discussion on this Item. This includes discussion and decisions of the Standing Committee. This may also include information from sectors, trade associations, task groups, and subcommittees.
Regional Association Reporting – An OWM summarization of the Regional Association Meeting finalized reports. • Each region will be identified by their regional acronym along with the year and meeting. • The meeting within each region will be in chronological order. • This information is taken directly from the Regional Association Final report. • The Technical Advisor may reach out to the regional Chair for clarification.
Found at the end of the Report: **References:** **Appendix A: Supplemental Documents** **Appendix B: List of Symbols, Abbreviations, and Acronyms**

Table A - Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
CC	Certificate of Conformance	OIML	International Organization of Legal Metrology
CWMA	Central Weights and Measures Association	OWM	Office of Weights and Measures
HB	Handbook	QR Code	Quick Response Code
LPG	Liquefied Petroleum Gas	S&T	Specifications and Tolerances
NCWM	National Council on Weights and Measures	SMA	Scale Manufacturers Association
NEWMA	Northeastern Weights and Measures Association	SWMA	Southern Weights and Measures Association
NIST	National Institute of Standards and Technology	USNWG	U.S. National Work Group
NTEP	National Type Evaluation Program	WWMA	Western Weights and Measures Association

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
- Grain Moisture Meters (a) ..... GMA Series
- Grain Moisture Meters (b) ..... GMB Series
- Near-Infrared Grain Analyzers ..... NIR Series
- Multiple Dimension Measuring Devices ..... MDM Series
- Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices ..... LVS Series
- Transportation Network Measuring Systems ..... TNS Series

Other Items ..... OTH Series

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Details of All Items
(In order by Reference Key)

GEN – General Code

GEN-25.1 - G-S.5.6. Recorded Representations

Source: Tesla, NEMA, ABB, Electrify America, RaceTrac, Colorado Division of Oil and Public Safety

Submitter's Purpose and Justification:

Update Handbook 44 Section 1.10 General Code paragraph G-S.5.6 Recorded Representations, to explicitly include QR codes as an acceptable form of electronic receipt, enhancing customer convenience and aligning with modern technology practices.

Integrating unique QR codes as an acceptable form of electronic receipt offers numerous benefits that align with the goals of modernizing transactional processes and enhancing customer convenience. QR codes provide enhanced accessibility as they can be easily scanned using mobile device, offering a quick and efficient way for customers to access their receipts rather than having to input personal information to receive an emailed receipt. This eliminates the risk of losing physical copies and allows for more organized and easily retrievable records. QR codes have become ubiquitous across various industries, with a significant increase in their use for payment and information dissemination purposes. In fact, the global QR code payment market was valued at $9.98 billion in 2022 and is expected to expand at a compound annual growth rate of 16.9% by 2030.[1] Moreover, it's predicted that the global spend using QR code payments will reach over $3 trillion by 2025; rising from $2.4 trillion in 2022.[2]

From a technological standpoint, QR codes are highly versatile and can be integrated across various platforms and systems, making them adaptable to different business environments and customer preferences. Moreover, QR codes can be unique to individual customers and present transaction information via a payment terminal or kiosk. Lastly, digital receipts via QR codes can be encrypted, ensuring a secure means of transmitting transactional information and reducing the risk of fraud associated with other receipt types.

QR codes align with current standards as stipulated in Section G-S.5.6, which requires recorded representations to be printed digitally. QR codes can encapsulate all necessary information required by the standard and can be easily integrated into existing systems that comply with Handbook 44. As technology continues to advance, QR codes are likely to remain relevant and be supported by emerging technologies, ensuring long-term compliance and usability.

Potential opposing arguments, include technical barriers, privacy concerns, and implementation costs. While not all customers may have mobile device capable of reading QR codes, businesses can offer multiple

1 Grand View Research, QR Code Payment Market Size, Share & Trends Analysis Report By Offerings, By Solution, By Payment Type, By Transaction Channel, By End-user, By Region, And Segment Forecasts, 2023 – 2030, (April 24, 2023).

2 Juniper Research, QR Code Payments: Key Opportunities, Competitor Leaderboard & Marketing Forecasts 2022-2026, (May 2022).

options, including traditional printed receipts, to accommodate all customers. Maintaining redundancy and offering multiple options for consumers to receive receipts is essential for enhancing consumer trust and accommodating diverse needs and preferences. Privacy concerns can be mitigated by implementing secure methods of generating QR codes, which can include less personally identifiable information than paper receipts and other forms of digital receipts. Although there may be initial costs associated with transitioning to QR codes, these can be offset by long-term savings from reduced paper usage and improved operational efficiency, with many modern point-of-sale systems already supporting QR code generation with minimal additional investment. Moreover, there may be implementation costs for industries that already utilize digital receipts, such as expenses related to software updates. However, such providers can likely leverage existing infrastructure, minimizing the need for significant additional investment. Ensuring compliance with Handbook 44 when using QR codes can be achieved by standardizing the format and content of QR codes to provide all required information in a verifiable manner.

NIST OWM Executive Summary

GEN-25.1 – G-S.5.6. Recorded Representations

NIST OWM Recommendation: Developing or Withdraw

- The current language in G-S.5.6. Recorded Representations seems to suggest that all forms of delivering electronic transaction data is allowed. Therefore, amendment of this requirement seems unnecessary.

  However, this item does raise some concerns with the current language regarding recorded representations:

  - The intent of G-S.5.6. is to ensure that the commercial transaction provides an accurate record of the transaction (receipt of purchase).
  - The current language in NIST Handbook 44, nor the item under consideration provides assurance that the customer receives a permanent record to be held in their possession of all relevant transaction data. A QR code by itself is not a receipt.
  - The current language in NIST Handbook 44, nor the item under consideration provides assurance that the customer has unrestricted access to the relevant transaction data. There are no safeguards to prevent limited access through a paid subscription or app, or exchange of personal information.

NIST OWM recommends either to Withdraw this item or make it Developing. OWM also recommends revising the current language in NIST Handbook 44 to include the necessary safeguards with respect to recorded representations.

Table 2. Summary of Recommendations
GEN-25.1 – G-S.5.6. Recorded Representations

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Voting		
NEWMA	Withdrawal		Interprets the QR code is already permissible under the existing language in G-S.5.6. that recognizes system's providing a receipt electronically
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

The text below depicting the proposed modifications to paragraph G-S.5.6. includes updates from the submitter dated 10/7/2024 representative of the code text as it appears in the 2025 edition of HB 44.

Amend Handbook 44 General Code as follows:

> G-S.5.6. Recorded Representations. – Insofar as they are appropriate, the requirements for indicating and recording elements shall also apply to recorded representations. All recorded values shall be presented digitally. In applications where recorded representations are required by a specific code, the customer may be given the option of not receiving the recorded representation. Recorded representations referenced in specific codes shall be made available to the customer in hard copy form, unless otherwise specified by the customer. For systems equipped with the capability of issuing an electronic receipt, ticket, or other recorded representation, the customer may be given the option to receive any required information electronically (e.g., via cell phone, computer, **unique and dynamic quick response QR code,** etc.) in lieu of or in addition to a hard copy.
>
> (Amended 1975, 2014, 2023**, and 20XX**)

NIST OWM Detailed Technical Analysis:

NIST OWM is of the opinion that although G-S.5.6. Recorded Representations currently seems to allow any form of electronic recorded representation, this language does not reflect the initial intent of providing a

receipt (record of transaction). The addition of QR codes in the list of examples does not change the requirement in any way. Therefore, the proposed amendment of G-S.5.6 is unnecessary.

While the use of QR codes seems to be allowed under G-S.5.6. Recorded Representations, the item under consideration raised several concerns with the current language in NIST Handbook 44 with respect to recorded representations.

1. The objective of a recorded representation (electronic receipt) is that the customer receives a permanent record of the transaction that remains in possession of the customer. A QR code by itself does not fulfil this objective. It is possible that the QR code itself contains all the information of the transaction (similar to a bar code that contains the identification number of an article), but it is more likely that the QR code leads the customer to a website where they can view the transaction data. In that case, the customer is not in possession of the record and therefore would no be in control of this information. The current proposal does not provide any guidelines to assure that transaction data is permanently retained, i.e., retained over a sufficiently long period of time and protected against corruption or even manipulation. Permanent access to, and integrity of the transaction information needs to be guaranteed, e.g., the displayed transaction data can be downloaded or printed.

   The current language regarding recorded representation lacks the necessary safeguards to assure the customer receives a permanent (non-alterable) record of the transaction data to be kept in their possession, nor is this metrologically relevant functionality covered by the item under consideration.

2. Unlike emailed receipts, the use of QR codes is not a guarantee of unrestricted access to transaction information. There is nothing in the proposal to prevent a provider to require a special app or subscription in order to grant access to the online transaction data. Or make the transaction data available for only a short period of time. Such restrictions could limit the customer's accessibility, impose financial costs on the customer, or require the customer to share personal information. The general publics access to transaction data must be unrestricted.

   The current language regarding recorded representation lacks the necessary safeguards to assure unrestricted access to the transaction data, nor is this covered by the item under consideration.

NIST OWM recommends this item to be withdrawn or developing. NIST OWM recommends revising the definition of a recorded representation and reviewing references to recorded representations to guarantee that the objective of a receipt (a permanent record of transaction data in possession of the customer) is fully achieved.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

At the 2024 WWMA Annual meeting, Franchesca Wahl (Tesla, submitter) gave testimony on behalf of the joint submitters (also adding Michigan to the list of submitters). This item is an additional example of receiving an electronic receipt. QRs are widely used, accepted, and security and privacy concerns can be met. No additional personal information will need to be provided. They recommend a voting status.

Mahesh Albuquerque (Colorado Division of Oil and Public Safety) Cosubmitter, Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program), Mike Brooks (Arizona Department of Agriculture Weights and Measures Services Division AZ), Jose Arriaga (Orange County, California) all expressed support for voting status. The proposed language addition is just an example. The current NIST Handbook 44 code would allow for the use of a Quick Response code already.

Kevin Schnepp (California Division of Measurement Standards), Aaron Yanker (Colorado Department of Agriculture, Weights and Measures), Matthew Douglas (California Division of Measurement Standards), and Khoa Lam (Los Angels County, California) all spoke to security concerns. Will the QR be static (overlay fraudulent activity), unique for each transaction, and how long will it be displayed for a customer to capture the receipt?

Kurt Floren (Los Angels County, California) added clarification. The item is a proposed addition to the general code and would apply to all devices in NIST Handbook 44.

Francesca Wahl responded the QR code will be unique to each transaction, dynamic and generated on the screen of the device. The item is intended to be in general code as it is optional. The EV industry is not the only submitter. The customer would not need to input any personal information.

Mahesh Albuquerque stated 3.34. S.6. This code speaks to electronic receipts. This option is already available. This code could be used or amended as a reference to something specific.

The 2024 WWMA S&T Committee recommends a Voting status. The Committee believes that the item meets its intended purpose and is ready for a vote including the editorial changes noted below.

To adhere with proper NCWM Form 15 formatting, the Committee made the following adjustments:

- The Committee utilized the 2024 version of G-S.5.6. from NIST Handbook 44. The published version in WWMA's agenda is from a previous version of NIST Handbook 44.
- The Committee added "unique and dynamic quick response" to the proposed language.
- The Committee added the amended dates at the bottom of the proposal.

G-S.5.6. Recorded Representations. – Insofar as they are appropriate, the requirements for indicating and recording elements shall also apply to recorded representations. All recorded values shall be presented digitally. In applications where recorded representations are required by a specific code, the customer may be given the option of not receiving the recorded representation. Recorded representations referenced in specific codes shall be made available to the customer in hard copy form, unless otherwise specified by the customer. For systems equipped with the capability of issuing an electronic receipt, ticket, or other recorded representation, the customer may be given the option to receive any required information electronically (e.g., via cell phone, computer, **unique and dynamic quick response [QR] code,** etc.) in lieu of or in addition to a hard copy.

(Amended 1975, 2014, ~~**and**~~ 2023**, and 20XX**)

The Committee acknowledges the advances in QR code technology and recognizes its place in the marketplace. The Committee encourages further discussion on the impacts to various devices, consumers, and industry.

The Committee strongly recommends that:

- The NTEP Sectors evaluate QR Code Technology and how it may affect the use of various devices, as it is being proposed in the general code.
- The NTEP Sectors consider the concerns heard during open hearings related to security, implementation, use, etc.
- Stakeholders, including the NTEP Sector, consider developing specifications for the use of QR codes to be added to NIST Handbook 44.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, Matthew Williams, TDLR – spoke in support of the item and noted the language was not of the most current version of Handbook 44.

Alison Wilkinson (MD) spoke in support of the item.

Tessa Sanchez (Tesla) Co-submitter recommended voting status for the item, stating that QR codes are commonly recognized and listed the benefits of having QR codes, including enhanced accessibility and protection of customer information.

The Committee recommends voting status on this item, along with updating the text to the most current version of the handbook.

Northeastern Weights and Measures Association

At the 2024 Interim Meeting, Kevin Reynolds (Tesla) commented on behalf of all submitters that the proposal is intended to update the general code in order to explicitly include QR codes as an acceptable form of electronic receipt for consumers. Utilizing QR codes to provide access to electronic receipts is not explicitly addressed in the general code today. Therefore, it is important to update the code to include this additional pathway for an electronic receipt. They gave the following example: a customer may pull up to a gas station or an EV charging station and after the transaction is completed have the option to select an electronic receipt to receive their invoice. Instead of having to type in personal information to access the receipt via email, text message, print it or call a hotline, the customer can instead scan the digital QR code and be taken to a web portal that automatically provides the receipt, with all the required information, which can easily be downloaded and saved as a PDF to reference later on. In general, QR codes are becoming a commonly recognized form of electronic receipt for many products today as part of standard payment terminal designs.

Jason Flint (NJ) commented that the paragraph already allows the option of receiving a receipt electronically and the addition of "QR code" in the example is redundant. They recommended a withdrawn status. Bill Nebot (NY) commented that they agree with NJ. Mike Smith (NY) commented they agreed with NJ and suggested striking all examples within the parenthesis. Scott Dolan (VT) commented that they concur with NY and NJ.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting a representative from Tesla spoke on behalf of the submitting group in support of this item. It was stated that instead of typing in personal information into a web portal to obtain a receipt, a QR code could be used as a more secure method. In response to a question by a regulator from Minnesota, it was noted that the submitters were advised by NIST during NTEP certification to include QR Codes in the existing list in order to assist in the NTEP certification process. Finally, it was brought to the Committee's attention that both the SWMA and WWMA assigned this item as voting.

A regulator from Wisconsin spoke in support of this item as it is written.

A regulator from Minnesota spoke in support of this item as written. It was also stated that lists of examples may have a negative impact because people may view that list as exhaustive and continue to add to it when deemed necessary.

A regulator from Iowa supported this item and agreed with the comments from Minnesota.

A regulator from Nebraska supported this item as written, noted QR Codes are currently allowed, and agreed with the comments from Minnesota.

The Committee recommends this as a voting item based on comments heard during open hearing.

Scale Manufacturers Association (SMA)

At the 2024 Fall meeting, the SMA supported this item provided the QR code is unique for the specific transaction.

SCL – Scales

SCL-24.2. D Multiple Sections Regarding Tare

Source: Ross Andersen (retired New York)

Submitter's Purpose and Justification:

The changes are now limited to five sections. The three new specifications deal with identification of weight values on instrument indications and printed/recorded records and the issue of mathematical agreement. The two tolerance paragraphs address the application of tolerance to both gross and net weights.

All of the material in the original justification remains pertinent but will need to be addressed through proper training. This particularly applies to the terminology issues where common terms have multiple meanings, e.g., the "gross weight" of the commodity is also the "net weight."

Paragraphs S.1.17. and S.1.18. deal with issues of identifying weight values. These are necessary to ensure that the Code is driving the requirements and not NTEP. This has long been an issue as NTEP should be following and not leading. At present there is no guidance in HB44 on these issues other than the General Code G-S.6. while all of the technical direction is coming from the NTEP checklists. As an example, G-S.6. says displays shall be clearly identified. Yet, we permit gross weight displays to be used without designation, even when the scale has tare capability? Under G-S.6., couldn't a conscientious official require that the display be identified as gross when no tare is in use? The two simple paragraphs clearly lay out the requirements.

The mathematical agreement issue in S.1.19. is significant as agreement can only be required to calculations of weight from two measured values. Once you measure all three values, mathematical agreement becomes impossible. Consider two cases with unrounded values and (rounded values):

Case 1	Case 2
Gross = 8.244 lb (8.24 lb)	Gross = 8.236 lb (8.24 lb)
Tare = 0.546 lb (0.55 lb)	Tare = 0.554 lb (0.55 lb)
Net = 7.698 lb (7.69 lb)	Net = 7.682 lb (7.69 lb)

In Case 1 the 7.698 lb net weight would correctly round to 7.70 lb if the net weight were measured. In Case 2 the 7.682 lb net weight would correctly round to 7.68 lb if the net weight were measured. It is vital to understand that this is not unusual and statistically should occur about 25% of the time. This means weighed values would be smaller than calculated values by -1 d about 12.5% of the time and by +1 d about 12.5% of the time. Notice how this situation is similar to the case already in the Code in S.1.2.1. but is not presently addressed in the Code for simultaneous display of gross, tare and net. If a scale were produced with all three weights measured, how would officials react to a lack of mathematical agreement?

The T.1.1. paragraph presently does not address net weight. In keeping with the principle that we test the instrument as it is used, any instrument with a tare mechanism can be tested in net mode. Historically, tolerance was applied to net weight for all scales prior to the 1984 changes to the Scale Code. The T.N.2.1. paragraph attempts to address net weight but is deficient in that it does not clearly require that the test begin at center zero in net mode.

The amendments to these two paragraphs specify that the test load must be added after ensuring the gross or net zero starting point is accurate within ¼ e. Note the 2024 changes to S.1.1.1. That section has been in effect since 1993 and always implied that the zero starting point in a commercial transaction or a test was accurate to within ¼ e. The addition of (b) requiring zero setting be accurate to ¼ e and the revised (c) requiring a center zero indicator all work to ensure the transaction or test begins at an accurate zero, whether we are testing gross or net weight. It is obvious that semiautomatic zero and semiautomatic tare both get the starting zero accurate to ¼ e.

The question is how would this apply tolerances when using keyboard or programmed tare? In the commercial transactions using these forms of tare, neither the user nor the customer sees a net load zero indication at any step in the weighing process. R76 avoids the issue by stating that tolerances only apply to net when semiautomatic tare (R76 tare device) is in use. If you wished to test net weight with one of these alternative tare methods, you would have to apply test weights to load to the tare weight and use error weights to ensure that the net zero was accurate to ¼ e. This is because these tare values are rounded and because the instrument may have indication error at the displayed tare weight. All this work is avoided by testing only with semiautomatic tare, which is required to set the zero accurate to ¼ e.

NIST OWM Executive Summary

SCL-24.2. − Multiple Sections Regarding Tare

NIST OWM Recommendation: Developing

- NIST OWM recognizes the issues raised by the submitter. The error introduced to the measurement under the current requirements can be as much as the acceptance tolerance for single interval scales, and a multiple of the acceptance tolerance for multi-interval scales.
- NIST OWM believes that the proposed amendments may 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.
- Some of the points identified by NIST OWM that may add clarification to the item:

SCL-24.2. − Multiple Sections Regarding Tare

- The proposal should emphasize that mathematical agreement can only be obtained in the case of a net calculation based on two independent weighing results (e.g., weigh-in-weigh-out systems). Mathematical agreement cannot be guaranteed with any tare operation without introducing an error in either the gross, tare, or net weight.
- Omit the proposed requirement S.1.18 as it is confusing and has no added value.
- To amend the current language in S.1.2.1 and include examples that illustrate the proper net weight determination when tare is determined in various ways.
- Review the terms used in S.1.16. and S.1.17. and consider whether they could be combined to apply to indications and recorded representations, as the information is repetitive (See the Detailed Analysis).

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

	Status Recommendation		Note*	Comments
Submitter	Developing			
OWM	Developing			
WWMA	Developing			
NEWMA	Withdraw			
SWMA	Withdraw			
CWMA	Developing			
NCWM	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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

Amend Handbook 44 Scales Code as follows:

Add the following paragraphs:

S.1.16. Marking of Weight Indications.

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

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

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

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

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

S.1.17. Printing of Weighing Results.

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

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

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

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

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

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

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

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

Amend the following paragraphs:

T.1.1. General. – ~~**The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied**~~ **The tolerances herein prescribed shall be applied to errors of**

underregistration and errors of overregistration as specified in Table T.1.1. Tolerances for Unmarked Scales. **The tolerances apply to errors in gross weight indication starting at gross load zero. The tolerances also apply errors in net weight indication starting at net load zero. In both cases, the starting zero shall be accurate to ¼ e before addition of the test load.**

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**~~ 2024**, and 202X**)

T.N.2. Tolerance Application.

T.N.2.1. General. – ~~**The tolerance values are positive (+) and negative (−) 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 herein prescribed shall be applied to errors of underregistration and errors of overregistration. The tolerances apply to errors in gross weight indication starting at gross load zero. The tolerances also apply errors in net weight indication starting at net load zero. In both cases, the starting zero shall be accurate to ¼ e before addition of the test load.**

(Amended 2008 **and 202X**)

NIST OWM Detailed Technical Analysis:

Paragraph S.1.2.1 is the only requirement in the current Scales Code that specifies how a net weight must be calculated, and it only applies to multi-interval or multiple range scales. It requires the Net Weight to be mathematically correct when calculated from the Gross & Tare Weight.

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 included in paragraph S.1.2.1, then this rounding error occurs in the Net value, which is the value that is used for the commercial transaction.

Example 1:

An item is weighed on a scale with e = 1 g using a pushbutton tare.

Assume the actual tare value = 10.5 g and the actual gross weight= 31.4 g

=> The actual net weight is = 31.4 g - 10.5 g = 20.9 g

The indications of the Gross and Tare values rounded to e are:

Gross = 31 g, Tare = 11 g

Due to mathematical agreement, the Net is calculated from these rounded values:

Net = Gross – Tare = 31 g – 11 g = 20 g

The indication of Net 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 from 20 g to 21 g when adding a 0.1 g flip weight. This is because the internal gross load changes from 31.4 g to 31.5 g which causes the gross indication to round up to 32 g (32 g – 11 g = 21 g), assuming the scale rounds up at 0.5 g. Again, assuming the scale rounds to 21 g when the internal value reaches 20.5 g, you would assume the internal net weight was 20.4 g before applying the 0.1 g flip weight. **This indicates an error of -0.5 e (20.4 g – 20.9 g)**. 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 is used to fill propane tanks: 6/15 kg x 0.002/0.005 kg

The tank is filled with propane that weighs 0.999 kg. The actual weight of the empty tank is 7.003 kg and

=> The actual gross = 7.003 kg + 0.999 kg = 8.002 kg

Indications rounded to e:
Gross = 8.000 kg (e=0.005 kg)
Tare = 7.005 kg (e=0.005 kg)

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 is 0.002 kg and should be displayed as 0.998 kg. The acceptance tolerance is 0.5 e = 0.001 kg.

The difference between the indication and the true value is 0.003 kg which is **3x 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 this creates non-uniformity:

1) The general interpretation of NIST HB 44 is that Gross, Tare, and Net calculations must be in mathematical agreement, but there is no such requirement. Only the example in paragraph S.1.2.1 seems to suggest that they must be in mathematical agreement, but a clear requirement is missing.
2) To obtain the most accurate measurement, it is generally accepted that rounding must be the very last operation when calculating a weight value. However, to achieve mathematical agreement, S.1.2.1. forces rounding of the first two weight values and then calculation of the third one. This is the only way to guarantee mathematical agreement. **Therefore, as prescribed in S.1.2.1, rounding is NOT the final operation.**
3) Mathematical agreement also 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) Paragraph S.1.2.1 implies that the Net value should be the calculated value. However, this is the value that is used for the commercial transaction. 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 verification scale intervals (e.g., a tare weight of exactly 50 e and a net load of 200 e), the rounding error observed 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 two indications.

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.

The submitter should consider using the term "Identification" rather than "Marking" in the title of S.1.16. In addition, the item seems to be written to require the display rather than the indications to be properly "marked," although the title specifies "Marking of Weight Indications." The submitter should also consider rewording parts (a) through (d) to more clearly specify that the indications must be properly identified. For example, part (a) could be reworded as follows:

(a) On a scale equipped to only provide a gross indication, the indication may not be identified or may be identified by the symbol "G".

With respect to S.1.17., as written it would only apply to printed representations of weighing results, not electronic representations, which are allowed per the Block 4 items adopted in 2023, specifically G-S.5.6. Recorded Representations. There also seems to be a repetition between S.1.16. and S.1.17. Could they be combined to apply to indications and recorded representations?

The submitter acknowledges that mathematical agreement cannot be guaranteed if all three values are weighed by the scale. It seems that the submitter is trying to align the requirements regarding tare with OIML R 76. However, the language in the proposal for S.1.18 and the existing language in S.1.2.1 are confusing and even seem to contradict each other. S.1.2.1 seems to require mathematical agreement on multiple range and multi-interval scales, while the proposed language for S.1.18 states that this is not possible.

OWM suggests omitting the proposed paragraph S.1.18 from the proposal and instead amending the current language in S.1.2.1 to bring this in line with OIML R 76. OWM also suggests deleting the second paragraph of S.1.2.1 and replacing the example with examples similar to those in R 76 clause 4.6.12.

Summary of Discussions and Actions:

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

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

Regional 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 Schnepp (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.

During the 2024 WWMA Annual Meeting, Steve Harrington (Oregon, Department of Agriculture, Weights and Measures Program) had the Same comments as last year for this item. The language appears to be the same. The item may have merit but does not feel the item is ready for a vote and has challenges. Recommended a Developing status.

Corey Hainy (SMA) stated that the SMA met last April to discuss the item, this comment is based on the April meeting. The SMA is not in support of this item and recommends withdrawal. Any changes to the item will be assessed at the November meeting.

Matthew Douglas (State of California, Division of Measurement Standards) stated that it appears the language in this item has not changed. They recommend the item remains developing and that the submitter work with NIST to develop clear explanation as to why it is necessary. In addition, the item should be separated and blocked appropriately with only one version of S.1.18.

Aaron Yanker (Colorado, Department of Agriculture, Weights and Measures) agrees with the comments from Oregon and California. The submitter should separate the individual items and block it together in appropriate NCWM format.

The WWMA 2024 S&T Committee recommends a Developing status. Additionally, the committee suggests the submitter work with NIST OWM to clarify how and why the item is beneficial. The Committee also recommends for clarity that the submitter breaks up the item, block it appropriately, and select one version of S.1.18. to move forward with.

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.

At the 2024 SWMA Annual Meeting, Cory Hainy, SMA recommended withdrawal of the item. They don't believe there is enough confusion to warrant the change

The committee recommends withdrawal status of the item.

Northeastern Weights and Measures Association

At the 2023 NEWMA Interim Meeting, the Committee recommended this item be Developing.

At the 2024 NEWMA Annual Meeting, Brandi Harder (Rice Lake), representing the Scale Manufacturers Association, commented the SMA does not support this item as they do not feel the current language is confusing to users and requested that it be withdrawn. No comments were heard from regulators.

The Committee recommended to maintain a Developing status and the body concurred.

At the 2024 NEWMA Interim Meeting, Michael Peeler (NJ) commented that the current version in the Handbook is clear, but reading the proposal is confusing, with the exception of the definitions of gross weight, net weight and tare weight. They recommended a withdrawn status.

After hearing comments from the floor, the Committee recommended a Withdrawn status for this item and the body concurred.

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.

At the 2024 CWMA Interim Meeting, a representative of the Scale Manufacturer's Association commented that the SMA does not support this item. The SMA feels the change isn't warranted.

The Committee recommends that the submitter develop the item further following the recommendations from the NCWM 2024 Interim Meeting.

At the 2024 CWMA Interim Meeting, a representative from NIST OWM recommended that this item remain developing noting there are conflicts between definitions and language in some of the paragraphs.

A regulator from Iowa commented that anything that reduces confusion is good and that this item should remain developmental.

The committee recommends this item as developing.

Scale Manufacturers Association

During the 2024 SMA Spring Meeting they indicated they do not support this item and ask that it be withdrawn. They do not feel there is confusion to warrant the change.

During the 2024 SMA Fall Meeting they indicated they do not support this item and ask that it be withdrawn. They do not feel there is confusion to warrant the change.

SCL-22.2 A UR.3.1.X. Required Minimum for Cannabis Products

Source: NCWM Cannabis Task Group

Submitter's Purpose and Justification:

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

NIST OWM Executive Summary

SCL-22.2 – UR.3.1.X. Required Minimum for Cannabis Products

[1]**NIST OWM Recommendation:** Assigned

- OWM has multiple concerns with the proposed parts (b) and (c) of UR.3.1.X.
  - Part (b) would require a minimum load as specified in Table 8 when weighing cannabis and cannabis products. Part (c) requires a verification scale interval (e) of 0.01 g or less when 3 ounces or less of cannabis or cannabis products are weighed. 3 ounces is roughly 85 g. This effectively requires a load of 8500 e for weighments conducted at 3 oz (85 g) and greatly exceeds the minimum load of 20 e which Table 8 specifies for scales with an e of 0.01 g
  - Part (c) also requires a Class II scale that is traceable to a National Type Evaluation Program Certificate of Conformance (NTEP CC) when weighing *cannabis* and *cannabis* products.
    - The requirement that a scale have an NTEP CC is addressed by each state's weights and measures law and this conflicts with some states.
- For all of the reasons above, OWM recommends this item remains assigned to the Task Group. OWM offers to assist the Cannabis Task Group in developing a technically sound proposal.

[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 Council of Weights and Measures (NCWM) as part of NIST's statutory mission to promote uniformity in state laws, regulations, and testing procedures.

Table 2. Summary of Recommendations
SCL-22.2 – UR.3.1.X. Required Minimum for Cannabis Products.

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

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

Item Under Consideration:

Amend NIST Handbook 44, Scales Code as follows:

UR.3. Use Requirements.

UR.3.1.X. Required Minimum Loads for *Cannabis* Products.

(a) The use of italicized text in the references to "*Cannabis*" 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.

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

(c) Scales used for commercial purposes to buy or sell all *Cannabis* products or the production of *Cannabis* products that have a total weight of 3 ounces or less shall be a Class II scale, be traceable to a National Type Evaluation Program Certificate of Conformance, and have a verification scale interval (e) of not greater than 0.01 g. A scale with a higher accuracy class than that specified as "typical" in Table 7a. Typical Class or Type of Device for Weighing Applications may be used.

(Added 20XX)

NIST OWM Detailed Technical Analysis:

With the determination of a suitable scale for a certain application, there are 3 main scale characteristics to consider:

1. **The overall accuracy of the measurement throughout the entire weighing range**

   The choice for a particular classification should be based on the desired accuracy of the scale throughout its entire weighing range. The relative maximum permissible error lies in the order of 1% for class IIII, 0.1% for class III, 0.01% for Class II and 0.001% for Class I. Please note that this is the accuracy of the measurement itself, not taking into account the inaccuracy due to the

display resolution (scale division).

Table 7a of the Scales code in NIST Handbook 44 assigns a typical accuracy class to several specific applications. Unless specified otherwise in Table 7a, the default classification for an application is Class III. As noted, a scale with a higher accuracy class than specified as typical in Table 7a, may be used which allows a scale of a class that is more accurate that the "typical" class specified in this table to be used for an application.

Class II scales may seem the most suitable device for the retail sale of cannabis products, which would place cannabis in the same accuracy class as precious metals and gems. However, the density of dried Cannabis buds is significantly less than the density of gold or diamonds. That means that Buoyancy plays a much bigger role in the weighing of dried Cannabis buds. A quick analysis of NIST OWM indicates that under extreme variation of temperature, humidity and air pressure, the measurement results can vary as much as 0.6 %. When weighing a load of 85 g (3 oz) this would be equal to 0.17 g. With a scale division of 0.01 g this is equal to 17 divisions.

2. The minimum recommended load that determines the maximum uncertainty due to the resolution of the weight indication

At the low end of the weighing range, the display resolution plays a bigger role than the accuracy of the measurement itself. The uncertainty of the weight indication can be as much as ±0.5 d. For relatively small loads (compared to the scale's capacity) this uncertainty may be relatively large compared to the load itself.

For this reason, the Scales code in NIST Handbook 44 includes Table 8, Recommended Minimum Load. For example, the recommended minimum load for a Class II scale with a scale division of 0.01 g is 20 scale divisions. This limits the uncertainty due to the resolution of the weight indication to 0.5 divisions / 20 divisions = 2.5%.

<u>As a consequence, the required scale division is determined by the smallest amount that is expected to be weighed on the scale</u>. The size of the scale division must be equal to or smaller than the smallest expected load divided by the minimum recommended load. For example, to weigh a load of 50 g on a Class III scale, it is recommended that the scale have a scale division smaller than or equal to 50 g/20 = 2.5 g (in this case a 2 g d).

Please note that the values in Table 8 do not depend on the application. These recommended minimum loads solely depend on the scale's accuracy class and not on the commodity being weighed, nor on the unit price of the commodity.

<u>Amendment under consideration</u>:
The Item Under Consideration proposes to add new UR.3.1.X, parts (a), (b), and (c).

NIST OWM has the following concerns regarding parts (b) and (c):

1. Part (b) would require a minimum load as specified in Table 8 when weighing *cannabis* and *cannabis* products. Part (c) requires a verification scale interval (e) of 0.01g or less when 3 ounces or less of *cannabis* or *cannabis* products are weighed. 3 ounces is roughly 85 g which effectively requires a load of 8500 e for weighments conducted at 3 oz/85 g and greatly exceeds the minimum load of 20 e specified by Table 8 for scales with an e of 0.01 g

2. Part (c) also requires a class II scale that is traceable to a National Type Evaluation Program Certificate of Conformance (NTEP CC) when weighing *cannabis* and *cannabis* products. The requirement that a scale have an NTEP CC is addressed by each state's weights and measures law and this would conflict with some states.

3. The price increment per scale division

A high unit price may lead to a large price difference between two weighing results that differ by only one scale division. For example, weighing a commodity with a unit price of $20 per gram on a scale with a 0.1 g scale division leads to a price increment of $2.00 per scale division. To avoid a large increment per scale division one could select a scale with a smaller scale division.

If a limitation of the scale division due to price increment is desired, then this should be added as a User Requirement. A proposal that was under consideration during the 2022 NCWM cycle specified several "maximum" scale divisions which corresponded to a particular net weighment. The intent of that proposal seemed to be to limit the price increment per scale division. If the Cannabis Task Group decides that a limitation of the price increment per scale division is necessary, they should consider developing such limitation in the form of a formula which provides more flexibility and makes it universally applicable.

Summary of Discussions and Actions:

During the 2022 NCWM Interim Meeting, the Committee received a somewhat wide range 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.

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

During the 2024 Annual Meeting, Charlie Rutherford (Co-Chair of the Cannabis Task Group) provided the Committee with updated language for this item that removed the proposed amendments to Table 7a and Table 8 and further developed the proposed paragraph UR.3.1.X.

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 HB 44 - 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 Schnepp (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.

During the 2024 WWMA Annual Meeting, the following comments were provided :

Aaron Yanker (Cannabis Task Group member): The item as printed in this agenda has not changed from the 2024 NCWM annual. Please review that document for current comments. The task group is still working on the item to address comments heard at the annual meeting including grams equivalent, commercial performance, all cannabis products etc.. The item is being worked on by the group to hopefully get the item read for a vote.

Corey Hainy (SMA): The SMA supported development of the item at the April meeting. We will meet in November to review item further. 7.a language replaced with "all cannabis". Reference to Table 8 with new proposed changes.

Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program): Position is the same as last year. It is difficult to set up something in HB44 that is so commodity specific.

Matthew Douglas (State of California, Division of Measurement Standards): Supports the assigned status. Consideration should be made regarding the other item on the agenda that may remove Table 8. Reference to NTEP traceability is not necessary in HB44.

The 2024 WWMA S&T Committee recommends an Assigned status and looks forward to further development by the NCWM Cannabis Task Group, with consideration to comments heard during open hearings.

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.

At the 2024 SWMA Annual Meeting, Cory Hainy, SMA spoke in support of developing status and recommended cannabis references be replaced with retail cannabis.

The committee recommended the item remains assigned.

Northeastern Weights and Measures Association

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

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

(a) 0.01g for net weighments up to 10 g
(b) 0.1g for net weighments greater that 10g , up to 100 g, and
(c) 1 g for net weighments greater than 100g , up to capacity

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

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

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

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

During the 2022 NEWMA Annual Meeting, James Cassidy (Massachusetts) commented as the Co-Chair of the NCWM Cannabis Task Group. He supported the Assigned status so the Task Group can continue to

develop the item from comments received at the 2022 Interim. Russ Vires (SMA) supported continued development and indicated that a user requirement typically does not pertain to a specific commodity. Russ Vires suggested the words "retail cannabis" should be added to the "Class II" section of Table 7a and the words "bulk cannabis processing and sales" should be added to the "Class III" section of Table 7a.

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

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

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

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

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

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

And

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

Class	Weighing Application or Scale Type
I	Precision laboratory weighing and weighing of all Cannabis products
II	Laboratory weighing, precious metals and gem weighing, grain test scales, and weighing of all Cannabis products

Class	Weighing Application or Scale Type
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.

At the 2024 NEWMA Annual Meeting, Lou Sakin (Holliston, MA), representing the Cannabis Task Group, gave an update on this item. Lou commented that it is still Assigned and the task group continues to work on this item. The task group has met with NIST staff and the task group will meet in June to rewrite the entire item. Lou requested that any suggestions to move this item forward would be appreciated and to please contact task group chair. Brandi Harder (Rice Lake), representing the SMA, commented that the SMA supports the item with edits including replacing "All Cannabis" with "non-retail Cannabis" in Table 7a Class III, and add a note in to Table 7a that states "Refer to Table 8 for guidance on scale selection for Cannabis".

The Committee recommended maintaining an Assigned status and body concurred.

At the 2024 NEWMA Interim Meeting, Michael Peeler (NJ) commented that since the tables and additional user requirements have been removed, the item is fully developed and recommends a voting status.

Mike Smith (NY) commented that subsection (c) should clarify if "total weight" is net weight or gross weight.

Scott Dolan (VT) commented the word "traceable" implies something metrological and believes it should be replaced with "has received".

Cheryl Ayer (NH) agrees with NY and VT.

After hearing comments from the floor, the Committee recommended a Voting status for this item with the following changes to (c) that appear below, and body concurred.

(c) Scales used for commercial purposes to buy or sell all Cannabis products or the production of Cannabis products that have a total net weight of 3 ounces or less shall be a Class II scale with a National Type Evaluation Program Certificate of Conformance, and have a verification scale interval (e) of not greater than 0.01 g. A scale with a higher accuracy class than that specified as "typical" in Table 7a. Typical Class or Type of Device for Weighing Applications may be used.

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 is it "e" or "d", will send notes to Committee. Ivan Hankins (Iowa) would support item with Eric Golden's language. Eric Golden continued by recommending the following change to which will add clarity to the listed weight ranges in SCL-22.2 (in red):

SCL-22.2 UR.1. Selection Requirements, and 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, and 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.

At the 2024 CWMA Annual Meeting, the Co-Chair of the Cannabis Task Group commented that they are still working on this item and would like it to remain as Assigned.

A representative of the Scale Manufacturer's Association commented that the SMA supports this item with the following changes: In Table 7a Class III, replace the words "All Cannabis" with "Non-retail Cannabis". Add in notes section in Table 7a; "Refer to table 8 for guidance on scale selection for Cannabis".

The Committee recommends that this item remain as Assigned.

At the 2024 CWMA Interim Meeting, a regulator from Wisconsin commented that while cannabis is illegal in Wisconsin, they still offered support for states to pursue regulation for their citizens in the cannabis industry.

A regulator from Minnesota noted that this item references Table 8. and that item SCL-25.1 seeks to remove Table 8.

A representative from NIST OWM supports this item remaining assigned. It was reiterated that item SCL-25.1 seeks to remove Table 8. and a suggestion was made that this item reduces the "3 ounce" requirement or to convert the "3 ounce" reference to grams to minimize excessive scale intervals.

The committee recommends this item remain assigned to the NCWM Cannabis Task Group to address NIST OWM concerns.

Scale Manufacturers Association

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 table 8 for guidance on scale selection for Cannabis".

During the 2024 SMA Spring Meeting, the SMA indicated they support the continued development of this item and continue to recommend that in Table 7a Class III, replace the word "All Cannabis" with "non-retail Cannabis" and add in notes section in Table 7a; "Refer to table 8 for guidance on scale selection for Cannabis".

SCL-25.1 I S.5.2., S.6., and UR.3.1.

Source: NIST Office of Weights and Measure

Submitter's Purpose and Justification:

To update Handbook 44, Section 2.20 Scales, S.5.2. Parameters for Accuracy Class, S.6. Marking Requirements and UR.3. User Requirements regarding the minimum capacity and the recommended minimum load:

1. Define the minimum capacity (and implicitly the recommended minimum load) in units of scale divisions. This is a continuation of the work by the Verification Scale Division Task Group to remove any ambiguity from Table 8 in UR.3.1. Defining the values in scale divisions, d, brings UR.3.1. in line with OIML R 76 and underlines the added value of having an auxiliary indication.
2. Remove Table 8 from UR.3.1 and add a new Table S.5.2.2. Minimum Capacity to the specification section. The term Minimum Capacity is defined in NIST Handbook 44 and was initially considered as part of the parameters for accuracy classes when the scales code was being reorganized in the 1980's. The minimum capacity is a characteristic of the accuracy class and should be defined in specifications as are the other parameters defining the accuracy classes. The specification of a minimum capacity is already established in Section 2.24. Automatic Weighing Systems and this amendment will bring Section 2.20. Scales further in line with OIML R 76 Non-automatic weighing instruments.
3. **Please note that specifying the minimum capacity does not impose any technical restrictions on the instrument and has no influence on the code's enforcement.**
4. Mark the scale with the specified minimum capacity as defined in Handbook 44, Appendix D Definitions. Because the Minimum Capacity is a characteristic of the accuracy class, it should be marked on the weighing instrument. That way, the minimum capacity is clearly presented to both the vendor and the customer which will lead to less confusion in the field. Again, requiring the minimum capacity is also established in Section 2.24. Automatic Weighing Systems and this amendment will bring Section 2.20 Scales further in line with OIML R 76 Non-automatic weighing instruments.
5. **Please note that a marking requirement is purely informational and does not automatically impose any technical restrictions on the instrument or require compliance with the marking.**
6. Amend UR.3.1. Recommended Minimum Load to refer to the specified minimum capacity. If minimum capacity is a specification, UR.3.1. can simply refer to the specification instead of having a copy of the table in UR.3.1. Duplication of specifications or requirements can lead to confusion, inconsistencies, and non-uniformity for all stakeholders.

Original Justification:

1. **Defining the minimum capacity and recommended minimum load (RML) in units of the scale division, d.**
    - UR.3.1. & Table 8 were adopted to reduce the error associated with rounding of the scale division.
    - Most scales are configured with e = d, this proposal has no effect on these devices.
    - Using d to determine the minimum capacity (and RML) is technically correct.
    - This fixes what OWM views as an oversight when these requirements were adopted.
    - This would harmonize NIST Handbook 44 with OIML R 76 in regard to the minimum capacity (and RML).
2. **Adding the minimum capacity as a parameter in specifications.**
    - Adding as a specification:
        - gives the opportunity to mark it on the instrument, but
        - does not automatically require marking on the instrument or change enforcement practices.
        - This allows retention of UR.3.1. and adoption of this parameter as a retroactive requirement.
    - With the exception of UR.1., there are no references to minimum capacity in Section 2.20. Scales, therefore adoption would have no effect on existing instruments.

- Again, this would harmonize NIST Handbook 44 with OIML R 76 in regard to the minimum capacity.

3. Marking of the minimum capacity on the instrument.

- Vendor, user and customer are not always aware of recommended minimum load. This amendment makes all parties involved in the commercial transactions aware of the suitability of the scale for small loads.
- As proposed, marking the minimum capacity would be a nonretroactive requirement and would not affect scale manufactured before the effective date unless they are moved to a new state.
- Many devices in use already have a marked minimum capacity stemming from a certification according to OIML R 76.
- Marking the instrument with the minimum capacity is just informational. It does not automatically require enforcement of a minimum load (which is recommended in UR.3.1) and it does not impose any technical restrictions on the functionality of the instrument.
- Again, this would harmonize NIST Handbook 44 with OIML R 76 in regard to marking minimum capacity.

Amendment of UR.3.1. and Table 8.

- Referring to the new proposed Table S.5.2.b. in the amended UR.3.1., which removes Table 8, avoids duplication of the tables and, thus, reduces the chance of mistakes, confusion, inconsistency, and non-uniformity.
- The minimum capacity is a characteristic of the accuracy class and, therefore, a characteristic of the scale.
- The recommended minimum load pertains to the use of the instrument and can only be prescribed in a user requirement.
- Hence the difference between "minimum capacity" and "recommended minimum load" and the need to amend UR.3.1.

NIST OWM Executive Summary

SCL-25.1 – S.5.2. Parameters for Accuracy Class, S.6. Marking Requirements and UR.3. User Requirements

NIST OWM Recommendation: Informational

- This item makes a distinction between the minimum capacity (a characteristic of the classification) and the minimum load (the actual load placed on the scale).
- It clarifies that the minimum capacity of the scale depends on the scale division.
- It ties the minimum capacity to the classification.
- It requires the minimum capacity to be marked on the scale, which makes it easier for the user and inspector to determine the scale's minimum capacity.
- This proposal brings the Scales Code in line with OIML R 76 regarding the markings of the minimum capacity and its relationship to the scale division.
- In the Justification, to be clear, part 4. should read "4. Amendment of UR.3.1. and **Removal of** Table 8".

Table 2. Summary of Recommendations
SCL-25.1 – S.5.2. Parameters for Accuracy Class, S.6. Marking Requirements and UR.3. User Requirements

	Status Recommendation	Note*	Comments
Submitter	See OWM		
OWM	Informational		
WWMA	Informational		
NEWMA	Voting	1	Supports alternative language from Ross Andersen (NY, Retired)
SWMA	Informational		
CWMA	Developing		
NCWM	Informational		

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

Item Under Consideration:

Amend Handbook 44 Scales Code as follows:

Part 1 and 2. Amendment of S.5.2 Parameters for Accuracy Class

Restructure S.5.2 and add new specification:

S.5.2. Parameters for Accuracy Class. ~~*– The accuracy class of a weighing device is designated by the manufacturer and shall comply with parameters shown in Table 3.*~~
~~*[Nonretroactive as of January 1, 1986]*~~

(a) ***The accuracy class of a weighing device is designated by the manufacturer and shall comply with the parameters shown in Table 3.***

[Nonretroactive as of January 1, 1986]

(Amended 20XX)

(b) The minimum capacity of a scale is specified in Table S.5.2. Minimum Capacity and is based on the accuracy class and verification scale interval.

(Added 20XX)

Table S.5.2. Minimum Capacity

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

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

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

The minimum capacity is 5 e for a weight classifier marked in accordance with a statement identifying its use for special applications.

(Added 20XX)

Part 3. Amendment of S.6 Marking Requirements

Amend Table S.6.3.a. as follows:

Table S.6.3.a.
Marking Requirements

To Be Marked With ⇓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC[1]	**Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC**	**Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC**	**Load Cell with CC (11)**	**Other Equipment or Device (10)**
Manufacturer's ID (1)	X	X	X	X	X
Model Designation and Prefix (1)	X	X	X	X	X
Serial Number and Prefix (2)	X	X	X	X	X (16)
Certificate of Conformance Number (CC) (23)	X	X	X	X	X (23)
Accuracy Class (17)	X	X (8)	X (19)	X	
Nominal Capacity (3)(18)(20)	X	X	X		
Value of Scale Division, "d" (3)(4)	X	X			
Value of Verification Scale Division, "e" (3)(**4**)	X	X			
Minimum Capacity (29)	**X**	**X**			
Temperature Limits (5)	X	X	X	X	

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

(Added 1990) (Amended 1992, 1999, 2000, 2001, 2002, 2004, ~~**and**~~ 2025 **and 202X**)

Amend Table S.6.3.b as follows:

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

3. ***The device shall be marked with the minimum capacity, which shall be prefaced by the terms "Minimum Capacity", "Min. Capacity", "Min. Cap.", or "Min."***
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

The other notes in the table are omitted for brevity in this proposal.

Part 4. Amendment of UR.3.1

Amend UR.3.1. as follows:

UR.3.1 Recommended minimum load - ~~**A recommended minimum load is specified in Table 8. Recommended Minimum Load**~~ **A minimum load equal to the scale's minimum capacity as specified in Table S.5.2. is recommended** since the use of a device to weigh light loads is likely to result in relatively large errors.
(Amended 20XX)

~~Table 8. Recommended Minimum Load~~		
~~Class~~	~~Value of Scale Division (d or e*)~~	~~Recommended Minimum Load (d or e*)~~
~~I~~	~~equal to or greater than 0.001 g~~	~~100~~
~~II~~	~~0.001 g to 0.05 g, inclusive~~	~~20~~
~~-~~	~~equal to or greater than 0.1 g~~	~~50~~
~~III~~	~~All**~~	~~20~~
~~III L~~	~~All~~	~~50~~
~~IIII~~	~~All~~	~~10~~
~~*For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means. For Class III and IIII devices the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d."~~		
~~-~~		
~~**A minimum load of 10 d is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.~~		

(Amended 1990).

NIST OWM Detailed Technical Analysis:

This item makes a distinction between the minimum capacity (a characteristic of the classification) and the minimum load (the actual load placed on the scale).

It clarifies that the minimum capacity of the scale depends on the scale division.

It ties the minimum capacity to the classification.

It requires the minimum capacity to be marked on the scale which makes it easier for the user and inspector to determine the minimum capacity of the scale.

This proposal brings the Scales Code in line with OIML R 76 regarding the markings of the minimum capacity and its relationship to the scale division.

Summary of Discussions and Actions:

During the 2024 NCWM Annual Meeting, Loren Minnich (NIST OWM) asked the Committee to remove the paragraphs related to the recommended minimum load, which included UR.3.1. and Table 8. Recommended Minimum Load, from item SCL-23.3 because, as proposed, Table 8 referenced the verification scale interval (e) as opposed to the scale division (d), which is technically incorrect. Loren explained that the recommended minimum load requirement, as described in UR.3.1., is intended to reduce the relative error due to rounding of the scale division (d) associated with the use of a device at light loads. The Committee agreed to remove the paragraphs and create a new item, SCL-25.1, that was assigned an Informational status. After the conclusion of the meeting, NIST OWM submitted a group of items intended to address this issue and the Committee agreed to accept these as the basis for SCL-25.1.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA Annual Meeting, Loren Minnich (NIST OWM), stated the item proposes removing Table 8 and insert new table to specifications "Minimum Capacity", Everything would be based on "d". Minimum capacity is something that the user should be aware of and the specification to require marking the device. (clarifying question from the committee?) Yes-The intention is still "recommended". Still wants the user to use the scale in that way and believes it is more effective with one table. Mr. Minnich also stats that he prefers minimum capacity to minimum load.

Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program) has concerns with "recommended" believes recommended limits the ability to make this enforceable.

Matthew Douglas (State of California, Division of Measurement Standards): Supports Mr. Harrington's comments and believes this item needs further development and recommends an informational status. The item has a recommended minimum load and minimum capacity, they are two different things. This needs clarification.

Corey Hainy (SMA): The SMA will meet in November to discuss all SCL items and develop a position.

The 2024 WWMA S&T Committee recommends this item remain Informational and looks forward to further development of the item with consideration of the comments heard during open hearings.

Southern Weights and Measures Association

During the SWMA Annual Meeting, Cory Hainy, SMA – Association meets in November and will determine their status at that time. A letter was received of Ross Andersen for alternative language to be considered.

The committee recommends the item remain informational.

Northeastern Weights and Measures Association

During the 2024 NEWMA Interim Meeting, Steve Timar (NY) commented that he originally did support the proposal but questioned how a recommendation could be enforceable. UR.3.1. "Recommended minimum load" should be "Required minimum load" for commercial transactions. It is part of device suitability and should be enforceable regardless of what commodity is being weighed and offered support for the submitter's (Ross Anderson) proposed changes to replace Table 8 Recommended Minimum Load with Table T.N.1.4 and placing it in the Tolerance section of HB 44 rather than in the Specifications. This would also solve the proposal put forth by the Cannabis Task Group making the minimum loads for cannabis products required minimum loads. Cheryl Ayer (NH) commented that she agrees with NY. Scott Dolan

(VT) questioned if it should appear as a user requirement, not a specification. Steve Timar stated that the intent was to mirror OIML R76 specification table and a recommendation cannot be enforced.

After hearing comments from the floor, the Committee recommended a Voting status, with the changes recommended by Ross Anderson and the body concurred..

Central Weights and Measures Association

During the 2024 CWMA Interim Meeting, Loren Minnich (NIST OWM) commented that as Table 8. appears, if you have a scale where d and e are not equal then rounding will need to occur and that will cause an error. It was also stated that even though Table 8. is being moved to the Specification section as a marking requirement, it is still guidance. The commentor welcomes comments on ways to improve this item.

Greg Vander Plaats (MN) commented that there are no problems with moving the information from Table 8. to the specifications portion of the Scales Code because there will still be a User Requirement reference to the newly created Specifications Table. It was also stated that the minimum load should be in "e" not "d" and that the minimum recommended load for class II scales be changed from 20e to 50e. The NIST OWM representative was not opposed to this suggestion and appreciates the consideration.

Dick Suiter (Richard Suiter Consulting) commented that the issue of recommended minimum load has been in front of the conference numerous times and that they still have a problem with a recommended minimum load and the Handbook should do away with the word 'recommended'.

The committee recommends this item as developing so that the submitter can gather input and address concerns from the body.

Scale Manufacturers Association

At the 2024 SMA Fall Meeting, the SMA opposed this item as written. Their rationale is as follows:

- Using d for the minimum capacity allows a much smaller minimum load, which results in a much larger relative error.
- Marking requirements would result in a burden on manufacturers with limited benefit to the end user.

SCL-25.2 - Table S.6.3.a. Marking Requirements and Definitions

Source: NIST Office of Weights and Measures

Submitter's Purpose and Justification:

Bring the definition of emin in alignment with the recent changes that clarified references to the verification scale interval and the scale division and update the terms that describe emin in Table S.6.3.a.

Previous Status:

2025: New Proposal

Original Justification:

Item SCL-23.3 was adopted at the 2024 NCWM Annual Meeting. This item amended Section 2.20. Scales to refer to "e" as the verification scale interval instead of the verification scale division. The reference to emin in Table S.6.3.a. in the Scales Code and the definition of emin in Appendix D were inadvertently left out of the group of items included in SCL-23.3.

Rarely is it the case that there isn't a valid argument against an item, but in this case, the community has agreed that the term "verification scale interval" is the correct way to refer to "e" in the scales code.

The submitter recommends that this be a Retroactive Voting item in 2025.

NIST OWM Executive Summary

SCL-25.2 – Table S.6.3.a. Marking Requirements and Definitions

NIST OWM Recommendation: Voting

- When SCL-23.3 was adopted at the 2024 NCWM Annual Meeting, the term Verification Scale Division was amended to Verification Scale Interval throughout the Scale Code (2.20), but the term remains in the AWS Code (2.24).
- The reference to e_{min} in Table S.6.3.a. in the Scales Code and the definition of e_{min} in Appendix D, were inadvertently left out of the group of items included in SCL-23.3.
- Because e_{min} is referenced in both the Scales Code and the AWS Code, there need to be separate definitions for each section.
- OWM views this as a housekeeping item.
- Because it is "new", the format for the definition applicable to section 2.20. is formatted incorrectly and should appear in the Item Under Consideration as shown below:
  e_{min} (minimum verification scale interval). – The smallest verification scale interval for which a weighing element complies with the applicable requirements. [2.20]

(Added 20XX).

Table 2. Summary of Recommendations
SCL-25.2 – Table S.6.3.a. Marking Requirements and Definitions

	Status Recommendation	Note*	Comments
Submitter (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	1		

***Notes Key:**

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

Item Under Consideration:

Amend Table S.6.3.a. in the Section 2.20. Scales Code to replace the term "Division" with "Interval" in the description of e_{min} as shown below:

Table S.6.3.a.
Marking Requirements

To Be Marked With ⇓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC[1]	Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC	Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC	Load Cell with CC (11)	Other Equipment or Device (10)
Minimum Verification Scale ~~**Division**~~**Interval**(e_{min})			X (19)		

(Added 1990) (Amended 1992, 1999, 2000, 2001, 2002, 2004, 2024**, and 20XX**)

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

Amend the definition of e_{min} that includes the term "division" to remove the reference to Section 2.21. Belt-Conveyor Scale Systems, as there is no reference to e_{min} in this section, so it will only apply to Section 2.24. Automatic Weighing Systems as follows:

e_{min} (minimum verification scale division). – The smallest scale division for which a weighing element complies with the applicable requirements. [~~**2.20, 2.21,**~~ 2.24]

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

And add a new definition of e_{min} that replaces the term "division" with "interval," which will apply only to Section 2.20. Scales Code as follows:

e_{min} (minimum verification scale ~~division~~interval). – The smallest **verification** scale **~~division~~interval** for which a weighing element complies with the applicable requirements. [2.20**~~, 2.21, 2.24~~**]

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

NIST OWM Detailed Technical Analysis:

When SCL-23.3 was adopted at the 2024 NCWM Annual Meeting, the term Verification Scale Division was amended to Verification Scale Interval throughout the Scale Code (2.20), but the term remains in the AWS Code (2.24). The reference to e_{min} in Table S.6.3.a. in the Scales Code and the definition of e_{min} in Appendix D, were inadvertently left out of the group of items included in SCL-23.3. Because e_{min} is referenced in both the Scales Code and the AWS Code, there needs to be separate definitions for each section.

Because it is "new", the format for the definition applicable to section 2.20. is formatted incorrectly and should appear in the Item Under Consideration as shown below:

e_{min} (minimum verification scale interval). – The smallest verification scale interval for which a weighing element complies with the applicable requirements. [2.20]
(Added 20XX)

OWM views this as a housekeeping item.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

At the 2024 WWMA Annual Meeting, Loren Minnich (NIST OWM) stated the item is intended to clean up an oversight from the task group. The changes in this item do not change the application of emin.

Corey Hainy (SMA), stated the SMA will be meeting November 2024 to review this item.

Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program), offered support for the item and recommends a voting status. Mr. Harrington questioned if it needs to be retroactive.

Matthew Douglas (State of California, Division of Measurement Standards), supports the item for vote and expressed his appreciation for the efforts to identify and correct the oversight.

The 2024 WWMA S&T Committee recommends a Voting status. The Committee believes the item is fully developed and ready for a vote.

Southern Weights and Measures Association

At the SWMA Annual Meeting no comments were heard on this item.

The committee recommends the item be voting status.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting, Michael Peeler (NJ) commented that this item appears to be a housekeeping item and recommends a voting status.

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

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, Loren Minnich (NIST OWM) commented that this marking requirement was overlooked when the changes to Handbook 44 were adopted in July.

Greg Vanderplaat (Minnesota) commented that there are no issues with this item. Comments were made regarding the current edition of Handbook 44 and a conflict with the notes in Table S.6.3.b. not matching the reference in S.6.3.a.

Loren Minnich (NIST OWM) commented that the error mentioned by the regulator above will be corrected in the 2025 edition.

The committee recommends this item as voting.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they are in support of this item.

SCL-25.3 - UR.3.14. Zero-Balance Recorded Weight for Forklift Scales

Source: Pennsylvania Bureau of Ride and Measurement Standards

Submitter's Purpose and Justification:

Add a provision to the User Requirements for medium capacity forklift scales to record zero reading immediately prior to weighing.

The Commonwealth of Pennsylvania is a major hub of commercial shipping throughout the Northeast and the United States. Commercial shippers routinely conduct re-weighs on the products being shipped, resulting in increased charges and fees to the consumer shipping the products from throughout the country and world. These re-weigh's have no documentation of a zero balance immediately prior to weighing and the scales are subject to extensive wear on the shipping docks. Our Large Capacity Scale Inspector has observed the forklifts traveling at significant speeds across the docks with pallets and noted on numerous occasions when inspecting those scales, them not to be in zero balance, as well as out of tolerance. One recent inspection of a national carriers location with 19 forklift scales (a smaller location) resulted 6 scales as found were anywhere from -80 lbs. to +565 lbs. and 9 were rejected out of tolerance for weights between -30 lbs. all the way to +515 and even +600 lbs. on 3080 lbs. test weight. Additionally, we have noted an increasing growth in the number of complaints regarding increased charges, even when the shipper weighed the commodity on state inspected and certified scales. We were advised by one customer that the shipper would only entertain a challenge to the re-weigh if they had a photograph of their shipment on a state certified scale with the bill

of laden for that shipment in the photo. This recording of a zero balance immediately prior to the weighing would provide equity in the transaction to all parties involved.

The added requirement of recording the zero balance prior to weighing would add a minimal encumbrance to the shipper's efficiency, by requiring the user to record zero immediately before each weighing. It should be noted that the systems they record on should already be capable to record the zero balance immediately prior and provide traceability to the weighing.

NIST OWM Executive Summary

SCL-25.3 – UR.3.14. Zero-Balance Recorded Weight for Forklift Scales

NIST OWM Recommendation: Developing

NIST OWM recognizes the issues with reweighs in the transport sector. However, OWM has some concerns about the proposal.

- Forklift scales are not defined in NIST Handbook 44 (HB 44) and fall under the category of on-board weighing systems. This could be interpreted as extending the requirement to apply to all on-board weighing systems which may have unforeseen consequences.
- As written, the requirement deals with the design of the instrument, i.e.," the scale shall indicate and record a zero-balance condition", which is a specification not a user requirement. As a specification, this requirement will have a significant impact on the certification of on-board weighing systems.
- Other types of scales don't record the zero-balance condition. The justification does not explain why this is a problem specific to forklift scales used in the transport sector but not for other types of scales or applications. A better understanding may lead to alternative solutions to the submitter's problem.
- The submitter should consider working with the NCWM Uniform Shipment Law Task Group to coordinate their efforts with this group.

Table 2. Summary of Recommendations
SCL-25.3 – UR.3.14. Zero-Balance Recorded Weight for Forklift Scales

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

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

***Notes Key:**

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

Item Under Consideration:

Amend the Handbook 44 Scales Code as follows:

UR.3.14. Zero-Balance Recorded Weight for Forklift Scales. - If a scale is utilized in onboard weighing with a forklift in absence of the customer witnessing, the scale shall indicate and record a zero-balance condition immediaely prior to recording the weight of the load.

(Added 20XX.

NIST OWM Detailed Technical Analysis:

OWM recognizes the problems with the incorrect use of weighing instruments during reweigh practices and understands the intent of this proposal to coerce the correct use of the instrument. However, OWM has some concerns about the language and feasibility of the proposed requirement.

1. Forklift scales are not defined in NIST HB 44. Instead, forklift scales are, by definition, on-board weighing systems. There are two solutions to this problem. Either, the language refers to on-board weighing systems instead of forklift scales, or a definition for forklift scales must be added to the Handbook and should accompany this item.

2. Adding a definition of forklift scales to the Handbook is undesirable. It creates a new category of instruments whose only difference with other onboard weighing systems is that the zero-balance condition is recorded.

3. Applying this requirement to all on-board weighing systems may have unforeseen consequences beyond the current scope of this item.

4. The requirement states "… the scale shall indicate and record a zero-balance condition …". This is a requirement on the functionality of the scale and not on the actions of the user. Therefore, this is a specification instead of a user requirement.

5. Currently, recording a zero-balance condition is not required. Possibly, many forklift scales (or other onboard weighing systems) may not be able to do so. This requirement would have a significant impact on the suitability of the equipment in the field. This goes further than just a requirement on the use of an instrument.

6. A forklift scale is generally used in the absence of the customer. Even if the customer is present, it is unlikely that they can view the display of the forklift scale. That means that this requirement would impact practically all weighments performed with a forklift scale. Therefore, the requirement can omit the condition of the customer's absence.

7. Currently, NIST HB 44 does not require any scale to record a zero-balance condition. S.1.1. Zero Indication requires a scale "to either indicate or record a zero-balance condition." Any scale that can indicate a zero-balance condition is not also required to be able to record this condition. It seems that, except for forklift scales used in the transport sector, other applications do not have this issue. The justification does not explain why the absence of a recorded zero-balance condition is a problem in the transport sector and not in other sectors. If the exact reason is known, it may be possible to think of other solutions than that proposed in this item.

NIST OWM is of the opinion that the problem and possible solution need further investigation, and suggests the submitter consider working with the NCWM Uniform Shipment Law Task Group to coordinate their efforts with this group. OWM, therefore, recommends a developing status.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual Meeting, Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program) stated that establishing a zero before collecting data is good practice, however, the item seems to be written as a specification. The wording tells you that the scale is performing the action and not the user and for that reason he suggested a Developing status.

Aaron Yanker (Colorado Department of Agriculture, Weights and Measures) agreed with Steven Harrington's comment. They recommended that the submitter considers working with the Uniform Shipping Task Group as this issue may be addressed within their task group.

Loren Minnich (NIST OWM) stated that the term "forklift" may not be adequately defined and agreed with Steven Harrington that if adopted, it would need an additional specification. The current language states "indicate OR record zero". Loren supported the idea of working with the NCWM Uniform Shipment Law Task Group. Loren understands and appreciates the intent, but is not sure if this is the correct direction.

Matthew Douglas (State of California, Division of Measurement Standards) echoed previous comments and liked the idea of working with the NCWM Uniform Shipment Law Task Group. They are generally supportive of the concept. They recommended a Developing status.

The 2024 WWMA S&T Committee recommends a Developing status. The Committee has concerns that the item may need a specification to support the proposed user requirement. Additionally, the item may be more appropriately addressed in the work of the NCWM Uniform Shipment Law Task Group. There were also concerns from NIST OWM that forklift may not be adequately defined.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, Mark Lovisa, Louisiana spoke in support of the item.

Greg Gholston, Mississippi recommended changing the phrase "absence of the customer witnessing" to "indirect sales application" or similar.

The committee recommends the item be voting status, if an update to the language is incorporated.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting, John Dillabaugh (PA) stated that this item was submitted based on inspection data from over 100 forklift scales that they found do not always start at zero prior to being used.

Cheryl Ayer (NH) and Michael Peeler (NJ) voiced their support for a voting status.

Michael Smith (NY) commended PA for the proposal and suggested an edit for clarity. The suggestion was to remove "with a forklift" from the sentence.

After hearing comments from the floor, the Committee recommended a Voting status, as amended below, for this item and the body concurred.

> **UR.3.14. Zero-Balance Recorded Weight for Forklift Scales. - If a scale is utilized in onboard weighing in absence of the customer witnessing, the scale shall indicate and record a zero-balance condition immediately prior to recording the weight of the load.**
>
> **(Added 20XX).**

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, a representative from NIST OWM recommend developing status for this item. They cited concern that this item would require these scales to be able to record a zero balance while the Handbook currently states these scales can either indicate or record a zero balance. It was also stated that this may need to be non-retroactive, or it may cause significant changes to equipment in use. Additionally, forklift scales are not defined in Handbook 44 and definition may need to be developed. A question was asked if this item would affect pallet jacks used in a similar manner.

The committee recommends this item as developing and that the submitter should address concerns regarding the requirement to record and indicate a zero balance, as well as the concern regarding the lack of a definition of a forklift scale.

Scale Manufacturers Association

At the 2024 SMA Fall Meeting, the SMA opposed this item.

Rationale:

- Recording zero will not solve the scale being out of tolerance.
- The term "immediately prior" is too vague.

SCL-25.4 - S.1.2.2.2. Class III, III L, and IIII Scales. and S.1.2.2.2.2. Weight Classifiers

Source: NCWM National Type Evaluation Program Weighing Sector

Submitter's Purpose and Justification:

Purpose:

Specify the e is equal to d for weight classifiers.

Justification:

(a) There are no weight classifiers in the market that have "e" not equal to "d".

(b) Weight classifiers have "e" equal to "d" because they are class III scales.

(c) "d" is not verified by NTEP during type approval.

The submitter recognized the potential arguments against of:

(a) Price calculation should be based on "d" and not "e" because "d" may be more precise.

(b) Because of abnormal rounding, having "d" shown helps the user have more visibility.

The submitter requested Voting status for 2025.

NIST OWM Executive Summary

SCL-25.4 - S.1.2.2.2. Class III, III L, and IIII Scales. and S.1.2.2.2.2. Weight Classifiers

NIST OWM Recommendation: Voting

- Per the submitters, which include representatives of NTEP, the SMA, and regulators, there are no weight classifiers with an accuracy class other than class III that have a verification scale interval (e) different from the scale divisions (d).
- Because weight classifiers round up to the next division, there is no advantage to have different values displayed for e and d.
- This would align NIST HB 44 with OIML R 76 requirements.

Table 2. Summary of Recommendations
SCL-25.4 - S.1.2.2.2. Class III, III L, and IIII Scales. and S.1.2.2.2.2. Weight Classifiers

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA		4	
NEWMA		4	
SWMA		4	
CWMA		4	
NCWM			

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

***Notes Key:**

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

Item Under Consideration:

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

S.1.2.2.2. Class III, III L, and IIII Scales. – The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales ~~**and weight classifiers**~~, "e" must be equal to "d."
(Added 1999) (Amended 2024) **(Amended 20XX)**

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 2024) **(Amended 20XX)**

NIST OWM Detailed Technical Analysis:

Per the submitters, who include representatives of NTEP, the SMA, and regulators, there are no weight classifiers with an accuracy class other than class III that have a verification scale interval (e) different from the scale divisions (d). Because weight classifiers round up to the next division, it is not advantageous to have different values displayed for e and d. This would align NIST HB 44 with OIML R 76 requirements.

Summary of Discussions and Actions:

This item is new to the S&T Committee Agenda and was submitted after the deadline to be forwarded to the regional associations for consideration.

Regional Association Reporting:

Western Weights and Measures Association

This item was not included on this region's agenda.

Southern Weights and Measures Association

This item was not included on this region's agenda.

Northeastern Weights and Measures Association

This item was not included on this region's agenda.

Central Weights and Measures Association

This item was not included on this region's agenda.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they are in support of this item.

SCL-25.5. - T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales

Source: NIST, Office of Weights & Measures

Submitter's Purpose and Justification:

Replace the term "scale division' with the term "verification scale interval" in paragraph T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales.

The term "scale division' should have been replaced with the term "verification scale interval" in paragraph T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales., and this paragraph as amended should have been included in the group of items proposed in SCL-23.3, which was adopted at the NCWM Annual Meeting in July of 2024. Because the definition of verification scale interval specifies that it be used when applying tolerance, NIST OWM views this as a clean up of this paragraph.

NIST OWM Executive Summary

T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales.

NIST OWM Recommendation: Voting

- Item SCL-23.3 was adopted at the 2024 NCWM Annual Meeting. That item amended NIST Handbook 44 to correctly reference the verification scale interval in certain specification and tolerance paragraphs that incorrectly referenced the scale division.
- This paragraph should have been included in that group of items as it references the scale division which is incorrect.
- Because S.5.3. requires multi-interval and multiple range scales to have an e equal to d, the application of tolerance will not change for these devices.

Table 2. Summary of Recommendations

T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales.

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Voting		
WWMA		4	
NEWMA		4	
SWMA		4	
CWMA	Voting		
NCWM			

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

***Notes Key:**

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

Item Under Consideration:

Amend NIST Handbook 44, Section 2.20. Scales Code Code as follows:

T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales. – For multi-interval and multiple range scales, the tolerance values are based on the value of the **verification** scale ~~**division**~~**interval** of the range in use.

NIST OWM Detailed Technical Analysis:

Item SCL-23.3 was adopted at the 2024 NCWM Annual Meeting. That item amended NIST Handbook to correctly reference the verification scale interval in certain specification and tolerance paragraphs that incorrectly referenced the scale division. This paragraph should have been included in that group of items as it references the scale division which is incorrect. Because S.5.3. requires multi-interval and multiple range scales to have an e equal to d, the application of tolerance will not change for these devices.

Summary of Discussions and Actions:

This item was only submitted to the CWMA for consideration at their 2024 Interim Meeting and has not been discussed at the NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

This item was not included on this region's agenda.

Southern Weights and Measures Association

This item was not included on this region's agenda.

Northeastern Weights and Measures Association

This item was not included on this region's agenda.

Central Weights and Measures Association

Loren Minnich (NIST OWM) voiced appreciation for this item being added to the agenda following a late submission and noted that this item is a simple change related to recent updates to the Handbook that occurred in July. It was recommended that this item be a voting item.

Greg Vander Plaats (Minnesota) voiced support of this item as a voting item.

The committee recommends that this item be numbered SCL-25.4 and be assigned a voting status.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they are in support of this item.

AWS – Automatic Weighing Systems Code

AWS-24.1 I N.1.5. Test Loads., N.1.5.1. Initial Verification., Table N.1.5.1. Initial Verification Test Loads, N.1.5.2. Subsequent Verification., N.2. Test Procedures -Weigh-Labelers., N.2.1. Non-Automatic Tests., N.2.1.3. Shift Test., N.2.2.1. Automatic Tests Non-Automatic for Weigh-Labelers., N.2.2.2. Automatic Tests for Automatic Checkweighers., N.3. Test Procedures -Automatic Checkweigher., N.3.1. Tests Non-Automatic., N.3.2. Automatic Tests., Table N.23.2.2. Number of Sample Weights per Test for Automatic Checkweighers

Source: Marel Ltd.

Submitter's Purpose and Justification:

Reword 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.

Pub 14 AWS, Table N.4.2 Number of Sample Weights per Test for Automatic Checkweighers

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

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

NIST OWM Executive Summary

AWS-24.1 – N.1.5. Test Loads., N.1.5.1. Initial Verification., Table N.1.5.1. Initial Verification Test Loads, N.1.5.2. Subsequent Verification., N.2. Test Procedures - ~~Weigh-Labelers~~., N.2.1. Non-Automatic Tests., N.2.1.3. Shift Test., N.2.2.1. Automatic Tests ~~Non-Automatic~~ for Weigh-Labelers., N.2.2.2. Automatic Tests for Automatic Checkweighers., ~~N.3. Test Procedures -Automatic Checkweigher.~~, ~~N.3.1. Tests Non-Automatic.~~, ~~N.3.2. Automatic Tests.~~, Table N.2~~3~~.2.2. Number of Sample Weights per Test for Automatic Checkweighers

NIST OWM Recommendation: Voting

- OWM agrees with the submitter that the language in paragraph N.1.5. can be interpreted in different ways and needs clarification.
- Paragraph N.1.5. Test Loads and Table N.1.5. Test Loads apply to all Automatic Weighing Systems.
- The subsequent paragraphs, N.2. Test Procedures – Weigh-Labelers & N.3. Test Procedures – Automatic Checkweighers apply to Weigh-Labelers and Automatic Checkweighers, respectively.
- Paragraph N.1.5. currently specifies the amount and number of test loads to be applied to all devices covered by this code, but it conflicts with the tests specified in N.3. paragraphs which apply to Weigh-Labelers and requires additional tests when compared to tests specified in the N.2. paragraphs that apply to Checkweighers, specifically:
    - Paragraph N.1.5, which refers to Table N.1.5, specifies four different test loads, which conflicts with paragraph N.3.2. Automatic Tests, which specifies "Test runs shall be conducted using two test loads."
    - There is also a potential for misinterpretation with paragraph N.2.2.2. Automatic Tests, which specifies, "Test runs should be conducted using at least two test loads."
- There were other gaps in the language proposed in this item and the language currently in NIST Handbook 44.
- This proposal reorganizes the notes section:
    - The N.1. paragraphs will now specify the amount and number of test loads, separated by tests for initial verification and tests for subsequent verification.
    - The N.2. paragraphs will now specify test procedures.
        - N.2.1. specifies procedures for devices designed to operate non-automatically.
        - N.2.2. specifies procedures for devices that only operate automatically.
    - The reorganization of the N.2 paragraphs incorporated procedures that were specified in the N.3. paragraphs allowing for the elimination of N.3. and its sub-paragraphs

Table 2. Summary of Recommendations

AWS-24.1 – N.1.5. Test Loads., N.1.5.1. Initial Verification., Table N.1.5.1. Initial Verification Test Loads, N.1.5.2. Subsequent Verification., N.2. Test Procedures ~~-Weigh-Labelers~~., N.2.1. Non-Automatic Tests., N.2.1.3. Shift Test., N.2.2.1. Automatic Tests ~~Non-Automatic~~for Weigh-Labelers., N.2.2.2. Automatic Tests for Automatic Checkweighers., ~~N.3. Test Procedures -Automatic Checkweigher.~~, ~~N.3.1. Tests Non-Automatic.~~, ~~N.3.2. Automatic Tests.~~, Table N.2~~3~~.2.2. Number of Sample Weights per Test for Automatic Checkweighers

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Voting			
WWMA	Informational			
NEWMA			5	
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

Amend Handbook 44 Automatic Weighing Systems Code as follows:

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

N.1.5.1. Initial Verification. – An initial verification test shall be conducted at a minimum of four different test loads according to Table N.1.5.1 Initial Verification Test Loads.

(Added 20XX)

Table N.1.5.1. Initial Verification Test Loads
At or near minimum capacity
At or near maximum capacity
At two (2) critical points between minimum and maximum capacity
Tests may be conducted at other loads if the device is intended for use at other specific capacities

(Amended 20XX)

N.1.5.2. Subsequent Verification. – Subsequent tests shall be conducted at a minimum of two different test loads at or near the minimum load and the maximum load expected during normal operation.

(Added 20XX)

(Amended 20XX)

N.2. Test Procedures ~~Weigh-Labelers. – If the device is designed for use in a non-automatic weighing mode, it shall be tested in the non-automatic mode according to NIST Handbook 44, Section 2.20. Scales Code.~~

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

N.2.1. Non-Automatic Tests. – If the automatic weighing system is designed to operate non-automatically and is used in that manner during normal 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.

(Amended 2004 **and 20XX**)

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N.2.1.3. Shift Test. – To determine the effect of off-center loading, a test load equal to **~~one-half (½)~~ one-third (1/3)** maximum capacity shall be placed in the center of each of the four points equidistant between the center and front, left, back, and right edges of the load receiver.

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N.2.2. Automatic Test Procedures.

N.2.2.1. Automatic Tests ~~Non-Automatic~~for Weigh-Labelers. – ~~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.~~The device shall be tested at the normal operating speed using test pucks or packages per N.1.1. Test Pucks and Packages. and N.1.2. Accuracy of Test Pucks or Packages. Each test load should be run a minimum of ten consecutive times.

(Amended 20XX)

N.2.2.2. Automatic Tests for Automatic Checkweighers. – 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.**~~ **highest speed in each weight range using test pucks or packages per N.1.1. Test Pucks and Packages. and N.1.2. Accuracy of Test Pucks or Packages. The number of consecutive test weighments shall be as specified in Table N.2.2.2. Number of Sample Weights per Test for Automatic Checkweighers. (Amended 20XX)**

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~~**N.3. Test Procedures -Automatic Checkweigher.**~~

~~**N.3.1. Tests Non-Automatic. If the scale is designed to operate non-automatically during normal user operation, it shall be tested non-automatically according to paragraphs N.2.1.1. Increasing Load Test through**~~

~~**N.3.2. Automatic Tests. The device shall be tested at the highest speed in each weight range using standardized test pucks or packages. Test runs shall be conducted using two test loads. The number of consecutive test weighments shall be as specified in Table N.3.2. Number of Sample Weights per Test for Automatic Checkweighers.**~~

~~**(Amended 2004)**~~

Table N.2~~3~~.2.2.
Number of Sample Weights per Test for Automatic Checkweighers

Weighing Range **m = mass of test load**	**Number of Sample Weights per Test**	
	Field	**Type Evaluation**
20 divisions $\leq$ m $\leq$ 10 kg 20 divisions $\leq$ m $\leq$ 22 lb	30	60
10 kg < m $\leq$ 25 kg 22 lb < m $\leq$ 55 lb	16	32
25 kg < m $\leq$ 100 kg 55 lb < m $\leq$ 220 lb	10	20
100 kg (220 lb) < m	10	10

(Amended 20XX)

(Amended 2004)

(Amended 2004 **and 20XX**)

NIST OWM Detailed Technical Analysis:

As it currently appears in NIST Handbook 44, Section 2.24. AWS, paragraph N.1.5. Test Loads 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. Test Loads 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.

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. The method by which test loads are applied to Weigh-Labelers and Checkweighers is specified in paragraphs N.2. Test Procedures – Weigh-Labelers and N.3. Test Procedures – Automatic Checkweigher respectively and both include

requirements for devices that operate non-automatically. There are no "test runs" for devices that operate non-automatically. For these devices, the test load is applied statically using test weights. Because paragraphs N.2. & N.3. include tests that are conducted statically, specifying "test runs" in N.1.5. is incorrect as it applies to devices that are non-automatic as well as automatic.

For these reasons, we initially supported the proposal that sought to amend paragraph N.1.5. Currently,this paragraph now requires tests of all devices covered in this section to "consist of four separate test runs conducted at different test loads as specified in Table N.1.5. Test Loads". Table N.1.5. requires a minimum of four unique test loads.

However, further analysis revealed several issues. The initial issue is the number of different test loads required to test these devices. There is a conflict between paragraph N.1.5, which refers to Table N.1.5, which specifies 4 different test loads, and paragraph N.3.2, which specifies "Test runs shall be conducted using two test loads." There is also a potential for misinterpretation with paragraph N.2.2.2, which specifies "Test runs should be conducted using at least two test loads."

OWM reached out to the submitter with new language to correct the conflict. As we both considered this new language, we realized that there were other gaps in the language currently in NIST Handbook 44 that were not addressed by the original proposal. To resolve these newly discovered issues, OWM, with the submitter's support and input, developed the language that is now the Item Under Consideration.

As shown below, N.1.5. now has two sub-paragraphs, one that applies to the initial verification of Automatic Weighing Systems (AWS) and another that applies to subsequent verifications. The AWS Code was adopted as a Tentative Code in 1995. These proposed changes are based on the requirements initially proposed in that tentative code. When adopted, it specified that the "Laboratory" test for "Dynamic" devices, now referred to as "Automatic" devices, be conducted with 4 different test loads and "Field" tests for these devices be conducted with two different test loads. The procedures for both Weigh-Labelers and Automatic Checkweighers are clarified by the addition of paragraphs N.1.5.1. and N.1.5.2., which specify the number of test loads required, and by the removal of the language in the test procedure paragraphs (N.2.) that refer to test loads.

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

N.1.5.1. Initial Verification. – An initial verification test shall be conducted at a minimum of four different test loads according to Table N.1.5.1 Initial Verification Test Loads.

Table N.1.5.1 Initial Verification Test Loads
At or near minimum capacity
At or near maximum capacity
At two (2) critical points between minimum and maximum capacity
Test**s** may be conducted at other loads if the device is intended for use at other specific capacities

N.1.5.2. Subsequent Verification – Subsequent tests shall be conducted at a minimum of two different test loads which approximate the minimum load and the maximum load expected during normal operation.

The test procedures for Weigh-Labelers and Automatic Checkweighers in paragraphs in N.2. and N.3. have been combined to create new N.2. paragraphs and the tests that apply to AWS that operate in a non-automatic mode have been separated from those that only operate automatically. The language previously in N.2.2.1. has been moved to N.2.1. and the tests specified in N.2.1.1. through N.2.1.5. remain with an amendment to N.2.1.3. to change the test load from $^1/_2$ capacity to $^1/_3$ capacity. Subsequently, the N.3. paragraphs can be removed as the information contained in them has been moved to N.2.2.1. & N.2.2.2.

N.2. Test Procedures ~~– Weigh-Labelers.~~ ~~– If the device is designed for use in a non-automatic weighing mode, it shall be tested in the non-automatic mode according to NIST Handbook 44, Section 2.20. Scales Code.~~

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

~~(Amended 2004)~~

N.2.1. Non-Automatic Tests. – If the automatic weighing system is designed to operate non-automatically and is used in that manner during normal 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.

(Amended 2004 **and 20XX**)

N.2.1.1. through N.2.1.5. remain, but are not included for the sake of space.

N.2.2. Automatic Test Procedures.

~~**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.~~

N.2.2.1.~~2.~~ Automatic Tests for Weigh-Labelers. – 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.

N.2.2.2. Automatic Tests for Automatic Checkweighers. – The device shall be tested at the highest speed in each weight range using standardized test pucks or packages. The number of consecutive test weighments shall be as specified in Table N.3.2. Number of Sample Weights per Test for Automatic Checkweighers.

(Amended 2004 **and 20XX**)

~~**N.3. Test Procedures –Automatic Checkweigher.**~~

~~**N.3.1. Tests Non-Automatic. If the scale is designed to operate non-automatically during normal user operation, it shall be tested non-automatically according to paragraphs N.2.1.1. Increasing Load Test through**~~

~~**N.3.2. Automatic Tests. The device shall be tested at the highest speed in each weight range using standardized test pucks or packages. Test runs shall be conducted using two test loads. The number of consecutive test weighments shall be as specified in Table N.3.2. Number of Sample Weights per Test for Automatic Checkweighers.**~~

~~**(Amended 2004)**~~

With these changes, OWM believes this item provides clarity and removes potential conflicts in the N. paragraphs of this section and we support the item moving forward with a Voting status.

Summary of Discussions and Actions:

During the 2024 NCWM Interim Meeting, Loren Minnich (NIST OWM) suggested the Item Under Consideration be amended with language approved by the submitter of the item, Andrew Goddard (Marel Ltd.). All comments made were in support of the item being assigned a Voting status.

The S&T Committee accepted this new language, which is now the Item Under Consideration, and assigned the item a Voting status.

During the 2024 NCWM Annual Meeting, Loren Minnich (NIST OWM) identified conflicts in the Notes section of this code that would remain if the item under consideration was adopted and provided the committee language developed with the submitter of this item, Andrew Goddard (Marel), that eliminates the conflict and reorganizes the Notes section. Kevin Schnepp (CADMS), recommended the Committee give the item an Informational status if they chose to move forward with the language suggested by OWM. Corey Hainy (SMA), spoke in support of the item but clarified that this recommendation was based on the initial item proposed.

Due to the significant changes proposed, the NCWM S&T Committee assigned the item an Informational status to allow for further consideration by the weights and measures community.

Regional Association Reporting:

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 Schnepp (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 (i.e., AWS-24.1), Item AWS-24.2, and Item AWS-24.3 be Blocked.

At the 2024 WWMA Annual Meeting, Loren Minnich (NIST OWM) stated NIST OWM worked with the submitter to further develop the item and addressed existing conflicts in the original proposal. Clarified the

difference between initial and subsequent testing. Also clarified the difference between automatic and non-automatic weighing.

Steve Harrington (Oregon Department of Agriculture, Weights and Measures Program) expressed concerned regarding the item, stating the item seems to apply to weigh labelers and package weighing applications, but doesn't cover all other systems. Recommends referring to the 2024 definition of AWS. Recommends a Withdraw status.

Corey Hainy (SMA) stated the written comments were from the SMA's review from the April meeting. The SMA will be meeting November 2024 to review this item.

The 2024 WWMA S&T Committee recommends this item remain Informational based on comments heard during open hearings.

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.

At the 2024 SWMA Annual Meeting, Cory Hainy (SMA) stated they will meet in November to determine their recommendation for this item.

The Committee recommends a Voting status for the 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.

At the 2024 NEWMA Annual Meeting, Brandi Harder (Rice Lake), representing the SMA, voiced support for this item but believes it could be written in a simpler format. No comments from regulators were heard on this item.

The Committee recommended maintaining a Voting status and the body concurred.

At the 2024 NEWMA Interim Meeting, no comments were heard from the floor. NEWMA does not have a recommendation for this item.

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.

At the 2024 CWMA Annual Meeting, a representative of the Scale Manufacturer's Association commented that the SMA supports this item.

The Committee recommends that this item remain as voting.

At the 2024 CWMA Interim Meeting, A representative from NIST OWM spoke about the history of this item in that there was initial support for this change but after analysis there are conflicts throughout the Notes section of Handbook 44. Currently, the main conflict is the table previously requires 4 test loads, but when you get into the N3 paragraphs you only need 2 test loads. They reorganized the N section with help from submitter. Devices tests in lab (4 tests) vs field (2 tests). There is a precedent throughout the Handbook for when a device is being placed into service vs subsequent tests which are not as thorough. Some devices are static and not dynamic and can be used that way. Fully developed and ready for voting.

The committee recommends this item as a voting item.

Scale Manufacturers Association

At the 2024 SMA Spring Meeting the SMA indicated they support this item but feel it could be written in a simpler format. NIST has changed the wording making it the same but longer.

At the 2024 SMA Fall Meeting the SMA indicated they support this item.

LMD – Liquid Measuring Devices

LMD-24.2 D N.4.1. Normal Tests

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

Submitter's Purpose and Justification:

Provide clarity to 3.30. Liquid-Measuring Devices, paragraph 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

LMD-24.2 – N.4.1. Normal Tests

NIST OWM Recommendation: Voting if the example is removed and the language suggested in the Detailed Analysis is incorporated into the Item Under Consideration.

- Although examples can be helpful, OWM believes NIST HB 44 is not the correct place for them and discourages their use in the handbook for a number of reasons:
  - The handbook is adopted as law and any additional information must be carefully considered as it can affect the application of the paragraph
  - Paragraphs that include unclear language should be amended to provide clarification to allow for uniform interpretation without the inclusion of this type of information
  - Additional guidance regarding the interpretation and application of the handbook is typically provided in documents such as Examination Procedure Outlines, training materials, etc.
  - Tina Butcher is currently updating NIST Handbook 112, Examination Procedures Outlines, and OWM intends to have the updated version available soon

- If the weights and measures community agrees that paragraph N.4.1, as written, is unclear in its application, OWM suggests amending it to provide further clarity. See the suggested language in the Detailed Analysis section of the NIST OWM Analysis.

- The following formula was added to this paragraph editorially for inclusion in the 2024 version of NIST Handbook 44 with the intent of providing additional clarity:

$$\frac{MDFR + RMDFR}{2} = minimum\ discharge\ flow\ rate\ for\ additional\ tests$$

- If the weights & measures community chooses to move forward with the example proposed by the submitter, to be consistent with other examples currently in NIST Handbook 44 and to be more relevant to the devices to which the formula is typically applied, OWM suggests the following format and values replace those proposed by the submitter:

  Example: If, under the conditions of installation, a device has a maximum discharge flow rate of 60 gpm and a rated minimum discharge flow rate of 20 gpm, using the above formula the minimum flow rate at or above which normal tests are conducted is calculated as follows:

$$\frac{\mathbf{60\ gpm + 20\ gpm}}{\mathbf{2}} = \mathbf{40\ gpm}$$

  For this device, any test conducted at a flow rate of 60 gpm down to and including 40 gpm is considered a normal test.

  Any tests conducted below the calculated minimum discharge flow rate for normal tests of the device as specified in N.4.1. Normal Tests and not below the rated minimum discharge flow rate are considered "special" tests and shall be conducted as prescribed in paragraph N.4.2. Special Tests.

Table 2. Summary of Recommendations
LMD-24.2 – N.4.1. Normal Tests

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

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

Item Under Consideration:

Amend Handbook 44 Liquid Measuring Devices Code as follows:

N.4. Testing Procedures.

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

(Amended 1991)

Example:

- **Maximum rated flow rate is 12 gpm / Minimum rated flow rate is 0.5 gpm.**
- **Maximum discharge flow rate developed under conditions of installation is 9 gpm = normal test**

- **Additional normal tests are determined using the following formula:** $\frac{Max\ discharge\ flow\ rate + rated\ \min discharge\ flow\ rate}{2} =$ $minimum\ discharge\ flow\ rate$

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

NIST OWM Detailed Technical Analysis:

OWM discourages the use of examples in NIST Handbook 44 for a number of reasons:

- The handbook is adopted as law and any additional information must be carefully considered as it can affect the application of the paragraph

- Paragraphs that include unclear language should be amended to provide clarification to allow for uniform interpretation without the need for this type of information

- Additional guidance regarding the interpretation and application of the handbook is typically provided in documents such as Examination Procedure Outlines, training materials, etc.

- Tina Butcher is currently updating NIST Handbook 112, Examination Procedures Outlines, and OWM intends to have the updated version available soon

At the 2024 NCWM Interim Meeting there was concern expressed with the terms that describe the flow rates used to determine the appropriate rate of flow for normal tests. OWM agrees that the terms, which were developed when the item was amended in 1991, may need to be modified to provide additional clarity to the paragraph. To begin to understand the intent of the current language it helps to refer back to the history of the item.

During the NCWM Annual Meeting in 1991, this paragraph was amended to "clarify the flow rates at which the tolerances for the normal test apply". The following discussion is from the 1991 NCWM S&T Committee Final Report:

> "The rated maximum flow rate for a meter is the maximum flow rate for which the manufacturer designed the device. This rate is marked on wholesale meters and retail devices with maximum discharge rates of 25 gallons per minute or more, but may not be marked on other retail devices. The maximum discharge rate is the maximum flow rate that can be generated under the conditions of a specific installation. The maximum discharge rate is normally less than the rated maximum flow rate and shall not exceed the rated maximum flow rate. The rated minimum flow rate is the minimum flow rate marked on wholesale meters and retail devices with maximum discharge rates of 25 gallons per minute or more. On other retail devices, the rated minimum flow rate is the minimum flow rate marked on the device or the minimum discharge rate at which the device will deliver when equipped with an automatic discharge nozzle set at its lowest setting (N.4.2.2.)"

The report also had an example meant to illustrate how the new language was to be interpreted and applied which included the following formula:

$$Lowest\ normal\ test\ flow\ rate = \frac{Maximum\ discharge\ rate + Minimum\ rated\ flow\ rate}{2}$$

Per this 1991 report, it is clear that the "maximum" value used to determine the limit for flow rates consider "normal" is based on the maximum flow rate "developed under the conditions of installation". There was concerned expressed that this value would lead to a lesser minimum flow rate for normal tests conducted in the field than those conducted during type evaluation as the device when tested during type evaluation would be operating near the rated maximum flow rate which is not often achieved in the field.

The other concern expressed at the 2024 NCWM Interim Meeting was with the term "rated minimum discharge flow rate". The term could be interpreted as meaning the minimum flow rate marked on the device, the minimum flow rate specified by the manufacturer (e.g., on the NTEP CC), or the minimum flow rate resulting from the conditions of installation. As described in the discussion that occurred in 1991, this term was intended to mean either the minimum flow rate marked on the device or the minimum flow rate resulting from the conditions of installation depending on what device was under test. In reference to "other retail devices", the report states "the rated minimum flow rate is the minimum flow rate marked on the device or the minimum discharge rate at which the device will deliver when equipped with an automatic discharge nozzle set at its lowest setting (N.4.2.2.)" Paragraph N.4.2.2. Retail Motor-Fuel Devices was added to the HB in 1984 and is referenced in the 1991 final report for S&T Committee Agenda Item 330-6 N.4.1. Normal Tests; Tolerance Application as part of the item's discussion of both wholesale and retail device flow rates. In 1991 paragraph N.4.2.2. specified the flow rate for performing a special test for devices with a flow rate less than 25 gpm and those marked with a flow rate greater than 25 gpm. Currently paragraph N.4.2.2. specifies the performance of a special test based on the flow rating or nozzle setting for Retail Motor-Fuel Devices and DEF Devices when the device is marked or not marked with a minimum flow rate. This paragraph has parameters for determining the proper flow rate for special tests of these devices. The 1991 report seems to suggest paragraph N.4.2.2. be referenced to determine the flow rate used as the value for the "rated minimum discharge flow rate" when calculating the minimum flow rate at or above which a test is considered a normal test or the "lowest normal flow rate" for Retail Motor-Fuel Devices and DEF Devices.

To address the concerns expressed during the Interim Meeting, the weights & measures community may want to consider which "maximum" flow rate is the most appropriate to be used in the formula, the rated maximum flow rate as marked on the device or the maximum discharge flow rate developed under the conditions of installation and how to more clearly describe the minimum flow rate. One option may be to separate the normal test requirements for devices marked with a flow rate and those not marked with a flow rate. Another option may be to separate normal tests similar to the way special tests are separated, i.e., Slow-Flow Meters, Retail Motor-Fuel Devices and DEF Devices, Other Retail Devices, etc.

Another approach would be to use consistent language throughout the paragraph when describing the "maximum" rate of flow used to calculate the range of flow rates considered "normal". The following language is provided as an alternative to adding an example:

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**~~ test~~**s**~~ **_** conducted at **the maximum discharge flow rate developed under the conditions of installation** ~~**flow rates**~~ down to and including one-half of the sum of the maximum discharge flow rate ~~**(MDFR)**~~ **developed under the conditions of installation** and the rated minimum discharge flow rate ~~**(RMDFR)**~~ shall be considered **a**

normal test~~s~~. ~~**As a formula, this is stated as**~~**To determine the minimum flow rate at or above which a "normal" test is conducted, the following equation is provided**:

$$\frac{(\boldsymbol{\sout{MDFR}maximum\ discharge\ flow\ rate} + \boldsymbol{\sout{RMDFR}rated\ minimum\ discharge\ flow\ rate})}{2} \boldsymbol{= minimum\ discharge\ flow\ rate\ for\ additional\ tests}$$

Where:

The maximum discharge flow rate is the maximum rate of flow developed under the conditions of installation.

The rated minimum discharge flow rate is the marked minimum discharge rate or the minimum flow rate specified by the manufacturer.

At a minimum, one "normal" test shall be conducted on each meter at the maximum discharge flow rate developed under the conditions of installation.

(Amended 1991**,** ~~**and**~~ 2023**, and 20XX**)

Here is a clean version:

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 test conducted at the maximum discharge flow rate developed under the conditions of installation down to and including one-half of the sum of the maximum discharge flow rate developed under the conditions of installation and the rated minimum discharge flow rate shall be considered a normal test. To determine the minimum flow rate at or above which a "normal" test is conducted, the following equation is provided:

$$\frac{(maximum\ discharge\ flow\ rate + rated\ minimum\ discharge\ flow\ rate)}{2}$$

Where:

The maximum discharge flow rate is the maximum rate of flow developed under the conditions of installation.

The rated minimum discharge flow rate is the marked minimum discharge rate or the minimum flow rate specified by the manufacturer.

At a minimum, one "normal" test shall be conducted on each meter at the maximum discharge flow rate developed under the conditions of installation.

(Amended 1991, 2023, and 20XX)

If the weights and measures community decides to move forward with the example proposed by the submitter, to be consistent with other examples currently in NIST Handbook 44, OWM suggests the following format and values for the example proposed by the submitter:

Example: If, under the conditions of installation, a device has a maximum discharge flow rate of 60 gpm and a rated minimum discharge flow rate of 20 gpm, using the above formula the minimum discharge flow rate for additional normal tests is calculated as follows:

$$\frac{60\ gpm + 20\ gpm}{2} = 40\ gpm$$

For this device, any test conducted at a flow rate of 60 gpm down to and including 40 gpm is considered a normal test.

Any tests conducted below the calculated minimum discharge flow rate of the device are considered "special" tests and shall be conducted as prescribed in paragraph N.4.2. Special Tests.

Summary of Discussion and Actions:

At the 2024 NCWM Interim meeting, Cheryl Ayer (NH) spoke in support of the item while noting the formula was added to this paragraph editorially by OWM and suggested adding the word "normal" to the formula between the words "additional" and "tests" to read "= *minimum discharge flow rate for* additional *normal tests"*. Loren Minnich (NIST OWM) suggested reformatting the example as indicated in the NIST OWM Analysis to align with other examples included in NIST Handbook 44 and referenced additional edits to the language in the formula as identified during the Meter Manufacturers Association meeting held during the Interim Meeting. Matt Douglas (CA DMS) indicated that this item was not available for review at the 2023 Western Weights & Measures Association Interim Meeting and commented that the term "maximum flow rate" may need additional clarification. Mike Peeler (NJ) spoke in support of the item. Michael Keilty (Endress + Hauser) expressed concern that the addition of the formula went beyond an editorial change, and this should have gone through the NCWM process. Michael also took issue with the term "minimum discharge flow rate" in the 3rd bullet of the proposed example. Dmitri Karimov (Liquid Controls) also was surprised that the addition of a formula made by OWM to this paragraph was considered "editorial". Dmitri also expressed concern with the term "rated minimum discharge flow rate" in the formula and language in N.4.1. and indicated this term may be the cause of confusion when applying the paragraph. Brent Price (Gilbarco) expressed surprise at the editorial change made by OWM and supported the addition of "normal" as suggested by Cheryl Ayer (NH). Matt Curran (FL) indicated support for an example but had concern with its inclusion in NIST Handbook 44, as it would be part of regulations. Matt suggested that the example may be more appropriately included in an EPO or other guidance document instead of the handbook. Cheryl Ayers (NH) reiterated that, as written, the paragraph is difficult to interpret but understood the concerns expressed by others regarding the terms in the item and noted that the handbook already includes examples and that helps with interpretation. Cheryl indicated that if the example isn't part of the paragraph, a reference to it should be included so it easier to find. John Hathaway (Total Control Systems, Murray Equipment) indicated support for the example but agrees that the language in the paragraph is unclear and supports a developing status. Michael Keilty (Endress + Hauser) commented that the handbook has different "normal tests" and the language in these paragraphs should be reviewed for consistency and supports developing status.

The NCWM S&T Committee assigned this item a Developing status to allow the submitter to work with OWM to harmonize the differences in the item with the language in NIST Handbook 44 and to address the concerns stated during the meeting.

During the 2024 NCWM Annual Meeting, the submitter of the item Cheryl Ayer (NH), provided the Committee with additional langauge to consider and exrpessed support for moving the item forward.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual Meeting, Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program) stated that the formula in the handbook is effective and not opposed to examples in HB44. Noted an error in HB44, the abbreviations are not correct (editorial). Supports a voting status on this item.

Scott Wagner (Colorado Division of Oil and Public Safety) supports the intent of the item. However, the item would benefit from different wording to emphasize clarity. He also supports a mathematical formula vs an example.

Loren Minnich (NIST OWM) commented that NIST is working to clarify the language in N.4.1. OWM does not support examples in HB44. prefers an equation. If an example is used an alternate example should be used such as a load racks or something similar with special test tolerances but would prefer to not add example.

Matthew Douglas (State of California, Division of Measurement Standards), expresed the same stance as last year opposing an example in HB44. Clarity in the wording can be achieved by specifying maximum discharge flow rate “developed under the conditions of the installation” in the third sentence.

Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program) believes no action is needed to clarify, and that the formula clears up this issue.

Michael Brooks (Arizona Department of Agriculture Weights and Measures Services Division), describes the wording as clunky and agrees with California. For those reasons Michael recommended a developing status.

Mahesh Albuquerque (Colorado Division of Oil and Public Safety), believes this item belongs in an EPO.

Brent Price (Gilbarco), agrees with California

The 2024 WWMA S&T Committee recommends this item remain Developing. The Committee suggests that the submitter work with NIST OWM based on comments heard during open hearings and consider the following editorial changes:

- Adding the language “developed under the conditions of the installation”

- Striking the proposed example. The Committee feels that an example may be more appropriately included in an EPO.

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 developed under the conditions of the installation 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:~~
- ~~• In this example Therefore, flow rates of 9 gpm down to and including 4.75 gpm are considered normal tests.~~

Southern Weights and Measures Association

During the 2024 SWMA Annual Meeting, Alison Wilkinson (MD) – Opposes item, examples should not be in handbooks, leaves it open for interpretation.

Matt Curran (FL) – Opposes item, suggested EPOs or guidance documents would be a better place for examples.

Brent Price (Gilbarco) – Agrees with previous commenters, examples don't belong in handbooks.

The committee recommends the item be withdrawn.

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.

During the 2024 NEWMA Annual Meeting, Cheryl Ayer (NH) commented that the purpose of this item is to give an example of the formula to provide clarification for readers, both regulators and service personnel. She pointed out that the formula was added editorially in the 2024 version of the handbook, but the acronym for maximum discharge flow rate (MDFR), was printed as MDRF and should be corrected if the formula appears in the handbook.

The Committee recommended maintaining a Voting status, but with the edits suggested by the submitter, and the body concurred.

At the 2024 NEWMA Interim Meeting, Cheryl Ayer (NH) spoke as the submitter of this item. Cheryl is not only looking at the LMD code, but also other codes with Normal Tests so there is uniformity between the codes and requested that this item remain developing. Michael Peeler (NJ) recommended a developing status for this item.

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

Central Weights and Measures Association

During the 2024 CWMA Annual Meeting, a representative from NIST OWM commented that they do not support adoption of this item and recommend either withdrawal or developing status. They discourage the use of examples in NIST Handbook 44 for a number of reasons. Currently, there are only two examples, in Section 2.21., paragraph N.2.2. and Section 3.30., paragraph S.4.4., in NIST Handbook 44. The handbook is adopted as law and any additional information must be carefully considered as it can affect the application of the paragraph sometimes in unintended ways. Paragraphs that include unclear language should be amended to provide clarification to allow for uniform interpretation without the need for this type of information. Additional guidance regarding the interpretation and application of the handbook is typically provided in documents NIST Handbook 112, Examination Procedure Outlines. Tina Butcher is currently updating this document and OWM intends to have the updated version available soon. If the weights & measures community chooses to move forward with this item, to be consistent with other examples currently in NIST Handbook 44, OWM suggests amending it to follow the format suggested in our Interim Analysis.

The Committee recommends this item be withdrawn.

During the 2024 CWMA Interim Meeting, Greg Vander Plaat (Minnesota) spoke against having examples listed in Handbook 44.

Loren Minnich (NIST OWM) supported the comments from Minnesota and yet pointed out that examples are rare and are specific. It was said that jurisdictions adopt the Handbook through different means thus examples may inadvertently become law in some states. NIST OWM is working on improving the language of the referenced paragraph to address the concerns of the submitter.

A regulator from Wisconsin agreed with comments from Minnesota and NIST OWM.

A regulator from Iowa stated that this is not necessary.

The committee recommends this item as withdrawn.

VTM – Vehicle Tank Meters

VTM-25.1 - UR.2.2. Recording Element

Source:NIST Office of Weights and Measures.

Submitter's Purpose and Justification:

When item VTM-21.1 was adopted, as part of Block 4 which appeared in the 2023 edition of Publication 16, the title of paragraph UR.2.2. was amended. That title is also referenced in sub-paragraph UR.2.2.1., but, due to an oversight, it was not amended as part of Block 4.

NIST OWM Executive Summary

VTM-25.1 – UR.2.2. Recording Element

NIST OWM Recommendation: Voting

- When Item Block 4 was adopted in 2023, which amended NIST Handbook 44 to further allow "electronic" receipts, the title of paragraph UR.2.2. was changed from "Ticket Printer, Customer Ticket" to "Recording Element" but the corresponding title in UR.2.2.1. was not amended.

- OWM views this as an oversight and submitted this as a housekeeping item to correct this issue.

Table 2. Summary of Recommendations
VTM-25.1 – UR.2.2. Recording Element

	Status Recommendation	Note*	Comments
Submitter (OWM)	Voting		
WWMA	Voting		
NEWMA	Voting		
SWMA	Voting		
CWMA	Voting		
NCWM			New Item

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

Item Under Consideration:

UR.2.2. Recording Element. – Vehicle-Mounted metering systems shall be equipped with a means to record all sales where product is delivered through the meter and shall comply with G-S.5.6. Recorded Representations. A copy of the ticket issued by the device shall be provided to the customer at the time of delivery or as otherwise specified by the customer.

(Added 1993) (Amended 1994 and 2023)

UR.2.2.1. Exceptions for the Sale of Aviation Fuel. – The provisions of UR.2.2. ~~**Ticket Printer**~~, ~~**Customer Ticket**~~**Recording Element** shall not apply to vehicle-mounted metering systems used solely for the delivery of aviation fuel into aircraft and for aircraft-related operations.
(Added 1999 **and 20XX**)

NIST OWM Detailed Technical Analysis:

When Item Block 4 was adopted in 2023, it amended NIST Handbook 44 to further allow "electronic" receipts. One of this group of items changed the title of paragraph UR.2.2. from "Ticket Printer, Customer Ticket" to "Recording Element," but the corresponding title in UR.2.2.1. was not amended. OWM views this as an oversight and submitted this as a housekeeping item to correct this issue.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

At the 2024 WWMA Annual Meeting, Loren Minnich (NIST OWM), believes this item is a clean up to a previously adopted item and recommends a voting status. Steven Harrington (Oregon Department of Agriculture, Weights and Measures Program), recommends voting for this item. Matthew Douglas (State of California, Division of Measurement Standards), agrees with previous comments and recommends voting for this item. Michael Brooks (Arizona Department of Agriculture Weights and Measures Services Division), recommends voting for this item.

The 2024 WWMA S&T Committee recommends a Voting status. The Committee believes that the item is fully developed and ready for a vote.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, Alison Wilkinson (MD), spoke in support of the item and recommends voting status. Dick Suiter (Richard Suiter Consulting), expressed concern on the phrase "recording element" and the definition of it. Undetermined status, but felt it needed to be researched further. Recommended printed receipt.

The Committee recommends the item be assigned to voting status.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting, Mr. Michael Peeler (NJ) commented that he agrees with changes and recommends a voting status. Mr. John Dillabaugh (PA) and Mr. Steve Timar (NY) also recommended a voting status.

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

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting Loren Minnich (NIST OWM) stated that this is a cleanup from a change of the title change of UR2.2.

A regulator from Minnesota supports these changes as the 2.2.1. refers to something that is no longer there. They also noted there was an issue with the correction as stated in the item.

The committee recommends this item as voting with corrected formatting below:

UR.2.2.1. Exceptions for the Sale of Aviation Fuel. – The provisions of UR.2.2. ~~**Ticket Printer, Customer Ticket**~~**Recording Element** shall not apply to vehicle-mounted metering systems used solely for the delivery of aviation fuel into aircraft and for aircraft-related operations.
(Added 1999 and 20XX).

HGV – Hydrocarbon Gas Vapor-Measuring Devices

HGV-25.1 - S.1.1.4. Advancement of Indicating and Recording Elements, S.1.1.5. Proving Indicator, S.2.2. Provision for Sealing, Table S.2.2. Categories of Device and Methods of Sealing, S.4.3. Temperature Compensation, S.4.4. Badge, N.3. Test Drafts, N.4.1. Normal Tests, and Appendix D. Definitions – register

Source: California Department of Food & Agriculture – Division of Measurement Standards

Submitter's Purpose and Justification:

The proposed changes are to recognize new technologies in hydrocarbon gas vapor-measuring devices.

Traditionally, Hydrocarbon Gas Vapor-Measuring Devices have been mechanical positive-displacement meters, however new technologies are available which are electronic in design.

Currently, the NIST Handbook 44 Section 3.33. Hydrocarbon Gas Vapor-Measuring Devices Code requires a badge ("badge" is defined in Appendix D in association with the 3.33. code to be "A metal plate…") which has specified markings and is to be affixed to the meter.

Additionally, the Section 3.33. Hydrocarbon Gas Vapor-Measuring Devices Code identifies that temperature compensation markings must appear on the register of the device. New technologies are available for which the body of the meter is plastic or another material which is able to be permanently marked with required identification information.

Mechanical registers can be removed and replaced necessitating temperature compensation information (if applicable) to be marked on the register. New technologies are available whereby electronic registers incorporated into the body of the meter and would not need this information on the register.

Proving indications have traditionally been used to allow for testing as the mechanical registers used in the past have had a limited resolution. Newer meters both mechanical and electronic are capable of displaying to the resolution necessary for testing.

Currently the only sealing provision identified by the 3.33. Hydrocarbon Gas Vapor-Measuring Devices Code is a security seal, the proposed language incorporates categories of sealing applicable to other device types.

The term "register" is not currently defined.

The submitter requested that this be a Voting Item in 2024.

NIST OWM Executive Summary

HGV-25.1 – S.1.1.4. Advancement of Indicating and Recording Elements, S.1.1.5. Proving Indicator, S.2.2. Provision for Sealing, Table S.2.2. Categories of Device and Methods of Sealing, S.4.3. Temperature Compensation, S.4.4. Badge, N.3. Test Drafts, N.4.1. Normal Tests, and Appendix D. Definitions – register

NIST OWM Recommendation: OWM recommends a Developing status to allow further vetting of the newer technologies to fully develop comprehensive design and user requirements for the next generation of metering equipment used in this application.

- Fully vett to ensure handbook requirements address: (1) the mechanisms in use for metrological features in these next generation measuring devices; and (2) the electronic options for all device applications that can be used to provide information such as audit trail security records and the measured quantity readings through remote indications.

- The "intended" design of a device although envisioned as fully compliant may not meet the full intent of basic weights and measures principles and OWM therefore recommends not including the term intended as a qualifier for how the advancement of indication must operate (i.e., as intended). Proper design and functioning of the more complex alternative newer digital electronic technologies should include all the elements which make it possible for these devices to meet performance requirements under all operating conditions. Recognize the use of these newer technologies in two ways:

  (1) Consider alternative modifications to paragraph S.1.1.4. Advancement of Indicating and Recording Elements by removing the term "mechanical" or use an alternate term such as "normal" operation which includes mechanical and electronic advancement of indications; and

  (2) Initially address the electronic meter designs in a new general design requirement which specifies the meter measurement technology shall adjust and correct for any design element or other factors that adversely affect measurements as stated in a new paragraph S.2.5. as shown below:

  S.2.5. Adjustments and Corrections for Measuring Elements and Measuring Systems. – A device shall be equipped with automatic means to determine and correct for changes in the product's properties or variations in other parameters having a significant metrological affect that results in a delivered quantity in excess of allowable limits. The device shall provide an indication when these feature are not operating properly.

- Retitle and reorganize paragraph S.4.4. ~~Badge~~Marking Requirements to specify: (1) General requirements for the marking information's permanence and prominent location on the front of the device and also specify it be either "clear" or preferably "legible"; (2) Method for Affixing Information i.e., the option for a Badge or if permissible external label, imprinting, stamping, etc. into the body of the device, (3) the list of the required information; and (4) the relationship of this information to G-S.1. marking information. In addition, the use of the word "badge" appears in other code paragraphs as the prescribed location for meter operating conditions that should be operational during the meter test.

For meters in operation where the primary indications are not reasonably viewable in the typical manner utility type meters are accessible to the customer, further modify Section 3.33 to include two new nonretroactive user requirements such as those shown on pages 85-86 in the NIST OWM Detailed Technical Analysis

HGV-25.1 – S.1.1.4. Advancement of Indicating and Recording Elements, S.1.1.5. Proving Indicator, S.2.2. Provision for Sealing, Table S.2.2. Categories of Device and Methods of Sealing, S.4.3. Temperature Compensation, S.4.4. Badge, N.3. Test Drafts, N.4.1. Normal Tests, and Appendix D. Definitions – register

that provide for meter reading information displayable to the customer in real time indications that clearly identifies the customer's premise that is the source for billable information.

Table 2. Summary of Recommendations

HGV-25.1 – S.1.1.4. Advancement of Indicating and Recording Elements, S.1.1.5. Proving Indicator, S.2.2. Provision for Sealing, Table S.2.2. Categories of Device and Methods of Sealing, S.4.3. Temperature Compensation, S.4.4. Badge, N.3. Test Drafts, N.4.1. Normal Tests, and Appendix D. Definitions – register

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		Further vetting of new technologies to fully develop comprehensive design and user requirements.
WWMA	Developing		
NEWMA	5		No comments heard and no recommendation.
SWMA	Developing		
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 Hydrocarbon Gas Vapor-Measuring Devices Code as follows:

S.1.1.4. Advancement of Indicating and Recording Elements. – Primary indicating and recording elements shall advance digitally or continuously and ~~**be susceptible to advancement only**~~

~~by mechanical operation of the device~~shall advance only by the designed operation of the device, as intended by the manufacturer.

(Amended 20XX)

S.1.1.5. Proving Indicator. – **All Hydrocarbon Gas Vapor-Measuring Devices shall be equipped with a proving indicator as described below or an indication which satisfies the resolution requirements identified below applicable to a proving indicator.**

(a) For mechanical (analog) proving indicators the following applies:

(1) Devices rated less than 280 m^3/h (10 000 ft^3/h) gas capacity shall be equipped with a proving indicator measuring 0.025 m^3, 0.05 m^3, 0.1 m^3, 0.2 m^3, or 0.25 m^3 per revolution, (1 ft^3, 2 ft^3, 5 ft^3, or 10 ft^3 per revolution) for testing the meter. **~~Devices with larger capacities shall be equipped as follows:~~**

(2) **~~(a)~~** Devices rated 280 m^3 (10 000 ft^3) up to but not including 1700 m^3/h (60 000 ft^3/h) gas capacity shall be equipped with a proving indicator measuring not greater than 1 m^3 (100 ft^3) per revolution.

(3) **~~(b)~~** Devices rated 1700 m^3/h (60 000 ft^3/h) gas capacity or more shall be equipped with a proving indicator measuring not more than 10 m^3 (1000 ft^3) per revolution.

The test circle of the proving indicator shall be divided into ten equal parts. Additional subdivisions of one or more of such equal parts may be made.

(b) For electronic (digital) indications, the smallest unit of volume displayed shall be no larger than 1/1000 of the value of the smallest unit of indicated delivery required in S.1.1.3. Value of Smallest Unit. The indication shall be capable of displaying continuously while testing the meter.

(Amended 1973**,** ~~**and**~~ 1988**, and 20XX**)

S.2.2. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices. For parameters adjusted using other means, the following applies.

Adequate provision shall be made for **an approved means of security (e.g., data change audit trail) or for physically** applying **a** security seal**s** in such a manner that **requires the security seal to be broken before** ~~**no**~~an adjustment or interchange can be made of:

(a) any measur~~**ement**~~ing **or indicating** element**;**

(b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and

(c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

Audit trails shall use the format set forth in Table S.2.2. Categories of Device and Methods of Sealing.*

[Nonretroactive as of January 1, 20XX]

(Amended 2019 and 20XX)

Amend Handbook 44 Hydrocarbon Gas Vapor-Measuring Devices Code to include a new Table S.2.2. to specify the format for device security that corresponds to proposed modifications to paragraph S.2.2. as follows:

Table S.2.2.
Categories of Device and Methods of Sealing

Categories of Device	***Methods of Sealing***
Category 1: No remote configuration capability.	***Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.***
Category 2: Remote configuration capability, but access is controlled by physical hardware. ***The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.***	***The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information through an on-site device.***
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). ***The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.***	***An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available on demand through the device or through another on-site device. The information may also be available electronically. 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.)***

[Nonretroactive as of January 1, 20XX]

(Table Added 20XX)

Further amend Handbook 44 Hydrocarbon Gas Vapor-Measuring Devices Code and Appendix D Definitions as follows:

S.4.3. Temperature Compensation. – If a device is equipped with an automatic temperature compensator, this shall be indicated on the badge**, ~~or~~** immediately adjacent to the badge**, or permanently marked on the front** of the device. **If the device is equipped with a mechanical register, this information shall also appear ~~and~~** on the register.

(Amended 20XX)

S.4.4. ~~Badge~~Identification. – A badge affixed in a prominent position on the front of the device**, and/or permanent markings in a prominent position on the front of the device** shall show the manufacturer's name, serial number and model number of the device, and capacity rate of the device for the particular products that it was designed to meter as recommended by the manufacturer.

(Amended 20XX)

N.3. Test Drafts. – Except for low-flame tests, test drafts shall be at least equal to**:**

(a) For devices equipped with a mechanical register:

(1) Meters equipped with test circles one complete revolution of the largest capacity proving indicator and shall in no case be less than 0.05 m^3 or 2 ft^3.

(2) Meters not equipped with test circles ten times the smallest indicated division and shall in no case be less than 0.05 m^3 or 2 ft^3.

(b) For devices equipped with an electronic register: at least ten times the smallest indicated division and in no case less than 0.05 m^3 or 2 ft^3.

All flow rates shall be controlled by suitable outlet orifices.

(Amended 1973**, ~~and~~** 1991**, and 20XX**)

N.4.1. Normal Tests. – The normal test of a device shall be made at a rate not to exceed the capacity rate given on the badge **or markings** of the meter.

(Amended 1988 **and 20XX**)

And

Appendix D:

register – An indicating element incorporated into the body of the meter or an indicating assembly connected to the meter. [3.33]

(Added 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM acknowledges use of technologies other than positive displacement diaphragm design type of meter in hydrocarbon gas vapor applications. The recognition of other device designs should be fully vetted to ensure handbook requirements address: (1) the mechanisms in use for metrological features in these next generation measuring devices; and (2) the electronic options for these newer and existing device applications that can be used to provide information such as audit trail security records or the measured quantity readings through remote indications.

The mechnical or electronic means of determing the movement or flow of gas and then register the quantity of product should be based on sound operating principles that apply to a particular meter technology to include relevant components necessary to meet accuracy requirements. Consider an alternative modification to paragraph S.1.1.4. Advancement of Indicating and Recording Elements by removing the term "mechanical" or use an alternate term such as "normal" operation which includes mechanical and electronic advancement of indications.

There should be a comprehensive set of at minimum general design requirements that specify the proper operating conditions for these more complex newer technologies to ensure these devices meet perfomance requirements. The "intended" design of a device although envisioned as fully compliant may not meet the full intent of basic weights and measures principles. Therefore proper functioning of the more complex new technologies should include all the elements which make it possible for these devices to meet perfomance requirements under all operating conditions. Consequently, NIST OWM recommends advancement of the indications be the result of the device's operations only. Rather than including the proposed new text "as intended by the manufacturer" in paragraph S.1.1.4. Advancement of Indicating and Recording Elements, consider including other paragraphs in the code such as proposed new paragraph S.2.5. Adjustments and Corrections for Measuring Elements and Measuring Systems shown below as a starting point for addressing the different properties each individual new meter technology must factor into the operating design to achieve performance requirements. This newly proposed specification is recommended to ensure that any meter design dependent on elements or features that shall not be absent and must be suitable for the equipment to operate properly and for repeated measurement accuracy are to be addressed in this general design requirement to read:

> **S.2.5. Adjustments and Corrections for Measuring Elements and Measuring Systems. – A device shall be equipped with automatic means to determine and correct for changes in the product's properties or variations in other parameters having a significant metrological affect that result in a delivered quantity in excess of allowable limits. The device shall provide an indication when these functions are not operating properly.**
>
> **(Added 20XX)**

The Submitter has acknowledged that the term badge is defined in Appendix D – Definitions based solely on its use in Section 3.33. The term "Identification" which is being proposed as the new title of paragraph S.4.4. Badge is synonymous with the information required to be permanently marked on equipment in General Code paragraph G-S.1. NIST OWM would suggest an alternate new title of paragraph S.4.4. to read: Marking Requirements. Then reorganization of paragraph S.4.4. to include numbered subparagraphs that specify: (1) General requirements for the marking information's permanence and prominent location on the front of the device and also specify that it be either "clear" or preferably "legible"; (2) Method for Affixing Information i.e., the option for a Badge or if permissible external label, imprinting, stamping, etc. into the body of the device, (3) the list of the required information; and (4) the relationship of this information to G-S.1. marking information. It should also be noted before eliminating the term "badge" that it is the prescribed location in paragraphs S.4.3. Temperature Compensation and current paragraph S.4.4. Badge for marking information that should be used to establish proper conditions when testing to correct deliveries that are temperature compensated and to not exceed the capacity rating of the meter.

One last point is that some meters may be in operation where the primary indications are not reasonably viewable in the typical manner utility type meters are accessible to the customer. Therefore, further modify Section 3.33 to include two new nonretroactive user requirements as shown below that provide for meter reading information displayable in real time indications that clearly identifies the customer's premise that is the source for the billable information such as shown below.

UR.1.1. Customer Indicating Element, Accessibility. – For systems in which the primary indicating element is not reasonably accessible to the customer, one of the following shall be provided.

(a) Console display which is accessible to the customer on which the customer can clearly identify and then select the device's reading information.

(b) Remote display which is provided to customer as a part of the system.

(c) At the option of the customer, an application that provides readings in real time.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

And

UR.2.4.6. Tenant Premise Identification. – Tenant premise identification shall be clearly and permanently shown on or at the device, and on all separate components of a device. Remote indications and all recorded indications shall be readily identifiable and readily associated with the customer's premise. Recorded indications shall also include time and date information.

[Nonretroactive as of January 1, 20XX]

(Added 20XX)

Summary of Discussions and Action:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the WWMA 2024 Annual Meeting Matthew Douglas (California Division of Measurement Standards) the Submitter explained the need to update HB 44 to keep up with this industry's newer electronic technologies regarding this device type. These devices are currently available. The submitter welcomes any feedback and supports a voting status.

The 2024 WWMA S&T Committee recommends a Developing status. The Committee encourages the submitter to seek feedback from stakeholders and NIST OWM to determine whether the item is fully developed and ready for a vote.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, the S&T Committee heard no comments on this item. This item was posted on the website but was not printed in the SWMA S&T Committee's agenda. The Committee recommends the item be assigned developing status to allow the submitter to obtain feedback from stakeholders and from NIST.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting, no comments were heard from the floor. NEWMA does not have a recommendation for this item.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, no comments were heard during open hearing. The Committee recommends this item be numbered HGV-25.1 and be assigned developing status.

HGM – Hydrogen Gas-Measuring Devices

HGM-23.1 D UR.3.8. Safety Requirement

Source: Quong and Associates, Inc.

Submitter's Purpose and Justification:

Add safety requirement for hydrogen gas measuring devices. The proper fueling of hydrogen vehicles is critical to ensure that the vehicle and high-pressure tank is not damaged. Unlike other gases, such as compressed natural gas, hydrogen heats as a vehicle is fueled due to the reverse Joule-Thompson effect. This means that the fueling rate and temperature of the hydrogen must be carefully controlled, or damage can occur to the vehicle hydrogen tanks. The hydrogen industry has done considerable work in developing standard fueling protocols in SAE J2601 available at:

> **https://www.sae.org/standards/content/j2601_202005/** and validation methods in ANSI/CSA HGV 4.3 available at:
> **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 bythe Air Resources Board (CARB) available at:
> (**https://ww2.arb.ca.gov/resources/documents/annual-hydrogen-evaluation.)** The proposed requirement provides assurances that dispensers have been verified to the proper fueling protocol which will protect the dispenser, vehicle, and consumer.

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

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

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

The submitter provided the following links:

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

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

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

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

- EVSE Pre_Rule Wkshop Shared Deck.pdf

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

NIST OWM Executive Summary

HGM-23.1 – UR.3.8. Safety Requirement

NIST OWM Recommendation: OWM has no recommendation until additional data is submitted.

- 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 other interested parties to clarify the types of test data available that are the result of compliance testing to the SAE J2601 standard and impact on metrological parameters of these dispensers.

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

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM		5	Awaiting reporting from California agencies on the impact on dispenser performance and required investment outlay for the proposed test
WWMA	Withdraw		
NEWMA	Developing		
SWMA	Withdraw		
CWMA	Developing/Withdraw		If no update is provided at the NCWM Interim, the CWMA S&T Committee supports withdrawal of this item
NCWM	Developing		At the conclusion of the July 2024 NCWM Annual Meeting the item maintains its Developing status

	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 Hydrogen Gas-Metering Devices Code as follows:

UR 3.8. Safety Requirement –All hydrogen gas-measuring devices subject to this code shall maintain verification of testingdemonstrating conformance with the latest version of SAE J2601 Fuel Protocols for Light Duty Gaseous Hydrogen SurfaceVehicles, as determined by the latest version of ANSI/CSA HGV 4.3 "Test Methods for Hydrogen Fueling Parameter Evaluation."
[Nonretroactive as of January 1, 20XX]
(Added 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM acknowledges the submitter has ended their work on this item. NIST OWM continue to look forward to the reporting from CA DMS and CARB as well as any other related updates from the California agencies to clarify the types of test data available that are the result of compliance testing to the SAE J2601 standard. More importantly data that demonstrates how metrology and safety are interconnected. 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 Schnepp (California Division of Measurement Standards) stated California has 68 stations that all require this standard and 33 private stations that do not have this requirement that facilitates accurate and safe fueling. Supports item. Kevin Schnepp 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.

At the 2024 NCWM Interim Meeting a representative from New Jersey Weights & Measures commented that safety requirements are not appropriate for NIST Handbook 44 and that his item should be withdrawn. A representative from the California Division of Measurement Standards commented that this is required in California and that a survey to gather additional data is underway. There will be additional comments when the results of the survey are known. A representative from NIST OWM commented that standards for safety have not been a part of NIST Handbook 44, dispensers of other fuel types have mechanisms in place to ensure safety, and that it is unclear how compliance will be verified.

The Committee decided to leave this item as developing to allow for data submission of the ongoing survey.

At the NCWM 2024 Annual Meeting, the S&T Committee indicated it understands that the submitter is no longer involved with the item but the California Division of Measurement Standards is still collecting data. The Committee is looking for that data to demonstrate there is a connection between the safety requirement and metrological functions. If data is not available by the 2025 Interim Meeting the Committee will consider withdrawing the item.

Regional Association Reporting:

Western Weights and Measures Association

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

Kevin Schnepp 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.

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

The WWMA 2023 S&T Committee recommends this item remain Developing based on comments heard to allow the submitter the ability to provide data and address the concerns 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 is addition to safety.

During the WWMA 2024 Annual Meeting, Kevin Schnepp stated the submitter of this item has retired. Mr. Schnepp also stated this is an item that is impactful to the state of California and efforts are on the way through SAE to make this safety requirement a UL listing requirement. He noted, if the item is not supported, a status to withdraw would be appropriate.

The 2024 WWMA S&T Committee recommends this item be Withdrawn based on comment heard during the open hearings.

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.

During the 2024 SWMA Annual Meeting, the SWMA S&T Committee heard no comments on this item. The Committee recommends the item be withdrawn and can be resubmitted if new data becomes available

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 HB 44. 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 recommended this item be withdrawn.

At the 2024 NEWMA Annual Meeting, no comments were heard during open hearings.

The Committee recommended to maintain a Developing status and the body concurred.

At the 2024 NEWMA Interim Meeting, Jason Flint (NJ) commented that the data which was promised which would prove this safety requirement effects the metrological functions has yet to be submitted. It is his understanding that the submitter of the item is no longer working on the project and the California DMS has been collecting the data. Jason Flint suggested that this item be given a developing status, however, if the data is not submitted by the NCWM Interim meeting that it be withdrawn. Jim Willis (NY) commented that he agrees with New Jersey.

After hearing comments from the floor, the Committee recommended a Developing status for this item, however, strongly urges the NCWM S&T Committee to withdraw the item if data is not submitted, and the body concurred.

Central Weights and Measures Association

At the 2022 CWMA Interim Meeting, there were no comments from the floor. The CWMA S&T Committee 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.

At the 2024 CWMA Annual Meeting, the Committee received no comments on this item.

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

At the 2024 CWMA Interim Meeting, no comments were heard during open hearings.

The committee recommends this item as developing with the understanding that if data previously requested on this item is not available for the 2025 NCWM Interim meeting that this item should be withdrawn.

FMT – Farm Milk Tanks

FMT-25.1 - UR.1. Installation

Source: USDA-AMS-Dairy Programs.

Submitter's Purpose and Justification:

To create more robust installation requirements for On Farm Milk Bulk Tanks. In many states in the Northeastern region such as NY, PA, and VT this change is of little importance because the States already have a cement requirement on the books. However, in states with no such cement requirement such as CT or ME the submitter indicates finding significantly higher rates of failed recertification in their capacity as a dairy regulator.

This will increase costs associated with the installation of on-farm milk bulk tanks and increase the time associated with the installation of on-farm milk bulk tanks.

The submitter recommended that this be a Retroactive requirement.

NIST OWM Executive Summary

FMT-25.1 – UR.1. Installation
NIST OWM Recommendation: Developing • The Item Under Consideration originally incorrectly referenced the Milk Meter Code. It was edited to correctly reference the Farm Milk Tanks Code. • The submitter of this item requests that the legs be permanently cemented as a requirement for installing a farm milk tank and notes that States in the Northeast, specifically NY, PA, and VT, have this requirement.

FMT-25.1 – UR.1. Installation

- VT provided a copy of their weights and measures law which include "and the tank legs are cemented to the floor."
- NY requirement states that foundations shall be of sufficient strength to support the fully liquid-laden tank without change in level and that the legs must be permanently cemented.
- PA non-regulatory recommendation is that bulk tanks are cemented to concrete footer on the back-end of the tank.

- At the Southern, it was noted that permanently cemented legs may cause an issue with cleanliness standards. Are cleanliness standards uniform in all states, and if so, how do Northeastern States comply with these standards?
- NIST OWM acknowledges the workload and safety conditions, but questions whether there are other plausible flooring options that would meet the demands of the farm milk tank environment and/or for maintaining the metrological integrity of the equipment.
- Although there are other User Requirements in the Farm Milk Tank Code that address maintaining the level condition of the tank, NIST OWM provides suggested alternative language for the proposal which is less prescriptive. See that suggested language in the "NIST OWM Detailed Technical Analysis" Section of this report.

Table 2. Summary of Recommendations
FMT-25.1 – UR.1. Installation

	Status Recommendation	Note*	Comments
Submitter			No status provided
OWM	Developing		
WWMA	Developing		
NEWMA	Voting		
SWMA	Developing		
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

Amend Handbook 44 Section 4.42 Farm Milk Tanks Code as follows:

> UR.1. **Installation**. – A stationary tank shall be rigidly installed in level without the use of removable blocks or shims under the **leveling** legs**. The leveling legs must be permanently cemented using a form to the floor to prevent any adjustment after the calibration. ~~If such tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined~~. A stationary tank shall not move during the loading or unloading process.**

NIST OWM Detailed Technical Analysis:

In reviewing the proposal, NIST OWM notes that the initial reference to the Item Under Consideration should be changed to reference the correct code. The Milk Meters Code was changed to Farm Milk Tanks Code. NIST OWM, along with other states, believes the language as written is too prescriptive and the following is alternative language for consideration :

> UR.1. **Installation**. – A stationary tank shall be rigidly installed in level without the use of removable blocks or shims under the legs**. A means shall be in place to prevent any readjustment or shifting out of the level after the equipment's calibration.** If such tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined**. A stationary tank shall not move during the loading or unloading process.**

NIST OWM acknowledges that flooring in the equipment area must be of suitable construction to withstand heavy loads, cleansing solutions, and hot water. This is in addition to safety issues that arise in a wet environment and with any possibility of leaking equipment and levels of control in place for biological contaminants. All these scenarios impact the longevity of flooring materials and necessitate proper maintenance of any flooring surfaces. NIST OWM questions whether there are other plausible flooring options that would meet the demands of the farm milk tank environment and/or for maintaining the metrological integrity of the equipment.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

At the 2024 WWMA Annual Meeting, the S&T Committee recommended developing status for this item based on comments received during the open hearings.

Loren Minnich (NIST OWM) stated that the item needs to be corrected on the Form 15 section "Item under Consideration" which references the Milk Meters Code, but should reference the Farm Milk Tanks Code. Loren agreed with the intent of the item but expressed concern that the language may be too prescriptive.

Matthew Douglas (California Division of Measurement Standards) agreed with Loren Minnich's comment that the language is too prescriptive and questioned the intent of the item. Matthew recommended this item be withdrawn.

Aaron Yanker (Colorado Department of Agriculture, Weights and Measures) agreed with the comments from the two previous speakers. The language is too prescriptive. He expressed concern that the language "permanently cemented" is only one way of accomplishing the intent of the item. Aaron recommended this item be assigned developing status and that the submitter work with industry and the NCWM Milk Meter Task Group to further develop this item.

Christopher Greer (Tulare County, California) agreed with the comments from Matthew Douglas.

Michael Brooks (Arizona Department of Agriculture Weights and Measures Services Division) agreed with Aaron Yanker's comments and recommended this item be assigned developing status.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, the S&T Committee recommended Developing status for this item based on comments heard during their meeting. Matt Curran (FL) opposed the item, as is and believes it will have unintended consequences, related to the cleaning and maintenance of the floor having adverse effects due to the permanent attachment. Further stating that it would increase the chance of Interstate Milk Shippers List (IMS) rating failures and selling across state lines would be difficult. Then Matt Curran recommended developing status for this item.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting Joel Northrop (USDA-AMS-Dairy Programs) gave a presentation as the submitter. Joel Northrop commented that some milk tanks are blocked up under the tank itself and not the leveling legs. Stationary tanks should not be able to move and some tanks are shifting and moving while loading/unloading because they are not installed correctly. Cheryl Ayer (NH), Michael Peeler (NJ), Jim Willis (NY), and Michel Picard (ME) recommended a voting status.

After hearing comments from the floor, the Committee recommended voting status for this item and the body concurred.

Central Weights and Measures Association

At the CWMA 2024 Interim Meeting no comments were heard during open hearings. The Committee recommends this item as developing and recommends the submitter gather more input from stakeholders.

MDM – Multiple Dimension Measuring Devices

MDM-25.1 - A.2. Other Devices Designed to Make Multiple Measurement Automatically to Determine Volume

Source: Multiple Dimension Measuring Devices Work Group

Submitter's Purpose and Justification:

Recognize MDMD devices that measure volume directly rather than measuring three dimensions and calculate a volume. These devices measure the volume of a commodity, such as sand, gravel, rock, and dirt, etc. These commodities are measured in a truck or other conveyance either statically or in-motion.

These devices are already in the marketplace and two manufacturers have a Provisional NTEP Certificate of Conformance. The changes to NIST Handbook 44 will permit the certificates to be accepted in all states. The MDMD Work Group voted to support this proposal with no opposing votes.

NIST OWM Executive Summary

MDM-25.1 – A.2. Other Devices Designed to Make Multiple Measurement Automatically to Determine Volume

NIST OWM Recommendation: Developing

- Items MDM-25.1, MDM-25.2, and MDM-25.3 cannot be evaluated and adopted separately. Therefore, NIST OWM suggests combining these three proposals into a single proposal, MDM-25.1.
- In order to include volume measurement devices, more requirements in Section 5.58. need revision than just A.2., N.1.1. and T.3.
- NIST OWM recommends a thorough investigation of other requirements that need amendment to apply to devices designed to make multiple measurements automatically to determine a volume as opposed to multiple dimension measuring devices.
- OWM has identified 10 specification, 4 note, 2 tolerance, and 2 user requirement paragraphs that meet this criterion and are included in the detailed analysis.

Table 2. Summary of Recommendations
MDM-25.1 – A.2. Other Devices Designed to Make Multiple Measurement Automatically to Determine Volume

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	No recommendation		
SWMA	Informational		
CWMA	Voting		
NCWM	Voting		

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

Item Under Consideration:

Amend NIST Handbook 44, Multiple Dimension Measuring Devices Code as follows:

A.2. Other Devices Designed to Make Multiple Measurement Automatically to Determine a Volume. – ~~Insofar as they are clearly applicable, the provisions of this code apply also to devices designed to make multiple measurements automatically to determine a volume for other applications as defined by Section 1.10. General Code paragraph G-A.1. Commercial and Law-Enforcement Equipment.~~

(a) The provisions of this code are applicable to any applications as defined by Section 1.10. General Code paragraph G A.1. Commercial and Law-Enforcement Equipment.

(b) may be used to measure the volume of a commodity.
(Added 20XX)

NIST OWM Detailed Technical Analysis:

Items MDM-25.1, MDM-25.2 and MDM 25.3 are related and all aim to include a new application of multidimensional measurement. However, it is impossible to evaluate and adopt them separately. Therefore, NIST OWM suggests combining these three proposals into a single proposal, MDM-25.1.

This analysis applies to the set of the three individual items, MDM-25.1, MDM-25.2, and MDM 25.3.

The items have merit. Volume measurement devices, such as the one certified by NTEP CC 24-001P, seem suitable for commercial transactions. However, more requirements in Section 5.58 need revision than just A.2., N.1.1. and T.3.

The MDMD code is written for instruments that determine the individual dimensions of an object (length, width, and height). The code contains multiple requirements related to these individual dimensions. These requirements cannot be applied to volume-measuring devices. Either every volume measuring device is non-compliant since it is unable to meet the requirement or the requirement is deemed not applicable, in which case the subject matter of the requirement is not taken into account.

Furthermore, regarding MDM-25.1, the changes proposed to A.2. are difficult to interpret. It is unclear whether both (a) and (b) need to be met or only one of these conditions. If both conditions need to be met, then it is better to combine the conditions in a single sentence to avoid confusion. If only one of the conditions needs to be met, then condition b is too vague as it implies that in that case Section 1.10. General Code paragraph G A.1. Commercial and Law-Enforcement Equipment, is not applicable. Also, condition b does not explain what is meant by "other devices". The proposal would include a volumetric measure because it can also be used to make multiple measurements to determine the volume of a commodity. The term 'device' is not defined in NIST Handbook 44.

In addition, the current application section of 5.58. seems to separate the devices using the terms "multiple dimension measuring device" and "devices designed to make multiple measurements automatically to determine a volume". A.1. specifies "multiple dimension measuring device" are used for measuring "hexahedron-shaped objects" and "irregularly-shaped objects… for the purpose of calculating freight, storage, or postal charges based on the dimensions and/or volume occupied by the object.". A.2. applies to "devices designed to make multiple measurements automatically to determine a volume". The terms "devices designed to make multiple measurements automatically to determine a volume" are not used in any of the other paragraphs in this section and would conceivably eliminate the application of those paragraphs to these devices.

Because of this, there are several requirements in Section 5.58. Multiple Dimension Measuring Devices that should be reviewed. They include the following:

- S.1.4. Dimensions Indication
    - Do the devices that measure the volume of commodities have the capability to provide the information required by this paragraph.
- S.1.5. Value of Dimension/Volume Division Units
    - S.1.5. requires that the value of a device division "d" is expressed in a unit of dimension and refers to measurement axes. In the case of a volume-measuring device, there are no measurement axes. Still, the format of the volume indication should follow the format described in the requirement.
- S.1.5.1. For Indirect Sales
    - The values specified in this paragraph may not be applicable to devices that measure the volume of commodities.
- S.1.5.2 Devices Capable of Measuring Irregularly-Shaped Objects

  - This paragraph may not be applicable to devices that measure the volume of commodities as it states "the value of the division size (d) shall be the same for the length axis (x) and the width axis (y). Do these devices have x and y axes?

- S.1.6. Customer Indications and Recorded Representations
- Table S.1.6. Required Information to be Provided by Multiple Dimension Measuring Systems
  - The requirements in 3. through 7. in Table S.1.6. don't seem to be applicable to devices that only measure volume. For example, soil or aggregate typically won't be in a hexahedron (six-sided) shape when measured in the means of conveyance such as a truck or rail car.
- S.1.7. Minimum Measurement
  - Is 12 d an acceptable minimum measurement for devices that only measure volume.
- S.1.8. Indications Below Minimum and Above Maximum
- S.2.2.1 Maximum Value of Dimensional Offset for Multi-Interval (Variable Division-Value Devices)
- Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems
  - This table requires the "Minimum and Maximum Dimensions for Each Axis for Each Range in Each Axis" to be marked on an MDMD device, do devices that measure only volume have any "axis" to mark?
- N.1.2. Position Test.
  - Will the test procedure for devices that measure the volume of commodities require the test object (materials) to be repositioned as is specified by this paragraph?
- N.1.2.1 Irregularly-Shaped Test Object Placement
  - This paragraph specifies that "Irregularly-shaped test objects must be measured while placed on a stable side. Object (commodities) measured by devices that measure only volume, will be irregularly shaped but conceivably will not have a stable side.
- N.1.4. Test Object Size
  - This paragraph references "dimensions marked on the device" which may not be applicable to devices that measure the volume of commodities as they will not be marked with dimensions.
- N.1.4.2. Irregularly-Shaped Test Objects
- T.2.3. Multi-interval (Variable Division-Value) Devices
  - This is specific to "dimensioning axes (length (x), width (y), or height (z))" which may not be applicable to devices that measure the volume of commodities
- T.2.4. Mixed-Interval Devices
  - This references "dimensioning axes" which may not be applicable to devices that measure the volume of commodities
- UR.3.1. Minimum and Maximum Measuring Ranges.

    - This references “smaller than the minimum or larger than the maximum dimensions marked on the device” which may not be applicable to devices that measure the volume of commodities.

- UR.3.2. Special Designs and UR.4.1. Zero or Ready Condition..

These both reference “a multiple dimension measuring device” which seems to exclude devices that measure the volume of commodities.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual meeting, Kenn Burt (San Luis Obispo County, California on behalf of the S&T Committee) stated that a letter had been received from the MDMD Work Group in support of this item, speaking to MDM-25.1, MDM-25.2 and MDM-25.3.

Matthew Douglas (State of California, Division of Measurement Standards) stated that they were overall supportive of the concept, however, the item needs clarification. They were not sure that the language presented fulfills the intent as the language as written may not include the intended devices.

Loren Minnich (NIST OWM) agreed with Matthew Douglas. The language is not achieving what it intends. NIST OWM also had concerns that this section was developed for measurements of length, width and height and that the item needs to be evaluated to ensure that it would apply to a volume measuring device. They suggested that a Developing status might be the most appropriate.

The WWMA 2024 S&T Committee recommends a Developing status. Consideration of the comments heard on the floor were specifically expressing that the language may not be achieving its intended purpose.

The Committee additionally recommends that this item, MDM-25.2, and MDM-25.3 be blocked together and that they be evaluated to ensure they would apply to a volume measuring device.

Southern Weights and Measures Association

At the 2024 SWMA Annual meeting, Dick Suiter, Richard Suiter Consulting gave a presentation on behalf of the NCWM Multiple Dimension Measuring Device Work Group and MDMD 2024 Volume Focus Group.

The presentation demonstrated how the systems operate. In addition, Mr. Suiter provided written comments, which are included in the supporting documents.

Tim Chesser, retired Arkansas – supported the item, but had questions on how the standards were verified. They mentioned that many of the commodities would have voids and would be unlike pea gravel and questioned speed and pausing affecting the measurement.

Dick Suiter, Richard Suiter Consulting – responded to Mr. Chesser’s comments stating that there are maximum and minimum speeds and if the measurement was taken outside those parameters, an error message is given. The certified tape measure is used to verify the standard. NTEP verifies the standard during NTEP assessments, currently has provisional NTEP Certificate of Conformance.

Tory Brewer, WV – Questioned the calibration of the standard and if there were labs accredited to perform the calibration.

The committee recommends the items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked and be assigned to informational status. The would like to gather more information from the stakeholders to allow more time for review and to answer some questions raised.

Northeastern Weights and Measures Association

At the 2024 Interim Meeting, no comments were heard from the floor.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, a representative from NIST OWM suggested that items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked together. They also support these items but have concerns on issues not addressed by this proposal dealing with length, width, and height.

The submitter of this item gave a presentation on how this device functions and what its purpose is. They asked for support of all MDM items as voting. It was noted that marking requirements need to be addressed for volume only devices and that they can work with NCWM S&T Committee for those changes. The submitter also submitted written comments to the committee; attached to this report as Appendix A.

A regulator from Iowa asked a question regarding if the method of sale was changing from weight to volume. The submitter answered that there may be variations for commodities sold by both weight and volume, but that this will introduce a traceable means of verification.

A second regulator from Iowa asked if there was any special equipment that needed to be installed on the trucks carrying the commodity for measurement. The submitter answered that no additional equipment be installed on those vehicles.

A regulator from Minnesota asked if speed and position restrictions need to be marked on this device or for vehicle operators like they do for an in-motion vehicle scale. They also asked if this device accounted for a live bottom container such as a container with a conveyer belt installed that would compress creating more volume when a commodity is loaded on top of it. The submitter answered that the test method looks at minimum and maximum speed and issues a non-measurement notice if the vehicle speed is too great and that this is also noted in the certificate of the device. They also answered that in the event of a live bottom container, the customer would have the advantage.

A regulator representing the State of Iowa supports this moving forward. They witnessed a demonstration on this item and found that the readings aligned with a static scale verification. It was also noted that this device will eliminate temporary scale needs for businesses that operate seasonally.

The committee recommends that this item be blocked with MDM-25.2 and MDM-25.3 and be assigned a voting status.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they support the continued development of this item. The SMA feels the proposal is missing many items such as marking requirements, reference to specific commodities from handbook 130, speed, out of measurement zone, direction (one way/both ways), and out of level.

MDM-25.2 - N.1 Test Procedures

Source: Multiple Dimension Measuring Devices Work Group

Submitter's Purpose and Justification:

Clarify test procedure for MDMD devices that measure volume directly rather than measuring three dimensions and calculate a volume. These devices measure the volume of a commodity, such as, sand, gravel, rock, and dirt, etc. These commodities are measured in a truck or other conveyance either statically or in-motion.

NIST OWM Executive Summary

MDM-25.2 – N.1 Test Procedures

NIST OWM Recommendation: Developing

- Items MDM-25.1, MDM-25.2, and MDM-25.3 cannot be evaluated and adopted separately. Therefore, NIST OWM suggests combining these three proposals into a single proposal, MDM-25.1.
- In order to include volume measurement devices, more requirements in Section 5.58 need revision than just A.2., N.1.1. and T.3.
- NIST OWM recommends a thorough investigation of the requirements that need amendment as specified in the detailed analysis, at a minimum.
- This item should be reworded to require the means of conveyance used during testing be representative of the those normally used when the device is in operation.
- As proposed, it requires the test itself to "be representative of the conveyance normally measured" which is is unclear as to what is required.

Table 2. Summary of Recommendations
MDM-25.2 – N.1 Test Procedures

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM	Developing		
WWMA	Developing		
NEWMA	No recommendation		
SWMA	Informational		
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

N.1. Test Procedures.

N.1.1. General. – The device shall be tested using test standards and objects of known and stable dimensions **and for volume measuring devices using vehicles, rail cars, or other means of conveyance, the tests shall be representative of the conveyance normally measured**.

NIST OWM Detailed Technical Analysis:

Item MDM-25.2, as proposed is unclear in what is required. It specifies the test itself "be representative of the conveyance normally measured". This item should be reworded to require the means of conveyance used during testing be representative of the those normally used when the device is in operation.

OWM suggest the following language be considered by the submitter:

N.1.1. General. – The device shall be tested using test standards and objects of known and stable dimensions. **For tests of devices designed to make multiple measurements automatically to determine a volume the means of conveyance, e.g., vehicles, rail cars, etc., shall be representative of the conveyance used during normal operation of the device**.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual meeting, Matthew Douglas (State of California, Division of Measurement Standards) stated that like the last item, they support development and the concept, but the item needs more clarity. They wondered if this proposal is saying that the volume of a rail car needs to be determined so that the rail car can be used for testing the device?

The 2024 WWMA S&T Committee recommends a Developing status, with consideration to the comment heard on the floor. The Committee also recommends that this item, MDM-25.1, and MDM-25.3 be blocked together, and that they be evaluated to ensure they would apply to a volume measuring device.

Southern Weights and Measures Association

At the 2024 SWMA Annual meeting, Dick Suiter, Richard Suiter Consulting gave a presentation on behalf of the NCWM Multiple Dimension Measuring Device Work Group and MDMD 2024 Volume Focus Group.

The presentation demonstrated how the systems operate. In addition, Mr. Suiter provided written comments, which are included in the supporting documents.

Tim Chesser, retired Arkansas – supported the item, but had questions on how the standards were verified. They mentioned that many of the commodities would have voids and would be unlike pea gravel and questioned speed and pausing affecting the measurement.

Dick Suiter, Richard Suiter Consulting – responded to Mr. Chesser's comments stating that there are maximum and minimum speeds and if the measurement was taken outside those parameters, an error message is given. The certified tape measure is used to verify the standard. NTEP verifies the standard during NTEP assessments, currently has provisional NTEP Certificate of Conformance.

Tory Brewer, WV – Questioned the calibration of the standard and if there were labs accredited to perform the calibration.

The committee recommends the items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked and be assigned to informational status. The would like to gather more information from the stakeholders to allow more time for review and to answer some questions raised.

Northeastern Weights and Measures Association

At the 2024 Interim Meeting, no comments were heard from the floor.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, a representative from NIST OWM suggested that items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked together. They also support these items but have concerns on issues not addressed by this proposal dealing with length, width, and height.

The submitter of this item gave a presentation on how this device functions and what its purpose is. They asked for support of all MDM items as voting. It was noted that marking requirements need to be addressed for volume only devices and that they can work with NCWM S&T Committee for those changes. The submitter also submitted written comments to the committee; attached to this report as Appendix A.

A regulator from Iowa asked a question regarding if the method of sale was changing from weight to volume. The submitter answered that there may be variations for commodities sold by both weight and volume, but that this will introduce a traceable means of verification.

A second regulator from Iowa asked if there was any special equipment that needed to be installed on the trucks carrying the commodity for measurement. The submitter answered that no additional equipment be installed on those vehicles.

A regulator from Minnesota asked if speed and position restrictions need to be marked on this device or for vehicle operators like they do for an in-motion vehicle scale. They also asked if this device accounted for a

live bottom container such as a container with a conveyer belt installed that would compress creating more volume when a commodity is loaded on top of it. The submitter answered that the test method looks at minimum and maximum speed and issues a non-measurement notice if the vehicle speed is too great and that this is also noted in the certificate of the device. They also answered that in the event of a live bottom container, the customer would have the advantage.

A regulator representing the State of Iowa supports this moving forward. They witnessed a demonstration on this item and found that the readings aligned with a static scale verification. It was also noted that this device will eliminate temporary scale needs for businesses that operate seasonally.

The committee recommends that this item be blocked with MDM-25.2 and MDM-25.3 and be assigned a voting status.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they are not in support of this item as written because the details, requirements, and test equipment for the initial and subsequent field testing are not currently included.

MDM-25.3 - T.3. Tolerance Values

Source: Multiple Dimension Measuring Devices Work Group

Submitter's Purpose and Justification:

Provide tolerances for MDMD devices that measure volume directly rather than measuring three dimensions and calculate a volume. These devices measure the volume of a commodity, such as sand, gravel, rock, and dirt, etc. These commodities are measured in a truck or other conveyance either statically or in-motion.

NIST OWM Executive Summary

MDM-25.3 – T.3. Tolerance Values
NIST OWM Recommendation: Developing • Items MDM-25.1, MDM-25.2, and MDM-25.3 cannot be evaluated and adopted separately. Therefore, NIST OWM suggests combining these three proposals into a single proposal, MDM-25.1. • In order to include volume measurement devices, more requirements in Section 5.58 need revision than just A.2., N.1.1. and T.3. • NIST OWM recommends a thorough investigation of the requirements that need amending as specified in the detalied anlaysis for item MDM-25.1, at a minimum.

MDM-25.3 – T.3. Tolerance Values
• The proposed new paragraph T.3.1. specifies, "maintenance and acceptance tolerance shall be as shown in Table XX". The new Table XX only specifies maintenance tolerances. This item needs further editing to provide clarity. • OWM suggests removing the sentence "The maintenance and acceptance tolerance shall be as shown in Table XX" from T.3.1. For Volume Devices, as maintenance tolerances are specified in part (a) of T.3.1. and acceptance tolerances are specified in part (b) of T.3.1.

Table 2. Summary of Recommendations
MDM-25.3 – T.3. Tolerance Values

	Status Recommendation		Note*	Comments
Submitter	Voting			
OWM	Developing		1	
WWMA	Developing			
NEWMA	No recommendation			
SWMA	Informational			
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

Item Under Consideration:

Amend the Handbook 44 Multiple Dimension Measuring Devices Code as follows:
T.3. Tolerance Values. – ~~The maintenance and acceptance tolerance values shall be ± 1division.~~

T.3.1 For Volume Devices. – The maintenance and acceptance tolerance shall be as shown in Table XX

(a) Maintenance Tolerance Values. – The maintenance tolerance shall be as shown in Table XX Maintenance Tolerance values.

(b) Acceptance Tolerance Values. – The acceptance tolerance values shall be one-half of the maintenance tolerance values with a minimum tolerance of 1d.

Table XX Maintenance Tolerances (All values in this table are in displayed divisions)			
1	2	3	4
0 – 20[1]	21 – 40	41- 80	81 +
[1] See S.1.7. Minimum Measurement (12 d).			

T.3.2. For all other devices. – The maintenance and acceptance tolerance values shall be ± 1 division.

NIST OWM Detailed Technical Analysis:

Items MDM-25.1, MDM-25.2 and MDM 25.3 are related and all aim to include a new application of multidimensional measurement. However, it is impossible to evaluate and adopt them separately. Therefore, NIST OWM suggests combining these three proposals into a single proposal, MDM-25.1.

The tolerances proposed in MDM-25.3 are much stricter than the maximum variations that can be obtained when applying 1d tolerance to the three individual axes. Therefore, the proposed tolerances seem acceptable. However, the item does not explain where the proposed tolerances originated from and how they relate to existing tolerances of commodities sold by volume. For the evaluation of the proposal, it is essential to have a justification of the proposed tolerances. In addition, the new paragraph T.3.1. specifies, "maintenance and acceptance tolerance shall be as shown in Table XX". The new Table XX only specifies maintenance tolerances. This item needs further editing to provide clarity. OWM suggests removing the sentence "The maintenance and acceptance tolerance shall be as shown in Table XX" from T.3.1. For Volume Devices, as maintenance tolerances are specified in part (a) of T.3.1. and acceptance tolerances are specified in part (b) of T.3.1.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual meeting, Matthew Douglas (State of California, Division of Measurement Standards) stated that they support development and the concept. They also stated that there seems to be the need for additional necessary information in the tolerance table, the table does not specify what the numbers are referring to.

Loren Minnich (NIST OWM) suggested that these items be blocked (MDM-25.1, MDM-25.2, MDM-25.3).

The 2024 WWMA S&T Committee recommends a Developing status, with consideration to the comments heard on the floor. The Committee also recommends that this item, MDM-25.1, and MDM-25.2 be blocked together and that they be evaluated to ensure that they would apply to a volume measuring device.

Southern Weights and Measures Association

At the 2024 SWMA Annual meeting, Dick Suiter, Richard Suiter Consulting gave a presentation on behalf of the NCWM Multiple Dimension Measuring Device Work Group and MDMD 2024 Volume Focus Group.

The presentation demonstrated how the systems operate. In addition, Mr. Suiter provided written comments, which are included in the supporting documents.

Tim Chesser, retired Arkansas – supported the item, but had questions on how the standards were verified. They mentioned that many of the commodities would have voids and would be unlike pea gravel and questioned speed and pausing affecting the measurement.

Dick Suiter, Richard Suiter Consulting – responded to Mr. Chesser's comments stating that there are maximum and minimum speeds and if the measurement was taken outside those parameters, an error message is given. The certified tape measure is used to verify the standard. NTEP verifies the standard during NTEP assessments, currently has provisional NTEP Certificate of Conformance.

Tory Brewer, WV – Questioned the calibration of the standard and if there were labs accredited to perform the calibration.

The committee recommends the items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked and be assigned to informational status. The would like to gather more information from the stakeholders to allow more time for review and to answer some questions raised.

Northeastern Weights and Measures Association

At the 2024 Interim Meeting, no comments were heard from the floor.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, a representative from NIST OWM suggested that items MDM-25.1, MDM-25.2, and MDM-25.3 be blocked together. They also support these items but have concerns on issues not addressed by this proposal dealing with length, width, and height.

The submitter of this item gave a presentation on how this device functions and what its purpose is. They asked for support of all MDM items as voting. It was noted that marking requirements need to be addressed for volume only devices and that they can work with NCWM S&T Committee for those changes. The submitter also submitted written comments to the committee; attached to this report as Appendix A.

A regulator from Iowa asked a question regarding if the method of sale was changing from weight to volume. The submitter answered that there may be variations for commodities sold by both weight and volume, but that this will introduce a traceable means of verification.

A second regulator from Iowa asked if there was any special equipment that needed to be installed on the trucks carrying the commodity for measurement. The submitter answered that no additional equipment be installed on those vehicles.

A regulator from Minnesota asked if speed and position restrictions need to be marked on this device or for vehicle operators like they do for an in-motion vehicle scale. They also asked if this device accounted for a

live bottom container such as a container with a conveyer belt installed that would compress creating more volume when a commodity is loaded on top of it. The submitter answered that the test method looks at minimum and maximum speed and issues a non-measurement notice if the vehicle speed is too great and that this is also noted in the certificate of the device. They also answered that in the event of a live bottom container, the customer would have the advantage.

A regulator representing the State of Iowa supports this moving forward. They witnessed a demonstration on this item and found that the readings aligned with a static scale verification. It was also noted that this device will eliminate temporary scale needs for businesses that operate seasonally.

The committee recommends that this item be blocked with MDM-25.2 and MDM-25.3 and be assigned a voting status.

Scale Manufacturers Association

At the 2024 Fall SMA Meeting, they determined that they are in support of this item.

OTH – Other Items

OTH-25.1 - 2.26. Weigh-in-Motion Systems Used for Vehicle Direct Enforcement

Source: New York City Department of Transportation

Submitter's Purpose and Justification:

Add a new Section 2.26. Weigh-In-Motion Systems Used for Vehicle Direct Enforcement to standardize the testing method for WIM systems for jurisdictions involved in direct weight limit enforcement. The update is being requested by NYS Dept of Ag & Markets, NJ Off. of W & M, Oregon Dept of Ag, NYCDOT, Washington DC DOT, C2SMARTER and Kistler.

1. INTRODUCTION

As noted in NIST Special Publication 2200-05 and according to the 2021 Fact Sheet: The Bipartisan Infrastructure Deal, one in five miles of U.S. highways and major roads and over 45,000 bridges are in poor condition. A major contributor to road damage stems from heavy or excess weight vehicles – or to be more precise – the heavy axle loads of these vehicles onto the road surface and/or pavement. As claimed by an article of Inside Science, this damage grows exponentially with the axle load of the vehicle. For comparison, a 40-ton commercial truck with 8 axles causes 625 times more road damage than a 2-ton passenger sedan with 2 axles. See Attachment B for NIST Special Publication 2200-5 for full document.

Enforcement of vehicle weight limits is typically cumbersome, requiring dedicated stations, contributing to freight and travel delays and strain on law enforcement resources. Even with the use of portable scales and virtual WIM systems, these efforts are not comprehensive, and have led to a culture where the disregard of the highway weight limits is giving an unfair economic advantage to those companies willing to risk running overweight trucks on our highways. This issue is exacerbated in our urban environments where limited space and enforcement personnel make it difficult or impossible to catch and cite these violators.

Recognizing the need for better weight limit enforcement, the New York State legislature authorized the New York City Department of Transportation (NYCDOT) in 2021 to conduct direct overweight vehicle enforcement using WIM as a demonstration program on a portion of the I-278, connecting Brooklyn to Manhattan, Staten Island, and Queens otherwise known as the Brooklyn Queens Expressway or the BQE. The system was certified by the New York State Department of Weights and Measures using the procedure previously submitted for handbook 44 update item WIM 23.1 as developed by NYCDOT, C2SMARTand Kistler. NYCDOT provided all the logistical support and covered the cost of the testing.

In the seven months leading up to the launch of the program, a monthly average of 7,777 overweight trucks traveled this section of the roadway. During the first seven months of direct enforcement, the rate dropped to monthly average of 2,769 overweight trucks. As shown in Figure 1, the decline comes as the overall number of vehicles, including trucks, remains steady, with the share of overweight trucks falling from about 6.3 percent of all trucks on the roadway to 1.9 percent in most recent months. There have been no challenges in this time related to the accuracy of the system.

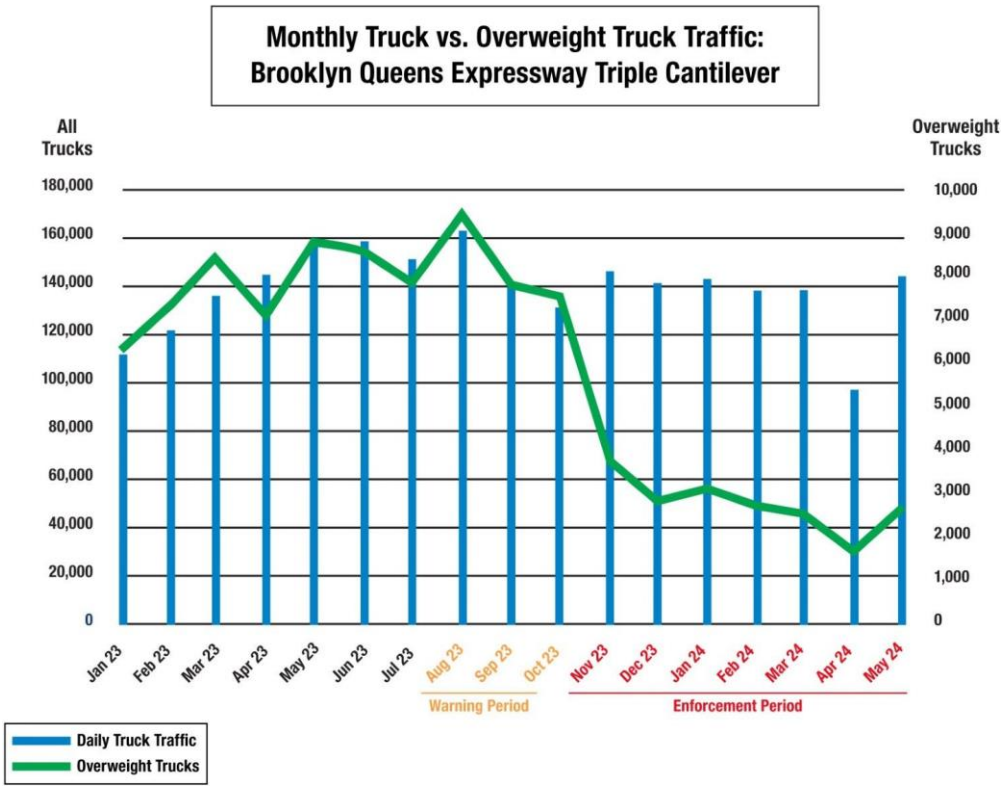


Figure 1 – Monthly Truck versus Overweight Truck Traffic on Brooklyn Queens Expressway (BQE) Triple Cantilever Structure

Since the time NYCDOT began its effort, several other states have proposed legislation for direct enforcement including Georgia and New Jersey. Several other jurisdictions are considering Direct Enforcement using WIM Systems.

The inclusion of the procedure in the handbook does not require a jurisdiction to begin direct enforcement using WIM. That authority remains with the legislative bodies of the jurisdiction. However, it is important for the proposed standard for the system to be formalized and harmonized across the nation to ensure that a unified testing protocol is being used by jurisdictions who so choose. Guarding against violations of vehicle weight restrictions to protect critical infrastructure is an issue of national concern and each jurisdiction will proceed based on local legislative authority

In addition to enforcing weight limits, officers in most States are responsible for checking Commercial Motor Vehicles (CMV's) for safety. This includes different levels of truck inspection, including the driver credentials, hours of service, key systems on the truck, load securement, and many more. Automating the weighing portion of the inspection will allow for a more efficient flow of vehicles through an inspection site and allow officers more time to focus on these

other safety issues. Currently, with most sites running with a single officer, as they are focused on weighing, doing an inspection, or interviewing a driver, other unsafe vehicles behind the current one go by without scrutiny. See Attachment C Supporting Letters for letters of support from CVSA and ASCE.

This proposal seeks an amendment of NIST Handbook 44 by adding Section 2.26 to allow for Weigh-In-Motion Systems Used for Direct Vehicle Weight Enforcement certification requirements to be standardized. The remainder of this proposal lays out the justification for the amendment as well as address some of the arguments that have been raised previously in opposition, using the BQE as an example to establish the urgent need for the amendment.

2. REVIOUS PROPOSAL DATA

A similar proposal, item WIM 23.1 was voted on during the 109th Annual meeting. The original submission was made on 8/15/2022 and received a voting status at the 2024 interim meeting However, that proposal did not receive adequate support for inclusion into HB 44.

Commenters expressed concerns of the system's tolerance and the testing procedure during open hearings that was previously considered. Previously submitted documents and comments from the regions can be found in the archives of the 108th and 109th annual meeting archives as well as 2023 and 2024 interim meeting archives. Some of the relevant documents are being attached to this submission.

During the development of the item over the time between August 2022 and voting in July 2024, all of the regions had an opportunity to review the proposal and amendments and hear from the stakeholders including the proposers in various forums. A demonstration of the proposal was also conducted in April of 2023 in Madison Wisconsin and witnessed by members of NCWM as well as NIST. In October of 2023, NYS Department of Agriculture certified the BQE site in NYC based on the proposal version of August, 2023. NYCDOT began issuing violations in November of 2023 and data related to decrease in overweight since this effort began was also shared with the conference. See Attachment F 2024 Annual Meeting WIM Presentation for summary of previous data.

3. READINESS OF PROPOSAL

With the input that was gathered in the prior efforts, the current proposal has been updated to address several concerns that were raised in the process.

A. Testing Requirements: - Some jurisdictions were concerned that the testing requirements could be burdensome and lengthy. The current proposal has incorporated a potential for reduced number of runs for operational testing after the first acceptance testing is done with the larger number of runs. In addition, a test procedure guidance based on successful testing in NYC with potential ways to handle the test logistics has been attached to provide a roadmap of actual implementation. While the requirements are extensive, they are in line with belt scale testing which is included in the handbook and match international standards. Additionally, the time required is comparable to testing large belt scale installations, in-motion rail systems, and other weighing systems for materials testing where evaluating performance using materials and a reference scale is necessary.

B. Thorough Technical Review: At the Interim 2023 meeting, the previous proposal received a status of informational. This allowed close collaboration with the S&T committee as well as NIST. With this collaboration, the entire proposal was thoroughly reviewed and harmonized with other applicable sections of the Handbook 44 as well as comparable international standards like OIML. Clarifications and updates based on actual implementation in NYC have been incorporated along with the lessons learnt from the demonstration in Wisconsin.

C. Need Across the Nation: While the proposal was brought forward by NYCDOT in 2022, currently there are multiple jurisdictions who are either actively seeking legislation to move forward with Direct Enforcement or are interested in having standards made available for future efforts to obtain legislative approval. Having a national standard will ensure that jurisdictions moving forward with this approach to

weight enforcement will have a better understanding of the resources needed to implement and can appropriately plan for it. In addition, while several WIM manufactures exist, without a clear standard there are varying outcomes from the systems, the industry will have clarity on expectations and can develop their products to match a recognized standard.

4. AUTOMATED TRUCK ENFORCEMENT USING WIM: ACCURACY OF WIM TECHNOLOGY VERSUS ACCEPTABLE TOLERANCE

ACCEPTABLE TOLERANCE: One of the more frequent concerns often voiced is the relatively large tolerance applied to gross vehicle weights, the axle loads, and axle-group loads. The proposal has been updated to include 2 classes of tolerance similar to the OIML standards allowing those officials charged with enforcing the regulations specific to commercial vehicles to select as appropriate based on need, site conditions, and manufacturer's recommendations.

While the tolerances proposed may seem large to the weights and measures community in comparison to commercial weighing equipment, they are non-the-less realistic and suitable for use by law enforcement. Unlike commercial vehicle scales which are installed and operated under very controlled conditions these systems are installed on interstate highways to weigh fully loaded vehicles traveling at highway speeds. The systems are continuously subject to the vibrations and stresses inherent to that environment. Unlike commercial applications where scale tolerances are made intentionally low so that they are a neglectable part of any business transaction in which the scale is used, the law enforcement official must consider the system's tolerances when issuing citations if those citations are to be upheld by a court of law. There is precedence in Handbook 44 to the idea that law enforcement scales be treated separate from commercial scales. Wheel load weighers have their own accuracy class, class IIII and weighing systems are allowed to collect and sum axle weights as an estimate of the gross vehicle weight. It is important to remember that the goal here is to protect our public roads and bridges from some of the worst offenders who are responsible for a disproportionate share of the damage to our infrastructure. Putting it another way, in a state with 80,000 lb weight limits we can risk allowing a truck weighing 85,000 lb to pass undetected if we can catch the one weighing 100,000 lbs.

Scales are evaluated not only to tolerance but to permanence. We expect them to hold their calibration for an extended period of time.

ACCURACY OF THE SYSTEM: The WIM system on the BQE has been certified multiple times and consistently met the tolerances included in the proposal. Prior to the 2nd certification, the system was tested to verify the accuracy retention over 6 months. The maximum error was 6.2%, 9.2% and 5.7% for GVW, single axle weight, and group axle weight, respectively.

The overweight enforcement system retained its accuracy over 6 months. In addition, after the system was installed but before it began to be used for direct violations at the BQE, the data from WIM was shared with NYPD in real time and then violations were issued based on portable scale weighments by the Highway Patrol. Over a span of 27 days, the NYPD enforced penalties on 48 overweight trucks, averaging less than 2 trucks per day using the more typical portable scales. The maximum GVW error was 9.2%, while the mean and average GVW errors were 0.25% and 0.05%, respectively. It should be noted that at the same time several overweight trucks identified by the WIM System could not be stopped as it took the Officers more than 2 hours to completed the inspection of each truck. No major impact was seen in the total number of overweight trucks on the corridor during this period. This is in stark contrast to the impact observed after the direct enforcement began.

Table 1 shows a summary of the data for the accuracy achieved at various sites that have applied similar WIM-based systems. The related background data is provided in Attachment D Sample WIM System Data and Attachment E Purdue WIM Report.

Table 1 – Maximum observed error for WIM-based systems collected at various sites

Sites and Testing Dates	Maximum Observed Error (%)		
	GVW	Single Axle	Group Axle
1- NY BQE Site NY PD Comparison in Mar-Apr '23	9.01%	N/A	N/A
2- NY BQE Site Validation 1 in Oct. '23	9.7%	13.1%	14.2%
3- NY BQE Site Validation 2 in Apr. '24	9.5%	19.2%	13.5%
4- WI Madison SWEF Demonstration in Apr. '23	6.4%	11.3%	7.8%
5- Indiana Study (2018)	5%*	N/A	N/A
* 5% maximum error at 95% compliance			

5. LOGISTICS OF THE TEST

The certification testing requires multiple trucks with varying loads along with drivers to complete the required number of runs. The results are then observed by the inspectors. This type of situations have already been addressed in Handbook 44 General Code, G-UR.4.4

Assistance in Testing Operations. – If the design, construction, or location of any device is such as to require a testing procedure involving special equipment or accessories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official.

As these systems are likely to be owned and operated by the state Department of Transportations, with readily available equipment and personnel to provide assistance with trucks and drivers along with traffic management should it be needed, such assistance should not be difficult to obtain for certification testing. The DOTs also have the option to contract with vendors to provide these services.

In addition, to reduce the time it would require the inspectors to test the systems, the proposal allows for reduced level of testing after the initial acceptance test has been successfully conducted. The requirements around testing and certification of reference scales have also provided jurisdictions with the ability to move forward with the option that best meets their needs based on the WIM site that is to be certified. The attached Test Procedure Guidance for WIM for Direct Enforcement Examination provides potential ways to address the logistics of the test. For reference, the demonstration runs at Wisconsin were completed in a single daytime 8 hour shift for 1 lane, while at the BQE due to traffic congestion, the test occurred during overnight single shift. Overnight testing was a site specific decision and not a requirement of the proposal. See Attachment G for Test Procedure Guidance.

6. CONCLUSIONS

Across the nation, the deterioration of aging infrastructure is exacerbated by the presence of overweight vehicles in excess of the Federal Bridge Formula (FBF). Though several states have implemented vehicle weight enforcement measures using a screening protocol that includes the use of mobile enforcement officers and stationary scales, these measures have been insufficient in significantly reducing the volumes of overweight vehicles on the nation's infrastructure. The use of WIM for the purposes of direct vehicle weight enforcement would both alleviate this problem and free up local and state resources to address other safety concerns. As noted in the attached letter from CVSA "This action correlates to a positive impact for highway safety, congestion reduction by means of an option to traditional weighing techniques especially in high traffic volume areas and acts as a force multiplier for jurisdictions facing increased traffic volumes with static weight enforcement resources. Coupled with WIM certification standards in place and accurate technology, direct WIM enforcement provides a mechanism for enabling jurisdictions to align weight compliance beyond inefficient past weight enforcement methodologies traditionally used only for screening purposes with minimal detection capability and an effective leveling of the playing field for the trucking industry."

The amendment of NIST Handbook 44 to include the attached proposal as Section 2.26 will provide a standard directly comparable to international standards. This request is not to introduce new regulations to the trucking industries but to guide the trucking industries to comply with the existing applicable laws to protect our infrastructure, provide safe corridors to the nation's taxpayers, and improve the resilience of our built environment. Moreover, this request would allow the United States to catch up with other countries globally (shown in Figure 2) that have successfully implemented and proved automated weight enforcement, including China (2004), the Czech Republic (2010), Russia (2013), Hungary (2016), France (in process) and Brazil (in process).

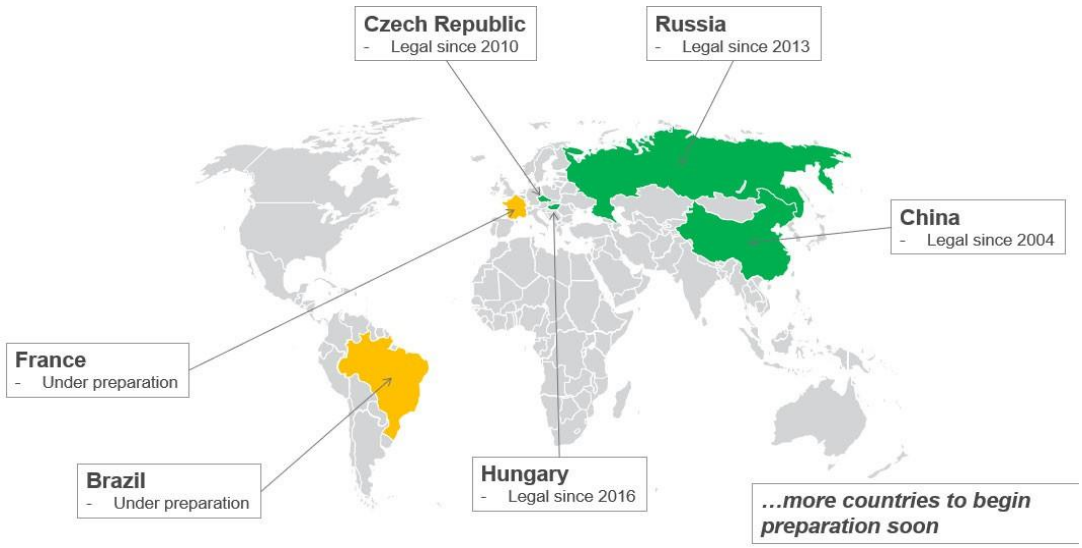


Figure 2. Automated enforcement around the world

The submitter included attachments that are available at https://www.ncwm.com/publication-15.

The submitter recommended that this be a Nonretroactive Voting item in 2025.

NIST OWM Executive Summary

OTH-25.1 – 2.26. Weigh-in-Motion Systems Used for Vehicle Direct Enforcement
NIST OWM Recommendation: Voting • The submitters have demonstrated the need for direct and permanent enforcement, and that WIM installations are suitable and extremely effective. • The submitters have addressed the concerns expressed during meetings of the Council by o Drastically reducing the number of test runs during subsequent verifications, and o Introducing a class with tighter tolerances which gives states more flexibility to implement WIM systems as they see fit.

OTH-25.1 – 2.26. Weigh-in-Motion Systems Used for Vehicle Direct Enforcement

- They have also submitted an updated proposal to the S&T Committee, which is included as a supporting document on the NCWM website. This update addresses concerns expressed by the regions during the fall meeting cycle.
- The changes provide additional clarification but are not significant in nature.
- NIST OWM is of the opinion that the updated item is fully vetted and supports a voting status.

Table 2. Summary of Recommendations
OTH-25.1 – 2.26. Weigh-in-Motion Systems Used for Vehicle Direct Enforcement

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

	Number of Support Letters	Number of Opposition Letters	Comments
Industry	1		
Manufacturers	1		
Retailers and Consumers			
Trade Association	2		

***Notes Key:**

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

Item Under Consideration:

Amend Handbook 44, adding new Section 2.26 as follows:

Table of Contents

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

A. Application

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

A.2. Exception. – This code does not apply to weighing systems intended for the collection of statistical traffic data and weighing systems used for the purpose of screening and sorting the vehicles based on the vehicle weight to determine if a static weighment is necessary. (Also see Section 2.25. Weigh-In-Motion Systems Used for Vehicle Enforcement Screening – Tentative Code)

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

S. Specifications

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

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

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

(a) 1, 2, or 5; or

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

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

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

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

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

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

S.1.4. Value of Other Units of Measure.

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

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

(a) meters and decimal submultiples of a meter;

(b) feet and inches; or

(c) feet and decimal submultiples of a foot.

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

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

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

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

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

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

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

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

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

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

S.1.7. Recorded Representations.

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

(a) transaction identification number;

(b) station ID;

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

(d) vehicle speed;

(e) number of axles;

(f) weight of each axle;

(g) identification and weight of axle groups;

(h) axle spacing;

(i) gross vehicle weight;

(j) total vehicle length;

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

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

(m) time and date.

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

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

S.2. System Design Requirements.

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

(a) single axle weight limit;

(b) axle group weight limit;

(c) gross vehicle weight limit; and

(d) bridge formula maximum.

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

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

S.3. Design of Weighing Elements.

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

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

S.5. Design of Balance

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

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

(b) is in stable equilibrium; and

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

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

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

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

S.5.3. Vehicle Recognition/Presence Device. – WIM systems which are able to operate without the intervention of an operator shall be provided with a vehicle recognition device. The device shall detect the presence of a vehicle in the weigh zone and shall detect when the whole vehicle has been weighed. WIM systems 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 systems shall be so constructed that an accidental breakdown or maladjustment of control elements likely to disturb its correct functioning cannot take place without its effect being evident.

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

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

(b) operational temperature limits;

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

(d) minimum and maximum vehicle speed;

(e) maximum number of axles per vehicle;

(f) maximum change in vehicle speed during weighment;

(g) minimum and maximum load; and

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

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

N. Notes

N.1. Test Procedures.

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

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

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

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

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

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

Note 2: If the WIM systems 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 (> 90% of the legal load limit for the test vehicle) for a minimum of 20 runs per test vehicle type; and

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

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

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

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

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

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

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

N.1.3.3. Portable Axle-Load Weighers.

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

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

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

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

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

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

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

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

N.1.6. Test Procedures.

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

N.1.6.2. Initial Verification Test. – 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.

N.1.6.3. Subsequent Verification Test. – At the conclusion of the dynamic test, there shall be a minimum of 10 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 of specified in Table T.2.3. Maintenance Tolerances.

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

See Table N.1.6 below to summarize the minimum number of test runs for Initial and Subsequent Verification Tests.

:

Table N.1.6 Minimum Number of Test Runs per Each Test Vehicle	
Initial Verification Test	
Load Condition	**Speed**
Half Load (10 runs)	**High Speed Vmax (5 runs)**
	Low Speed Vmin (5 runs)
Full Load (20 runs)	**High Speed Vmax (10 runs)**
	Low Speed Vmin (10 runs)
Subsequent Verification Test	
Load Condition	**Speed**
Half Load (6 runs)	**High Speed Vmax (3 runs)**
	Low Speed Vmin (3 runs)
Full Load (10 runs)	**High Speed Vmax (5 runs)**
	Low Speed Vmin (5 runs)

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

T. Tolerances

T.1. Principles.

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

T.2. Tolerance Values for Accuracy.

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

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

T.2.3. Maintenance Tolerance Values for Dynamic Load Test. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.3. based on class. See User Requirements UR 1

Table T.2.3. Maintenance Tolerances		
Load Description	**Tolerance as a Percentage of Applied Test Load (Class 5)**	**Tolerance as a Percentage of Applied Test Load (Class 10)**
Gross Vehicle Weight	**± 5 %**	**± 10 %**
Axle Load	**± 10 %**	**± 20 %**
Axle Group Load (including bridge formula)	**± 8 %**	**± 15 %**

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. The system owner shall determine the applicable class of system tolerance based on its analysis of the site, roadway maintenance capacity, legislative requirements and manufacturer's recommendations.

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.2.4. Site Selection - In order for any WIM system to perform properly, the user must provide and maintain an adequate operating environment for the system's sensors and instruments. This includes maintaining surface smoothness in advance of and beyond the WIM-system sensors per manufacturer's recommendation.

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 enforcement entity shall ensure compliance with specific jurisdictional legislation and/or protocols taking into account system tolerance. All gross vehicle, axle, and axle group weights must be printed and/or stored with the corrected values that include any necessary reductions due to the system tolerance and adopted violation thresholds.

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

Add the following definitions to Appendix D:

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

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

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

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

weigh-in-motion (WIM). – A process of determining 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; determine 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:

This item is related to Item WIM-23.1 that failed voting during the 2024 NCWM Annual meeting.

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 and that WIM installations are suitable and effective.

After the previous item, WIM-23.1, failed during the voting session at the 2024 NCWM Annual meeting, the submitters have worked with NIST OWM to address concerns heard from stakeholders.

The two main amendments to the proposal are:

1. To reduce the burden on inspection bodies, the submitters created a distinction between initial verifications and subsequent verifications. In the item under consideration the number of test runs during a subsequent verification has been reduced with approximately 50% while the number of test runs for the initial verification remains the same as in the final proposal of WIM-23.1.

2. The submitters introduced two classes (A and B) with different tolerances. Class B has the same tolerances as proposed in the final proposal of WIM-23.1. The tolerances of Class A are approximately half the tolerances of Class B. The introduction of multiple classes allows states to appoint the class they see fit. Different classes may depend on the location of installation.

The proposal under consideration:

- Leaves the existing code for screening WIM systems in section 2.25. untouched.
- 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.).
- Prescribes tolerance levels and test procedures that are in line with internationally recognized documentary standards, such as OIML R 134 and ASTM E1318.
- Includes guidance when considering penalties for overweight vehicles (UR.4.).
- Does not include any requirements regarding the provision of evidence to support automatic citation of violators.

OWM is of the opinion that the proposal is fully developed and ready to be voted upon.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting. However, this item is related to Item WIM-23.1. The full analysis for WIM-23.1 is available in NIST SP 2200-04, 2023 NIST Summary of U.S. Legal Metrology Activities.

Regional Association Reporting:

Western Weights and Measures Association

During the 2024 WWMA Annual meeting, Kenn Burt (S&T Committee Chair) clarified all entities listed under the purpose section of the item are also included as the source of the item.

A presentation on behalf of the submitters was given by Tanvi Pandya (New York, Department of Transportation). It demonstrated that the proposed standards now match the international standards for Weigh in Motion systems (WIM). She clarified the item is intended for law enforcement, not commercial transactions.

Steven Harrington (Oregon, Department of Agriculture, Weights and Measures Program, Submitter) stated this is a complete proposal. They compared the testing of this system to belt conveyors and WIM rail scale tests in that they require a significant amount of coordination, logistics, and time to complete. They also stated the tolerances in this proposal seem large but asked the body to consider that this is intended for law enforcement only and not commercial applications. They recommended a Voting status.

Corey Hainy (SMA) stated the SMA will meet November 2024 to discuss this item.

Matthew Douglas (State of California, Division of Measurement Standards) asked the following questions regarding the outlined test procedures for both initial testing and subsequent testing: How many trucks are needed for the inspection? How fast are the vehicles typically traveling during the tests?

Tanvi Pandya responded to Matthew Douglas by clarifying the speed of the vehicle during the test is determined by the person conducting the testing or what the normal travel speed is for that section of highway. The test is conducted with three different types of trucks that are “normally” traveling on that highway.

Matthew Douglas asked the following questions: Are the conditions of the road being considered? Is the vehicle selection and safety of the loaded vehicle at the travel speeds being considered? Can the system identify the weight depending on the location in the lane the vehicle is traveling? Does this item have merit? In your jurisdiction would you feel comfortable with your seal on this device? They recommended this item be assigned a Withdraw status.

Tanvi Pandya responded to Matthew Douglas by stating the system is for law enforcement and the system can meet everything questioned including lane straddling.

Aaron Yanker (Colorado, Department of Agriculture, Weights and Measures) asked the following questions: Is this a new item or just a reintroduction of the previous item that failed to be adopted at the 2024 NCWM Annual Conference last July? Does the item clearly define the vehicle speed? Does the item address any interferences? Does the item clearly define how to select and safely load the test vehicles? He stated that their state's DOT will not be using this system for enforcement. They expressed concerns of training both inspection staff and other agencies on the use of this system, interpretation of the test procedures, tolerances, and application of this proposed code section being used correctly for enforcement and issuing violations. They recommends this item be assigned a Withdraw status.

Steven Harrington clarified the item has a 10% tolerance to address any interference in the system. They acknowledged the testing portion of this item is a challenge. They confirmed the test vehicles would first be weighed on a certified reference scale and then used in the dynamic test. Additionally, in response to Matthew Douglas they would seal this device.

Tanvi Pandya urged the body to read all the supporting material including the NIST deep dive document, and claimed that data from each state's highway department is available to support this item.

Steven Harrington reaffirmed the item is intended for Law Enforcement and each jurisdiction can determine the level of application of any item in NIST Handbook 44.

Kevin Schnepp (State of California, Division of Measurement Standards) confirmed California Highway Patrol will not be using this system for direct enforcement.

Loren Minnich (NIST, OWM) clarified a static reference scale is required to be tested with certified test weights and then that reference scale is used to verifying the weight of the test vehicles prior to testing the WIM system.

Aaron Yanker asked the following questions: Does the item address the use of the reference scale in relation to the WIM system minimum divisions that is allowable between the two devices? Does the item address the allowable tolerances specifically in relation to static weight and the WIM weight of the same vehicle if those weights do not match?

Tanvi Pandya stated that each state's DOT must submit truck weights to a federal database. The weights are determined by WIM systems that are already in place and the Feds are supposed to hold the states accountable for overweight vehicles.

Steven Harrington stated that the submitters acknowledge each jurisdiction will have the discretion to use this item for enforcement or not. The specific jurisdictions stance should not preclude the code from being adopted into NIST Handbook 44 for use by other jurisdictions that choose to use it.

The 2024 WWMA S&T Committee recommends a Voting status. The committee feels that this item is fully developed.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, Tanvi Pandya, NYC DOT gave a presentation on behalf of the submitters. They pointed out new submitters, referenced supporting documents posted on the NCWM website and provided updates from the previous version. They noted they have been issuing violations in NYC since November 2023, without any litigation or challenges.

Alison Wilkinson (MD) recommends withdrawal. Current proposal is similar to previous version that failed to be adopted. Maryland DOT and state police are opposed to using this device for enforcement. However, they are currently using this device for screening. Due to no significant changes to the proposal, recommends it to be withdrawn.

Mark Lovisa (LA) would like to see the item assigned to task group, specific to this technology. Currently, the test procedures don't address all the parameters. Simultaneously weighments should be tested to rule out interference. Questioned if indicators are shared across multiple sensors. Also questioned if the camera system was a part of the testing system or separate. Because it is separate, wondering if it should be stamped to tie it to the weighment occurring. Believes a task group would assist in developing test procedures and stipulations needed to complete the testing process.

Kristen Walter (AR) agrees with Maryland and Louisiana comments. Is in opposition and requests item to be withdrawn.

Anisah Crosby (Washington DC) spoke in support of the item. Washington DC DOT worked closely with the submitters and are in support of this item.

Greg Gholston (MS) highlighted that the current language allows for the user to set the tolerance which not allowed anywhere else in the Handbook. There is currently no criteria set forth for selecting the tolerance. Agrees that a task group would be beneficial in ironing out the details in specifications. In addition, no marking requirements are listed for the tolerance classes. NIST Special Publication (SP 2200-05) states that the weighments must be corrected for inaccuracies. The language in UR.4. as it currently reads does not require the correction be mandatory. Commenter suggests adding that mandatory requirement, so it is not left up to each jurisdiction, as it is currently proposed. Also noted editorial changes needed:

Reference in Paragraph S.5.2.a. references S.5.4. but should be S.5.3.

N.1.1. Note 2. – Systems is plural and should be singular.

Consider consolidating N.1.6.2. with N.1.6.3.

Jason Glass (KY) reiterated it can be used for information gathering and pointed to G-A.1. (2) showing that the handbook applies to devices used for law enforcement.

Tanvi Pandya (NYC DOT) responded to questions regarding the camera being a part of the system. The system only includes what is needed to determine whether the vehicle is overweight or not. Cameras are not a part of the system. Enforcement evidence is not a part of the system.

Robert Huff (DE) – They would be obligated to test twice a year and respond to consumer complaints and recommends the item be withdrawn.

The committee recommends the item be assigned to a task group to focus on more comprehensive test procedures and specifications using this new technology.

Northeastern Weights and Measures Association

At the 2024 Interim Meeting, Tanvi Pandya (NYCDOT) gave a presentation on behalf of the submitters.

Walt Remmert (PA) voiced support for the item and recommended a voting status.

Marc Paquette (VT) voiced opposition to the item due to the large tolerances. They believe the tolerances should be closer to a Class IIII scale. They also questioned the definition of Class 5 and Class 10 and how they would be applied to the device.

Tanvi Pandya stated that the user would determine the class and set up/build the system to that class, but once the class is chosen, it cannot be changed.

Marc Paquette commented that even though they are opposed to the item, they believe it is fully developed and recommended a voting status.

Shane Ireland (ME) commented that the tolerances are too great.

Scott Dolan (VT) questioned if this system needs to appear in the handbook.

Jason Flint (NJ) commented that this is a system, not a device, and it is not being used commercially, rather for law enforcement. They pointed out that law enforcement equipment is specifically mentioned in the general code and recommend a voting status.

Jim Willis (NY), Cheryl Ayer (NH), Frank Greene (CT), John Dillabaugh (PA) recommended a voting status.

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, the submitter of this item gave a presentation on the changes made from the last submission and read excerpts from a letter of support from the Commercial Vehicle Safety Alliance (CVSA). This letter is posted on NCWM's Publication 15 webpage under supporting documents for OTH-25.1.

A representative from NIST OWM stated that these systems are not intended to be used like the red-light cameras. Each jurisdiction that chooses to implement this device must do due diligence in how they are going to use the item. This device is to gather data.

A regulator from Iowa asked what the problem was for those who oppose this item. It was noted that this device will be used this for citations and that if this makes it better for the motoring public then what we should support this item.

A regulator representing the State of Iowa supports this item. They note that there were talks about tolerances at national meetings that showed that there is a misunderstanding about how to use them. It was stated that the tolerances are wide because they want to ensure they are only picking up the grossly overweight vehicles. This is not a commercial scale.

The committee recommends this item as voting.

ITEM BLOCK 1 (B1) TRANSPORTATION-FOR-HIRE SYSTEMS

B1-TNS-25.1 - 5.60. Transportation Network Measurement Systems – Tentative Code

Source: Transportation-For-Hire Systems Task Group

Submitter's Purpose and Justification:

Remove the Transportation Network Measurement Systems Tentative Code completely.

Item under Consideration:
Delete the Handbook 44 Transportation Network Measurement Systems – Tentative Code as follows:

~~Table of Contents~~

Section 5.60. Transportation Network Measurement Systems – Tentative Code

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

(Tentative Code Added 2017)

A. Application

A.1. General. This code applies to a transportation network measurement system used in connection with a digital network that determines the actual time elapsed and/or distance travelled during a network-arranged ride to calculate a fare for transportation services.

Note: The fare is calculated by software services residing on the transportation network company servers using data transmitted by the indicating elements present in the vehicle, which are running software applications or services supplied by the transportation network company. The measurement data is generated from sources not physically connected to the vehicle (e.g., a navigation satellite system such as GPS and/or other location services).

A.2. Exceptions. This code does not apply to the following:

(a) Any system that charges a flat rate or fixed charge, and/or does not use a measurement of actual time elapsed or distance travelled to calculate a fare for transportation services.

(b) Odometers on vehicles that are rented or hired on a distance basis. (Also see Section 5.53. Odometers.)

(c) Taximeters. (Also see Section 5.54. Taximeters.)

(d) Any system where the fare is calculated by equipment located in the vehicle.

A.3. Additional Code Requirements. In addition to the requirements of this code, transportation network measurement systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements. Indicating and recording elements shall provide indications and recorded representations that are clear, definite, accurate, and easily read under any conditions of normal operation of the device(s).

~~All indicating and recording elements used in a transportation network measurement system shall operate correctly while using the online-enabled technology application service provided by the transportation network company.~~

~~**S.1.1. General Indicating Elements.** — A transportation network measurement system shall include, as a minimum:~~

~~(a) an indicating element used by a transportation network company driver that displays information and facilitates the measurements during a network-arranged ride to calculate a fare for transportation services; and~~

~~(b) an indicating element used by a transportation network company rider that displays information that allows the rider to review the current rate(s) for the transportation service and to request a ride.~~

~~**S.1.2. General Recording Elements.** — A transportation network measurement system shall be capable of:~~

~~(a) recording all information necessary to generate a receipt specified in S.1.10. Receipt;~~

~~(b) providing information to transportation network company drivers, including, but not limited to, a summary of rides given as specified in S.1.11. Driver's Summary; and~~

~~(c) providing a copy of all metrological data required by law to a weights and measures jurisdiction with statutory authority.~~

~~**S.1.3. Identification.** — All transportation network measurement system indicating elements shall display for the purposes of identification the following information:~~

~~(a) the name, initials, or trademark of the transportation network measurement system manufacturer, distributor, or developer; and~~

~~(b) the current version or revision identifier of the software application service provided by the transportation network company running on the indicating elements identified in S.1.1. General Indicating Elements.~~

~~(1) The version or revision identifier shall be prefaced by words or an abbreviation that clearly identifies the number as the required version or revision.~~

~~(2) Abbreviations for the word "Version" shall, as a minimum, begin with the letter "V" and may be followed by the word "Number." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R" and may be followed by the word "Number." The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).~~

~~**S.1.4. Location of Identification Information.** — The information required by S.1.3. Identification shall be accessible through an easily recognized menu and, if necessary, a submenu or other appropriate means. Examples of menu and submenu identification include, but are not limited to, "Help," "About," "System Identification," "Weights and Measures Identification," or "Identification."~~

~~**S.1.5. Display of Rates and Additional Charges**. — The transportation network measurement system shall be designed to make available to transportation network company riders the rate(s) for transportation services before the beginning of a network-arranged ride. The system shall be capable of providing an explanation of the basis for calculating a fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fee, before a rider submits the request for a network-arranged ride.~~

~~**S.1.6. Fare Estimates.** — The transportation network measurement system shall be capable of displaying a fare estimate to the transportation network company rider before a request for a network-arranged ride is made.~~

~~**S.1.7. Actuation of Measurement System.** — Following the initiation of a network-arranged ride by the transportation network company driver, and prior to the conclusion of that network-arranged ride, the transportation network measurement system shall only indicate and/or record measurements resulting from the movement of the vehicle or by the time mechanism.~~

~~***S.1.8. Fare Adjustment.** — A transportation network measurement system shall be designed with:*~~

~~*(a) a "time off" mechanism and a "distance off" mechanism provided for the transportation network system driver to render the measurement of time and distance either operative or inoperative during the ride; or*~~

(b) the capability to make post-transaction fare adjustments to reduce the amount of the fare, provided the system creates a record of all location and time data from the time the ride request was accepted by the transportation network company driver.

[Nonretroactive as of January 1, 2018]

S.1.9. Fare Identification and Other Charges.

S.1.9.1. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression when displayed on the transportation network company system receipt required by S.1.10 Receipt. Values shall be defined by suitable words or monetary signs.

S.1.9.2. Other Charges. – Other charges shall be indicated as separate line items when displayed on the receipt required by S.1.10. Receipt. Other charges shall be identified using an appropriate descriptive term, including but not limited to "Booking Fee," "Tolls," "Airport Pickup/Drop-off Surcharge" or an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.10. Receipt. – A transportation network measurement system shall issue a printed or electronic receipt to a transportation network company rider. This receipt shall include as a minimum the following:

(a) date of the start of the trip;
(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;
(c) start and end time of trip, total time of trip (maximum increment of one second), and if applicable, the total elapsed time during any time-off period;
(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;
(e) the associated fare in $;
(f) other charges where permitted shall be identified and itemized;
(g) total charge in $;
(h) the start and end addresses or locations of the trip;
(i) a map showing the route taken; and
(j) a means to obtain transportation network company rider assistance.

S.1.11. Driver's Summary. – A transportation network measurement system shall be capable of providing a summary of the driver's activity regarding network-arranged rides. The summary shall include, but not be limited to, the following information about each ride:

(a) date and time for start of trip;
(b) unique identifying information sufficient for the transportation network company to identify the transaction, or other identifying information as specified by the statutory authority;
(c) total time of trip, maximum increment of one second;
(d) distance traveled, maximum increment of 0.01 km or 0.01 mi;
(e) the total fare received;
(f) other charges where permitted; and
(g) a means to obtain transportation network company driver assistance.

S.2. Provision for Sealing.

S.2.1. System Security. – Adequate provision shall be made to provide security for a transportation network measurement system. The system shall be designed to:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modification using industry-standard technological protection mechanisms such as data encryption; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

S.2.2. System Audit. – The transportation network measurement system shall be designed in a manner that permits officials having statutory authority to verify compliance with this transportation network measurement system code.

S.2.3. Change Tracking. – Changes made by the manufacturer, distributor, or developer of a transportation network measurement system to any algorithms or code, which have a metrological effect, shall be logged and recorded. The period covered by this change record is not required to exceed one year.

S.3. Provision for Trip Data Loss. – If a portion of the trip data is lost due to power or signal interruption by the transportation network company driver's indicating element, the transportation network measurement system shall be capable of determining the information needed to complete any transaction in progress at the time of the power or signal loss.

S.3.1. Intermittent Trip Data Loss. – When the location services signal is lost intermittently during a prearranged ride (e.g., traveling through a tunnel), but recovered prior to the end of the ride, the transportation network measurement system shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

S.3.2. Significant Trip Data Loss. – When the location services signal is lost for a significant portion of the network-arranged ride, the transportation network measurement system shall provide for alternative fare structures.

Note: Significant trip data loss refers to instances when the location services signal is lost to the extent the transportation network measurement system is not capable of calculating an accurate fare in accordance with T.1. Tolerance Values using actual time and actual distance, or when the signal is not regained by the end of the ride.

S.3.3. Alternative Fare Structures. – If the transportation network measuring system is not using actual time and actual distance for a particular trip (e.g., zone-based fares, signal loss), that portion of the fare not based on actual time and actual distance is not subject to this code. Charges not based on actual time and actual distance measurements may be based on the terms of service.

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, distance test(s) of a transportation network measurement system shall be conducted. The distance test(s) shall consist of a road test unless safety or other practical concerns prohibit road testing. A transfer standard test may be performed in the absence of a road test. At least one test shall be of a length sufficient to exceed the minimum fare.

N.1.1.1. Road Test. – The test consists of operating the conveyance over a precisely measured course calibrated to a traceable linear measure of at least one mile in length

N.1.1.2. Transfer Standard Test. – The test consists of operating the conveyance over an unmeasured course while using a calibrated transfer standard, such as a fifth-wheel, to measure the distance travelled.

Note: Field examinations of transportation network measurement systems need not include testing of all individual devices used as driver/passenger indicating elements in connection with the service provided. It is considered sufficient that a representative sample of various indicating elements be incorporated in testing to verify proper operation of the system.

N.1.2. Test Procedures.

N.2.1. Test Length. – All tests must be at least one mile in length. If a measured course or testing equipment is not readily available that will enable a test of a length sufficient to exceed the minimum fare, after completing the testing specified in N.1.1. Test Methods, an additional unmeasured test may be conducted. The purpose of this additional unmeasured test is to verify compliance with S.1.10. Receipt.

N.2.2. Additional Tests. – If during testing a transportation network measurement system produces a measurement that does not comply with the tolerance values in T.1.1. Distance Tests, a minimum of three additional tests shall be conducted at the same location where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

To verify system-wide noncompliance, tests for variability shall be conducted, including a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

N.1.3. Test Conditions.

N.1.3.1. General. Except during type evaluation, all tests shall be performed under the conditions that are considered usual and customary within the location(s) where the system is normally operated as deemed necessary by the statutory authority.

N.1.3.2. Roads. All tests shall be conducted on public roads.

N.1.3.3. Testing for Environmental Influences. During type evaluation, the distance test may include a route traveled by the vehicle that will expose the system to conditions that could contribute to the loss of, or interference with, the location service's signal. This may include:

(a) objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;
(b) routes that do not follow a straight-line path;
(c) significant changes in altitude; and
(d) any other relevant environmental conditions.

N.2. Time Test. A transportation network measurement system, which determines time elapsed, shall be tested for compliance with the tolerances values specified in T.1.2. Time Tests, using a certified, traceable standard.

T. Tolerances

S.4. Tolerance Values. The tolerances will be as specified in T.1.1. Distance Tests and T.1.2. Time Tests. (The following proposed tolerance values will be confirmed based on performance data evaluated by the NIST U.S. National Work Group on Taximeters before the transportation network measurement systems code becomes a permanent code.)

S.4.1. Distance Tests. Maintenance and acceptance tolerances shall be as follows:
(a) On Overregistration: 2.5
(b) On Underregistration: 2.5 %

S.4.2. Time Tests. Maintenance and acceptance tolerances shall be as follows:
(a) On Overregistration: 5 seconds or 0.5 %, whichever is greater
(b) On Underregistration: 5 seconds or 0.5 %, whichever is greater

S.5. Tests Using Transfer Standards. To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.

UR. User Requirements

UR.1. System Indications. The indicating elements identified in S.1.1. General Indicating Elements shall display indications and information in a manner such that they can be conveniently read by the user of the device, computer, website, or online-enabled technology application service.

UR.1.1. Statement of Rates. The transportation network company rider shall be able to view the basis for calculating the fare including, if applicable, the base fare, rates for time and distance, and the amount of a booking fee, platform fee, or other similar service fees.

UR.2. Change Tracking. Upon request by an official having statutory authority, the transportation network company shall provide an explanation of changes that are logged pursuant to S.2.3. Change Tracking requirement

~~during the time period covered by the request. Any such request shall be answered within two business days, unless extended by the official having statutory authority. Records provided pursuant to S.2.3. Change Tracking shall be treated as confidential and proprietary to the extent permitted by any applicable law.~~

~~**UR.3. System Installation and Operation.** — The transportation network company driver shall use the indicating elements identified in S.1.1.(a) General Indicating Elements in accordance with the requirements of the manufacturer, distributor, or developer.~~

~~**UR.4. Fare Estimates.** — Estimates for fare charges shall be provided by the transportation network measurement system when requested by the transportation network company rider and following the input of a final destination for the trip being requested. The recipient of the fare estimate shall be able to access information about the fare estimate, including key variables that may lead to discrepancies between actual fare charged and the fare estimate provided as required by law.~~

~~**UR.5. Determination of Total Charges When Location Service Data Is Lost.** — At the conclusion of the trip, the transportation network company shall disclose to the transportation network measurement service rider and driver the manner in which total charges are determined when there is significant data loss from location services.~~

Appendix D. Definitions D

~~**digital network.** — An online-enabled technology application service, website, or system offered or used by a transportation network company that enables a transportation network company rider to arrange a network-arranged ride with a transportation network company driver. [5.60]~~

N

~~**network-arranged ride**. — The provision of transportation by a transportation network company driver to a transportation network company rider, or other persons selected by the transportation network company rider, arranged through a digital network. [5.60]~~

T

~~**transportation network company.** — An entity that uses a digital network to connect transportation network company riders with transportation network company drivers who provide network-arranged rides, and offers or provides a transportation network measurement system, subject to an agreement or terms of service between the transportation network company and transportation network company rider or driver. [5.60]~~

~~**transportation network company driver.** — An individual authorized by the transportation network company to access the digital network and receive connections to transportation network company riders for the purpose of providing network-arranged rides. [5.60]~~

~~**transportation network company rider.** — An individual who has obtained an account with a transportation network company and uses the transportation network company's digital network to connect with a transportation network company driver who can offer or provide a network-arranged ride to the transportation network company rider or other persons selected by the transportation network company rider. [5.60]~~

~~**transportation network measurement system.** — The information technology infrastructure and services offered or used by a transportation network company that receives data collected through a digital network and calculates a fare for a network-arranged ride. [5.60]~~

B1-TXI-25.1 - 5.54 Taximeters Transportation-For-Hire Systems

Source: Transportation-For-Hire Systems

Submitter's Purpose and Justification:

Add a new Transportation-For-Hire Systems Code to replace the existing Taximeter Code and Transportation Network Measurement Systems Tentative Code.

This code has been developed by the Transportation for Hire Task Group with the goal of producing a unified code that can be applied to all transportation for hire systems including traditional taximeters and app based rideshare companies.

It is based off of Section 5.54 Taximeters, which it will ideally replace. Bold and underlined portions in the submission indicate Task Group additions to the existing Taximeter Code. The Committee can decide whether a better path would be to wholly replace Section 5.54 with this item or to amend it throughout.

Item under Consideration:

Amend the Handbook 44 Taximeters Code as follows::

Section 5.54. ~~Taximeter~~s Transportation-for-Hire-Systems

A. Application

A.1. General. – **This code applies to devices and systems that calculate fare charges for transportation services when those charges are based on the distance traveled and/or time elapsed during the transport of passenger(s). This code applies to systems using single or multiple sources of data used to determine distance and/or time during transportation service for the purpose of calculating fees charged to passengers and/or payment for drivers.**

Except where expressly stated as applicable only to specific types of systems:

- **the requirements for transportation-for-hire systems in this code will apply to those systems using the data input used for calculation of charges from sources that are physically connected to the vehicle, systems using data input from external sources, or a combination of these sources; and**
- **requirements in this code apply to systems that provide periodic updates of fare charges accumulated during a trip and those systems that supply a good faith estimate of the total fare charges prior to a trip.**

A.2. Exceptions. – This code does not apply to the following:

(a) any system that charges a flat rate or fixed charge which does not use a dynamic measurement of time elapsed, or distance travelled to calculate a fare for transportation services;
(b) odometers on vehicles that are rented or hired on a distance basis. (Also see Section 5.53. Code for Odometers.)
(c) devices or systems used to determine shipping or freight charges.

(Amended 1977, 2016, and 2017)

A.3. Additional Code Requirements. – In addition to the requirements of this code, **transportation-for-hire systems** shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements. –Indicating and recording elements shall provide indications and recorded representations that are clear, definite, accurate, and easily read under any conditions of normal operation of the device(s).

For transportation-for-hire systems operating using application software provided by a transportation network company and installed on a user's computing device (i.e., transportation network measurement systems), the indicating and recording elements shall provide an appropriate digital platform (i.e., operating system) for the online-enabled application software allowing the system to operate as designed. Any additional features or functions installed on the user's indicating/recording element shall not interfere with the proper operation of the transportation-for-hire application software.

S.1.1. General.

S.1.1.1. For Systems Including a Built-for-Purpose Device Installed in the Vehicle. – A built-for-purpose device (e.g., taximeter) shall be equipped with a primary indicating element. **The indicating element shall be installed and positioned in the vehicle so that all relevant indications are readily observable by a driver and passengers.**

S.1.1.2. For Systems Consisting of Application Software Installed on Not Built-for-Purpose Devices. – The indicating element(s) in systems for transportation network measurement systems using not built-for-purpose devices on which an application software has been installed shall operate as follows.

(a) An indicating element used by a transportation network company driver shall:

- **receive data input used to compute distance traveled and/or time elapsed;**
- **display trip information;**
- **provide a means of communications between system components; and**
- **provide a trip summary at the conclusion of all network-arranged transportation services.**

The device used by the driver shall perform only those functions necessary to facilitate transportation-for-hire service during the period of time when that service is being provided.

(b) An optional device operated by a rider or consumer shall provide the user with all required information on a rider/consumer's receipt of the transaction (also see S.1.8.), and may also provide a means for making payment for the transportation service.

S.1.2. Recording Elements, General. – A transportation-for-hire service shall be capable of making available a receipt (in printed or electronic format) including information as required in S.1.8. Recorded Representations through an integral or separate recording element for all transactions conducted.

When the driver's earnings are determined using the dynamically measured distance traveled and/or time elapsed for trips provided, transportation network measurement systems shall **provide information to transportation network company drivers, including, but not limited to, a summary of rides given as specified in S.1.9. Driver's Summary**

S.1.3. Advancement of Indicating Elements. – The primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or by the time mechanism except where an advancement of analog indications occurs on a taximeter when being cleared.

S.1.3.1. For Systems Using a Built-for-Purpose Device Installed in the Vehicle. –

(a) At the conclusion of a transaction (e.g., following the totalizing of all accrued charges and having a customer receipt made available), no other advancement of fare, extras, or other charges shall occur until the taximeter has been cleared.

[Nonretroactive as of January 1, 2017]

(b) Where permitted, a flat rate or negotiated rate shall be displayed in the "fare" indicating mechanism, provided that once a flat rate or negotiated rate is entered the fare may no longer be advanced by movement of the vehicle or the time mechanism.

(Amended 1988 and 2016)

S.1.3.2. Time and Distance Mechanisms. – A transportation-for-hire system shall include either of the following:

(a) ***a "time off" mechanism and a "distance off" mechanism for the vehicle operator to render the measurement of time and/or distance inoperative during a ride. Each use of these mechanisms shall be reflected in the calculation of total charges and recorded on the passenger's receipt; or***
[Nonretroactive as of January 1, 20XX]

(b) for systems not equipped with a "time off" and/or "distance off" mechanism, the system shall be equipped with means to make post-transaction fare adjustments to reduce the amount of the fare, provided the system creates a record of all location and time data from the initiation of the transportation service.

(Added 2017) (Amended 2018 **and 20XX**)

S.1.4. Visibility of Indications. – Primary indications displayed on indicating elements shall be clear, definite, accurate, and easily read under any conditions of normal operation.

S.1.4.1. – For Built-for-Purpose Devices Installed in the Vehicle. – The indications of fare, including extras, and the mode of operation, such as "time" or "hired," shall be constantly displayed whenever the meter is in operation. All indications of passenger interest shall be easily read from a distance of 1.2 m (4 ft) under any condition of normal operation. This includes any necessary lighting, shading, or other means necessary to make displayed indications clearly visible to operator and passenger.

(Amended 1977, 1986, 1988, and 2017)

S.1.4.1.1. Minimum Height of Figures, Words, and Symbols. – The minimum height of the figures used to indicate the fare shall be 10 mm and for extras, 8 mm. The minimum height of the figures, words, or symbols used for other indications, including those used to identify or define, shall be 3.5 mm.

(Added 1986)

S.1.4.1.2. Passenger's Indications. *– A supplementary indicating element installed in a taxi to provide information regarding the taxi service to the passenger (i.e., Passenger Information Monitor or PIM), shall clearly display the current total of all charges incurred for the transaction. The accruing total of*

all charges must remain clearly visible on the passenger's display (unless disabled by the passenger) at all times during the transaction.
[Nonretroactive as of January 1, 2016]

(Added 2015) (Amended 2017)

S.1.4.1.2.1. Additional Information. *– Additional information shall be displayed or made available through a passenger's indicating element (as described in S.1.4.1.2 Passenger's Indications) and shall be current and reflect any charges that have accrued. This additional information shall include:*

(a) an itemized account of all charges incurred including fare, extras, and other additional charges; and

(b) the rate(s) in use at which any fare is calculated.

Any additional information made available must not obscure the accruing total of charges for the taxi service. This additional information may be made accessible through clearly identified operational controls (e.g., keypad, button, menu, touchscreen).
[Nonretroactive as of January 1, 2016]

(Added 2015)

S.1.4.1.3. Fare and Extras Charges. *– The indication of fare and extras charges on a passenger's indicating element shall agree with similar indications displayed on all other indicating elements in the system.*

[Nonretroactive as of January 1, 2016]

(Added 2015)

S.1.5. Actuation of Fare Indicating Mechanism. – When a built-for-purpose device installed in the vehicle designed to calculate fares upon the basis of a combination of distance traveled and time elapsed, but not both time and distance used concurrently to calculate fare, is operative with respect to fare indication, the fare indicating mechanism shall be actuated by the distance mechanism whenever the vehicle is in motion at such a speed that the rate of distance revenue equals or exceeds the time rate, and may be actuated by the time mechanism whenever the vehicle speed is less than this and when the vehicle is not in motion.

(Amended 1977 and 2017)

S.1.6. Operating Condition.

S.1.6.1. General. – When a built-for-purpose device installed in the vehicle is cleared, the indication "Not Registering," "Vacant," or an equivalent expression shall be shown. Whenever a built-for-purpose device installed in the vehicle is set to register charges, it shall indicate "Registering," "Hired," or an equivalent expression and the rate at which it is set shall be automatically indicated (Rate 1 or Rate A, for example).

(Amended 1988)

S.1.6.2. Time not Recording. – When a built-for-purpose device installed in the vehicle is set for fare registration with the time mechanism inoperative, it shall indicate "Time Not Recording" or an equivalent expression.

(Amended 1988)

S.1.6.3. Distance Not Recording. *– **When a** built-for-purpose device installed in the vehicle **is set for fare registration with the distance mechanism inoperative, it shall indicate "Distance Not Recording" or an equivalent expression.***
[Nonretroactive as of January 1, 2020]

(Added 2017) (Amended 2018)

S.1.7. Fare Identification. – Fare indications shall be identified by the word "Fare" or by an equivalent expression. Values shall be defined by suitable words or monetary signs.

S.1.8. Extras. – Extras shall be indicated as a separate item and shall not be included in the fare indication. They shall be identified by the word "Extras" or by an equivalent expression. Values shall be defined by suitable words or monetary signs. Means may be provided to totalize the fare and extras if the totalized amount returns to separate indications of fare and extras within 5 seconds or less.

(Amended 1988)

S.1.8.1. Nonuse of Extras. – If and when extras are prohibited by legal authority or are discontinued by a vehicle operator, the extras mechanisms shall be rendered inoperable, or the extras indications shall be effectively obscured by permanent means.

S.1.9. Protection of Indications. – All indications of fare and extras shall be protected from unauthorized alteration or manipulation.

(Amended 2015)

S.1.10. Recorded Representation. *– A printed or electronic receipt issued from a built-for-purpose device installed in the vehicle, whether through an integral or separate recording element, shall include as a minimum, the following information when processed through the taximeter system:*

(a) date;

*(b) unique vehicle identification number, such as the medallion number, taxi number, vehicle identification number (VIN), permit number, or other identifying information as specified by the statutory authority; **

*(c) start and end time of the trip; **

*(d) distance traveled, maximum increment of 0.1 km (0.1 mi); **

(e) fare in $;

*(f) each rate at which the fare was computed and the associated fare at that rate; **

*(g) additional charges (in $) where permitted such as extras, any surcharges, telecommunication charges, and taxes shall be identified and itemized; **

*(h) total charge for service in $ (inclusive of fare, extras, and all additional charges); **

*(i) trip number, if available;***

*(j) telephone number (or other contract information) for customer assistance;*** and*

*(k) a statement of chargeable time and chargeable distance for taximeters that calculate fare using time and distance concurrently.****

(l) for software-based systems, the software version identification number

Note: When processed through the taximeter or taximeter system, any adjustments (in $) to the total charge for service including discounts, credits, and tips shall also be included on the receipt.**

[Nonretroactive as of January 1, 1989]

**[Nonretroactive as of January 1, 2000]*

***[Nonretroactive as of January 1, 2016]*

****[Nonretroactive as of January 1, 2018]*

(Added 1988) (Amended 1999, 2015, and 2017)

S.1.10.1. Multiple Recorded Representations - Duplicate Receipts. *– A recording element may produce a duplicate receipt for the previous transaction provided the information printed is identical to the original with the exception of time issued. The duplicate receipt shall include the words "duplicate" or "copy." The feature to print a duplicate receipt shall be deactivated at the time the meter is hired for the next fare.*

[Nonretroactive as of January 1, 2000]

(Added 1999)

S.1.11. Non-fare Information. *– The fare and extras displays may be used to display auxiliary information, provided the meter is in the Vacant condition, and such information is only displayed for10 seconds, or less. If the information consists of a list of information, the list may be displayed one item after another, provided that each item is displayed for 10 seconds, or less.*

[Nonretroactive as of January 1, 2002]

(Added 2000)

S.1.12. Electronic Receipt Required. **– An electronic receipt shall be provided to the customer from software and application-based meters, when the payment transaction is completed electronically via the businesses application or software program.**

S.2. Basis of Fare Calculations. – A transportation-for-hire system shall calculate fares only upon the basis of:

(a) distance traveled;

(b) time elapsed; or

(c) a combination of distance traveled and time elapsed.

A transportation-for-hire system may utilize more than one rate to calculate the fare during a trip. Any change in the applied rate must occur at the completion of the current interval.

(Amended 1977 and 2016)

S.2.1. Initial Time and Distance Intervals. – The time and distance intervals of a built-for-purpose device installed in the vehicle that does not calculate fares based on distance traveled and time elapsed used concurrently shall be directly proportional as expressed in the following formula:

$$\frac{Seconds\ of\ \ Initial\ Time\ Interval}{Seconds\ \ per\ \ Non-Initial\ Time\ Interval} = \frac{Distance\ of\ \ Initial\ \ Mileage\ Interval}{Distance\ \ per\ \ Non-Initial\ \ Mileage\ Interval}$$

(Added 1990) (Amended 2017)

S.3. Design of Operating Control.

S.3.1. Positions of Control. – The several positions of the operating controls shall be clearly defined and shall be so constructed that accidental or inadvertent changing of the operating condition of the built-for-purpose device installed in the vehicle is improbable. Movement of the operating controls to an operating position immediately following movement to the cleared position shall be delayed enough to permit the device's display to come to a complete rest in the cleared position.

(Amended 1988)

S.3.2. Control for Extras Mechanism. – The knob, handle, or other means provided to actuate the extras mechanism shall be inoperable whenever the built-for-purpose device installed in the vehicle is cleared.

S.4. Interference. – The design of a built-for-purpose device installed in the vehicle shall be such that when a fare is calculated by using time and/or by using distance (but not used concurrently) there will be no interference between the time and the distance portions of the mechanism device at any speed of operation.

(Amended 1977, 1988, and 2017)

S.5. Provision for Security Seals. – 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 requires the security seal to be broken before an adjustment or interchange can be made of:

(a) any metrological parameter affecting the metrological integrity of the transportation-for-hire systems and associated equipment; or

(b) any metrological parameter controlled by software residing in the built-for-purpose device installed in the vehicle or an associated external computer network.

When applicable, the adjusting mechanism shall be readily accessible for the purpose of affixing a security seal.

(Audit trails shall use the format set forth in Table S.5. Categories of Device and Methods of Sealing)
(Amended 1988, 2000, and 2017)

Table S.5. ***Categories of Device and Methods of Sealing***	
Categories of Device	***Methods of Sealing***
Category 1: *No remote configuration capability.*	*Seal by physical seal or, for components that may be removed from the vehicle, a combination of physical seals and a physical or electronic link as described in S.5.2. Taximeters Calibrated to Specific Vehicles.*
Category 2: *Remote configuration capability, but access is controlled by physical hardware.* *The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the remote configuration mode.*	*The hardware enabling access for remote access to calibration functions must be at the device and sealed using a physical seal and the device shall include an event logger.* *An event logger must be used to record changes to configuration parameters made through remote access.* *The event logger must include event counters (000 to 999 with a minimum count of 1000 events), the parameter ID, the date and time of the change, and the new value of the parameter. A printed or electronic copy of the information must be available through the device. The event logger*

Table S.5. *Categories of Device and Methods of Sealing*	
	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.*
Category 3: *Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).* *The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode. The device shall not operate as normal when in the remote configuration mode.*	*An event logger must be used to record changes to adjustable parameters that are made through remote access, and which is accessible only by authorized persons (using an Internet web browser or other such secure software.* *The event logger shall include event counters, the date and time of the change, the parameter ID, and the new value of the parameter. A printed or electronic copy of the information must be available through the device. The event loggers 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 change to be stored for each parameter.)* *The device shall become inoperable when access to the system's metrological parameters is made through unapproved or unauthorized means. The device shall remain inoperable until cleared by the official having statutory authority.*

[Nonretroactive as of January 1, 2018]
(Added 2017)

S.5.1. Taximeter Connected to Networked Systems. – Metrological features that are not located on the taximeter device installed in the vehicle (i.e., accessed through a computer network, server, or "cloud") shall be secured by means that will:

(a) protect the integrity of metrological data and algorithms used to compute fares from such data against unauthorized modifications; and

(b) use software-based access controls or equivalent technological protections that limit access to metrological data and algorithms used to compute fares from such data only to authorized persons.

(Added 2017)

S.5.2. Taximeters Calibrated to Specific Vehicles. – In the case of taximeters where the proper performance and calibration of the device has been verified when used in a specific vehicle and which may be removed from the vehicle (e.g., slide mounting the taximeter), means shall be provided through a physical seal or electronic link between components affecting accuracy or indications of the device to ensure that its performance is not affected and operation is permitted only with those components having the same unique properties.
(Added 2017)

S.6. Power Interruption, Electronic Taximeters.

(a) After a power interruption of three seconds or less, the fare and extras indications shall return to the previously displayed indications and may be susceptible to advancement without the taximeter being cleared.

(b) After a power interruption exceeding three seconds, the fare and extras indications shall return to the previously displayed indications and shall not be susceptible to advancement until the taximeter is cleared.

After restoration of power following an interruption exceeding three seconds, the previously displayed fare shall be displayed for a maximum of one minute at which time the fare shall automatically clear, and the taximeter shall return to the vacant condition.*

*[*Nonretroactive as of January 1, 2002]*

(Added 1988) (Amended 1989, 1990, and 2000)

S.7. Measurement Signal Loss. – If the measurement signal is interrupted, the taximeter shall be capable of determining any information needed to complete a transaction in progress at the time of signal loss/interruption.

Note: If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time provided the time mechanism is not affected by signal loss.

(Added 2017)

S.7.1. Intermittent Trip Data Loss. – When the measurement signal is lost intermittently during a trip (e.g., traveling through a tunnel), but recovered prior to the end of the trip, the taximeter shall be capable of calculating an accurate fare in accordance with T.1. Tolerance Values.

(Added 2017)

S.7.2. Significant Trip Data Loss. – When the signal is lost for a significant portion of the trip, the taximeter shall calculate the total charge utilizing recorded time and distance measurements and other charges (e.g., tolls and airport fees), and may also include other means in accordance with the terms of service (or other agreement) the passenger has agreed to.

Note: Significant trip data loss refers to instances when the measurement signal is lost to the extent that the taximeter cannot perform an accurate measurement or when the signal is not regained by the end of the trip.

(Added 2017)

S.8. Anti-Fraud Provisions, Electronic Taximeters. – An electronic taximeter may have provisions to detect and eliminate distance input that is inconsistent with the taximeter's source(s) of distance measurement data. When a taximeter equipped with this feature detects input inconsistent with the distance measurement data source(s):

(a) the meter shall either filter out the inconsistent distance input signals or cease to increment fare based on distance until the distance input signal is restored to normal operation. If the meter ceases to increment fare based on distance, the taximeter may continue to increment fare based on elapsed time when (1) permitted by the statutory authority; and (2) the time mechanism is not affected by inconsistent signals;

(b) the taximeter shall provide a visible or audible signal that inconsistent input signals are being detected; and

(c) the taximeter shall record the occurrence in an event logger. The event logger shall include an event counter, the date, and the time of at least the last 1000 occurrences.

(Added 2001) (Amended 2017)

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of a taximeter shall be conducted utilizing one or more of the following test methods:

(a) **Road Test.** – A road test consists of driving the vehicle over a precisely measured road course.

(b) **Fifth Wheel Test.** – A fifth wheel test consists of driving the vehicle over any reasonable road course and determining the distance actually traveled through the use of a mechanism known as a "fifth wheel" that is attached to the vehicle and independently measures and indicates the distance.

(c) **Simulated Road Test.*** – A simulated road test consists of determining the distance traveled by use of a roller device, or by computation from rolling circumference and wheel turn data.

*Simulated-road testing is not appropriate for taximeters using measurement data from sources other than signal(s) generated by rotation of the wheels of the vehicle.

(Amended 1977 and 2017)

Note: Field examinations of transportation network measurement systems need not include testing of all individual devices used as driver/passenger indicating elements in connection with the service provided. It is considered sufficient that a representative sample of various indicating elements be incorporated in testing to verify proper operation of the system.

N.1.2. Test Procedures. – The distance test of a taximeter, whether a road test, a simulated road test, or a fifth wheel test, shall include at least duplicate runs of sufficient length to cover at least the third money drop or 1 mi, whichever is greater, and shall be at a speed approximating the average speed traveled by the vehicle in normal service. In the case of metric calibrated taximeters, the test should cover at least the third money drop or 2 km, whichever is greater.

(Amended 1977)

N.1.2.1. Taximeters Using Measurement Data Sources from Other Than Rotation of the Wheels.

N.1.2.1.1. Testing, General. – Testing of taximeters with metrologically significant parameters that do not completely reside within the taximeter device shall include tests performed under variable conditions to verify that any non-compliant issue is generated from a network system rather than a single taximeter device. The variability tests shall include a minimum of three consecutive tests of varying lengths, locations, and/or environmental conditions.

(Added 2017)

N.1.2.1.2. Repeatability Testing, Taximeters Using Measurement Data Sources From Other Than Rotation of the Wheels. – Repeatability testing shall be conducted if, during testing, a taximeter registers a distance measurement that does not comply with the tolerance values in T.1.1. Distance Tests. A minimum of three additional tests shall be conducted at the same location and where all test variables are reduced to the greatest extent practicable to verify the system's ability to repeat transaction indications. Repeatability testing performed in excess of these three additional tests is done at the discretion of the official with statutory authority.

(Added 2017)

N.1.3. Test Conditions.

N.1.3.1. Measurement Data Based on the Rotation of the Vehicle's Wheels. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, the test of the taximeter shall be performed under the following conditions.

(Added 2017)

N.1.3.1.1. Vehicle Lading. – During the distance test of a taximeter, the vehicle shall carry two persons, or in the case of a simulated road test, 70 kg or 150 lbs. of test weights may be substituted in lieu of the second person.

N.1.3.1.2. Tire Pressure. – At the completion of test run or runs, the tires of the vehicle under test shall be checked to determine that the tire pressure is that operating tire pressure posted in the vehicle. If not, the tire pressure should be adjusted to the posted tire pressure and further tests may be conducted to determine the operating characteristics of the taximeter.

(Amended 1977)

N.1.3.2. Taximeters Using Other Measurement Data Sources. – Except during type evaluation, all tests shall be performed under conditions that are considered usual and customary for the location(s) where the system is normally operated and as deemed necessary by the statutory authority.

(Added 2017)

N.1.3.2.1. Testing for Environmental Influences. – During type evaluation, the distance test may be performed on a route traveled by the vehicle that exposes the system to conditions possibly contributing to the loss of, or interference with, the signal(s) providing measurement data. This may include:

(a) objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) routes that do not follow a straight-line path;

(c) significant changes in altitude; and

(d) any other relevant environmental conditions.

(Added 2017)

N.1.3.2.2. Testing for Environmental Influences. – During type evaluation, the distance test may be performed on a route traveled by the vehicle that exposes the system to conditions possibly contributing to the loss of, or interference with, the signal(s) providing measurement data. This may include:

(a) objects that may obstruct or reflect signals such as tall buildings/structures, forestation, tunnels, etc.;

(b) routes that do not follow a straight-line path;

(c) significant changes in altitude; and

(d) any other relevant environmental conditions.

(Added 2017)

N.2. Time Test. – If a taximeter is equipped with a timing device through which charges are made for time intervals, the timer shall be tested at the initial interval, four separate subsequent intervals, and an average time test of at least four consecutive subsequent time intervals.

(Amended 1988)

N.3. Interference Test. – For taximeters that calculate fares based on time and/or distance but not simultaneously, a test shall be conducted to determine whether there is interference between the time and distance elements. During the interference test, the vehicle's operating speed shall be 3 km/h or 4 km/h (2 mi/h or 3 mi/h) faster, and then 3 km/h or 4 km/h (2 mi/h or 3 mi/h) slower than the speed at which the basic distance rate equals the basic time rate. The basic rate per hour divided by the basic rate per mile is the speed (km/h or mi/h) at which the basic time rate and basic distance rate are equal.

Note: Performance of the interference test may not be considered appropriate as a field test while travelling in a vehicle equipped with a taximeter. This test may be performed during type evaluation under controlled conditions for practicality and for safety concerns.
(Amended 1988 and 2017)

T. Tolerances

T.1. Tolerance Values.

T.1.1. On Distance Tests. – Maintenance and acceptance tolerances for taximeters shall be as follows:

(a) On Overregistration: 1 % of the interval under test.

(b) On Underregistration: 4 % of the interval under test, with an added tolerance of 30 m or 100 ft whenever the initial interval is included in the interval under test.

T.1.2. On Time Tests.

T.1.2.1. On Individual Time Intervals. – Maintenance and acceptance tolerances on individual time intervals shall be as follows:

(a) On Overregistration: 3 seconds per minute (5 %).

(b) On Underregistration: 9 seconds per minute (15 %) on the initial interval, and 6 seconds per minute (10 %) on subsequent intervals.

T.1.2.2. On Average Time Interval Computed After the Initial Interval. – Except for the initial interval, maintenance and acceptance tolerances on the average time interval shall be as follows:

(a) On Overregistration: 0.2 second per minute (0.33 %).

(b) On Underregistration: 3 seconds per minute (5 %).

(Amended 1991)

T.1.3. On Interference Tests. – For taximeters designed to calculate fares upon the basis of a combination of distance traveled and time elapsed (but not using both simultaneously), the distance registration of a taximeter in the "time on" position shall agree within 1 % of its distance registration in the "time off" position.

(Added 1988) (Amended 2017)

T.2. Tests Using Transfer Standards. – To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard (i.e., fifth wheel) when compared to the basic reference standard.

(Added 2017)

UR. User Requirements

UR.1. Inflation of Vehicle Tires. – For taximeters that receive input of measurement data generated (directly or indirectly) from rotation of the vehicle's wheels, the operational tire pressure of passenger vehicles and truck tires shall be posted in the vehicle and shall be maintained at the posted pressure.

(Amended 1977 and 2017)

UR.2. Position and Illumination of Taximeter. – A taximeter shall be so positioned and illuminated that its indications, operational markings, and controls of passenger interest can be conveniently read by a passenger seated in a position of up to 1.2 m (4 ft) away from the taximeter under any condition of normal operation.

(Amended 1985, 1986, and 2017)

Note: Software and application-based systems are exempt from this user requirement if all transaction related information is readily accessible, clear, and verifiable by customers through their digital interface.

UR.3. Statement of Rates. – The distance and time rates for which a taximeter is set, including the initial distance interval and the initial time interval, the local tax rate, and the schedule of extras when an extras indication is provided shall be conspicuously displayed inside the front and rear passenger compartments. The words "Rate," "Rates," or "Rates of Fare" shall precede the rate statement. The rate statement shall be fully informative, self-explanatory, and readily understandable by the ordinary passenger, and shall either be of a permanent character or be protected by glass or other suitable transparent material.

(Amended 1977, 1988, 1990, and 1999)

Note: Software and application-based systems are exempt from this user requirement if all transaction related information is readily accessible, clear, and verifiable by customers through their digital interface.

Previous Status:

2025: New Proposal

Original Justification:

A unified code is needed because these devices and systems exist across a spectrum. Traditional taxicab companies can now use fully app-based fare calculating measurement and payment systems. Some systems blend in vehicle app-based GPS measurement systems with traditional in person ride pick-ups, while others can utilize physical metering inside the vehicle with electronic ride acquisitions.

A unified code will standardize the specifications, tolerances, test procedures, and user requirements for all types of these systems, as much as possible, bringing equity to the industry.

NIST OWM Executive Summary

B1- TXI-25.1 – 5.54 ~~Taximeters~~ Transportation-For-Hire Systems

NIST OWM Recommendation: Informational

- OWM recognizes this is a new agenda item whereby two codes have substantial changes. The submitter is recommending the removal of the tentative status of the Transportation Network Measurement Systems (TNS) -Tentative Code (5.60) from NIST Handbook 44 and incorporating this code (TNS) into the Taximeters Code (5.54). The Taximeters Code will then be renamed Section 5.54. Transportation for Hire Systems Code deleting Section 5.60 from NIST Handbook 44.

- The goal is to provide a unified code that will be applied to all transportation systems including taximeters and ride share app based companies.

- An updated 10/15/24 document has been supplied to the NCWM for publication into Pub 15. This update provides editorial and housekeeping changes.

Table 2. Summary of Recommendations
B1-TXT-25.1 – 5.54 ~~Taximeters~~ Transportation-For-Hire Systems

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

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

Item Under Consideration:

Amend Handbook 44,

NIST OWM Detailed Technical Analysis:

This agenda item has several moving parts to the proposal. First, the NCWM Specifications & Tolerance (S&T) Committee will need to accept the removal of NIST Handbook 44 Section 5.60 Transportation Network Measurement Systems, which is a tentative code, and allow NIST Handbook 44 Section 5.54 Taximeters to be renamed Transportation for Hire Systems (keeping the same Section number). Based on this decision the Committee would also need to incorporate proposed new language that would merge the two aforementioned codes into one unified code to address all specifications and tolerances as they would apply to both taxi and rideshare applications. A Transportation for Hire Systems Workgroup was formed to address these and other concerns and report back to the S&T Committee.

During the Transportation for Hire Systems Workgroup meetings an original proposal had been supplied to the NCWM for Regional review. During these Regional meetings feedback had been provided and further review of the proposal has been conducted. Certain updates and editorial changes have been addressed and the Chair of the Transportation for Hire Systems Workgroup Mark Lovisa (LA) has submitted and more current version for the NCWM to publish in their Pub 15.

Based on the updated and editorial changes NIST OWM recommends this agenda item to Information as the membership needs to review and provide substantive comments as they relate to the document and provide direction to task group to further move this item.

Summary of Discussions and Actions:

This item was introduced during the 2025 meeting cycle and has not been considered during an NCWM Interim or Annual Meeting.

Regional Association Reporting:

Western Weights and Measures Association

At the 2024 WWMA Annual Meeting Matthew Douglas (State of California, Division of Measurement Standards): Recommends a developing status too allow the submitter an opportunity to receive feedback from body, industry, and stakeholders. The WWMA 2024 S&T Committee recommends a Developing status.

Southern Weights and Measures Association

At the 2024 SWMA Annual Meeting, Mark Lovisa, Chair of Transportation for Hire Systems Task Group requested informational status. Believes the code needs finishing touches to polish and address editorial errors. Intent of the proposal is to even out the rules and regulations among taxis and rideshare companies. Soliciting input from the regulators that regulate transportation technology. The committee recommends the item be assigned an Informational status.

Northeastern Weights and Measures Association

At the 2024 NEWMA Interim Meeting, Mr. Michael Peeler (NJ) commented that the items still need some work with wording and recommended a developing status. Mr. Steve Timar (NY) concurs with NJ. He commented that TNMS supports the tolerances that appear in the proposal, but should remain developing so all parties can review the items. Ms. Cheryl Ayer (NH) agrees with NJ and NY.

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

Central Weights and Measures Association

At the 2024 CWMA Interim Meeting, No comments were heard during open hearing.

The committee recommends this item as developing and recommends the submitter gather more input from stakeholders and NIST OWM.

ITEM BLOCK 3 (B3) MILK METER TOLERANCES

Note: Prior to the 2024 development of Item Block 3, comments were initially received separately for Items VTM-20.2 and MLK-23.2, therefore the NIST OWM Analysis includes a separate analysis for each of the items within Block 3.

During 2019, the NCWM S&T Committee established the Milk Meter Tolerance Task Group to address milk meter tolerances. The group was tasked with reviewing Item VTM-20.2 and as a result of their work developed a proposal under Item MLK-23.2. During the 2024 NCWM Interim Meeting, the Committee agreed to block individual Items VTM-20.2 and MLK-23.2 into new Item Block 3.

B3-VTM-20.2 A Table T.2. Tolerances for Vehicle-Mounted Milk Meters

(**Note:** This item was revised based on changes that were made by the Committee at the 2021 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

B3-VTM-20.2 – Table T.2. Tolerances for Vehicle Mounted Milk Meters

NIST OWM Recommendation: NIST OWM has no recommendation.

- The proposed tolerances are those currently used in OIML standards and seem to be a good starting point for changes to the tolerances. Generally we support, wherever possible, efforts to harmonize with OIML standards, but care should be taken to examine the increased tolerance and any adverse results that arise compared to the previously used tolerances. In 2020 several milk industries sent letters of opposition to the original POUL TARP proposal for an increase of the tolerances in NIST HB 44 Section 3.31. VTM Code for milk meter applications. The initial POUL TARP proposal included wider tolerances than those in the current alternative proposal based on OIML standards. Below is POUL TARP's original proposal for changes to vehicle-mounted milk meter tolerances which were to increase the tolerances:

Table 2. Tolerances for Vehicle-Mounted Milk Meters

Indication (gallons)	Maintenance Tolerance (gallons)	Acceptance Tolerance (gallons)
100	~~0.5~~ **0.6**	~~0.3~~ **0.5**
200	~~0.7~~ **1.2**	~~0.4~~ **1.0**
300	~~0.9~~ **1.8**	~~0.5~~ **1.5**

400	**~~1.1~~ 2.4**	**~~0.6~~ 2.0**
500	**~~1.3~~ 3.0**	**~~0.7~~ 2.5**
Over 500	**Add ~~0.002~~ 0.006 gallons per indicated gallon over 500**	**Add ~~0.001~~ 0.005 gallons per indicated gallon over 500**

- The opposition to the original proposal can be found in the S&T archive folder for VTM-20.1 and the opposition included the following:
    - increasing the tolerance allows for unpredictable results creating more inaccurate results during the milk metering process,
    - increasing the tolerance between buyer and seller,
    - broadening tolerances introducing more uncertainty into the transaction between buyer and seller,
    - meters having a greater tolerance difference than plant scales or meters,
    - we believe tolerance should be set according to the needs of industry and not to accommodate one specific measuring system.
    - given that it has been demonstrated that another vehicle-mounted milk meter can successfully meet the current standards, we believe that the tolerances should be set according to the needs of the industry.
- At a previous conference, it was noted that a manufacturer received an NTEP CC based on the existing vehicle-mounted milk meter tolerances, but after reviewing the certificate, it was noted that the device was tested at a limited volume.
- The current milk meter tolerances in the Vehicle Tank Meters Code and the Milk Meters Code reduce the applicable percentage tolerance as the delivered volume increases.
    - For example at 100 gal the maintenace tolerance is 0.5 gallons which is a 0.5%, at 200 gal the maintenance tolerance is 0.7 gallons which is a 0.35% tolerance, and at 300 gallons the maintenace tolerance is 0.9 gallons which is a 0.3% tolerance.
- OIML tolerances permit a 0.5% percent tolerance for a system and 0.3% percent tolerance for the meter only.
- The current OIML tolerances are smaller than those originally proposed by POUL Tarp but are higher than the current tolerances.
- Charlie Stutesman, the previous chair, provided a comparison of the tolerances, which are available in the S&T archive folder on the NCWM website for various tolerances, along with current NTEP certificates that have been issued for these types of devices.
- The S&T Committee at the 2024 Interim Meeting agreed to combine VTM-20.2 and MLK-23.1. Aaron Yankers (Colorado) held task group meetings on March 6 and April 24, 2024, to discuss the proposal. The Task Group reviewed and discussed various tolerances applied to milk meter applications in NIST HB 44, and Aaron continues to collect feedback from the Task Group concerning the proposed changes.

- The Milk Meter Tolerance Task Group also met on June 11, 2024 prior to the 2024 NCWM Annual Meeting.
- The Task Group discussion during its three 2024 meetings included the direction for the milk meters items:
  - possibly combining the milk meter requirements from all other codes in NIST Handbook 44 into a new code section
  - reaching out to the original submitters of B3 items for clarity
  - and an update to be provided for the Block 3 items at the 2024 Annual meeting.
- The codes in NIST HB 44 that address the measurement of milk are sections 3.31, .3.35, 3.37, and 4.42.
- Sections 3.31 Vehicle-Tank Meters and 3.35 Milk Meters currently have the same tolerances. Section 3.37 Mass Flow Meters has a different tolerance. Section 4.42 Farm Milk Tanks Code applies to farm milk tanks that are used for the commercial measurement of milk. The farm milk tank tolerances are different than the meter tolerances.
- If the Task Group plans to combine all milk measuring device and system requirements from all the handbook codes into a single code, the group should consider:
  - For a VTM milk meter the product depletion test is considered as part of the official test of this meter type
  - The tolerances for a farm milk tank are different than tolerances that apply to milk meters in the Vehicle-Tank Meters Code, Milk Meters Code, and Mass Flow Meters Code.

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

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

	Number of Support Letters	Number of Opposition Letters	Comments
Industry		4	Agri-Mark, Dean Foods, Dairy Farmers of America, and Danone North America Other information on NCWM website: (Milk Meter Tolerance Spreadsheet, Milk Meter Tolerance Report, Proposed Tolerance Table, Milk Meter NTEP Certificate Data)
Manufacturers			
Retailers and Consumers			
Trade Association			

***Notes Key:**

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

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)

Table 2. **Tolerances for Vehicle-Mounted Milk Meters**		
~~**Indication (gallons)**~~	~~**Maintenance Tolerance (gallons)**~~ **Acceptance Tolerance**	~~**Acceptance Tolerance (gallons)**~~ **Maintenance Tolerance**
~~**100**~~ **Complete Measuring System**	**0.5 %**	**0.3~~5~~ %**
~~**200**~~ **Meter Only**	**0.7~~3~~ %**	**0.4~~3~~ %**
~~**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 Added 1989) (Amended 20XX)

NIST OWM Detailed Technical Analysis:

NIST OWM acknowledges the resumption of work to address both Block 3 items and to consider consolidating milk device measuring requirements in other handbook codes during three meetings held by the NCWM Milk Meter Tolerance Task Group led by new Chair Aaron Yanker (CO) during the second quarter of 2024. NIST OWM has followed the development of these proposals up to this point as follows: The Milk Meter Tolerance Task Group met on January 3, 2022 to discuss the proposed tolerances in NIST HB 44 Sections 3.31 VTM Code and 3.35 Milk Meters Code. The proposed tolerance applied in OIML standards for milk measuring systems are shown in the table below in comparison to the current NIST HB 44 VTM tolerances.

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

POUL TARP's original proposal was a request for wider tolerances than those in OIML standards. POUL TARP's original proposal received several opposition letters from the milk industry. Below is POUL TARP's original proposal for changes to the VTM milk meter tolerances.

Table 2. Tolerances for Vehicle-Mounted Milk Meters

Indication (gallons)	**Maintenance Tolerance (gallons)**	**Acceptance Tolerance (gallons)**
100	**~~0.5~~ 0.6**	**~~0.3~~ 0.5**
200	**~~0.7~~ 1.2**	**~~0.4~~ 1.0**
300	**~~0.9~~ 1.8**	**~~0.5~~ 1.5**
400	**~~1.1~~ 2.4**	**~~0.6~~ 2.0**
500	**~~1.3~~ 3.0**	**~~0.7~~ 2.5**
Over 500	**Add ~~0.002~~ 0.006 gallons per indicated gallon over 500**	**Add ~~0.001~~ 0.005 gallons per indicated gallon over 500**

The submitter, POUL TARP, explained that the 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 inherent 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 in the Measuring Instrument Directive (MID) and the Organization of Legal Metrology (OIML) Recommendation (R) 117 *Dynamic measuring systems for liquids other than water* and by 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 above 2 L (0.5 gal). NIST HB 44 Section 3.31. has Table 2. Tolerances for Vehicle-Mounted Milk Meters that designates tolerances as a volume for vehicle-mounted milk meters that was added to the code in 1989. This table specifies an acceptance tolerance of 0.3 gal and a maintenance tolerance of 0.5 gal for the first 100 gal measured. These tolerances decrease, as a percentage, 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 NCWM S&T Committee assigned a task group to this item and NIST OWM expressed interest in working with the Task Group.

Charlie Stutesman previously of Kansas weights and measures and then Chair of the Task Group 2019 through 2022 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 for the NCWM Interim and Annual Meetings.

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

Chair – Charlie Stutesman (Kansas)

NEWMA Representative – Jim Willis (New York)

SWMA Representative – Mitch Marsalis (Louisiana)

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)

Milk Meter Tolerance 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 Tank 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~~

~~(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 %

Proposed change to Handbook 44 would include a simple rewrite of Table 2 and paragraph T.4. in Section 3.31 VTM Code and Table 1 in Section 3.35 Milk Meters 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 processer (seller to buyer),
- the operation of metering systems that measure milk to include discussion of air elimination systems,
- review of the milk measuring tolerances in NIST HB 44 from 1919 to 2020,
- review of the proposal to harmonize the NIST HB 44 VTM code milk metering tolerances with OIML tolerances for single milk meters and milk meter measuring systems, and
- whether or not the Task Group wanted to consider expanding its scope to include combining all milk metering requirements in NIST HB 44 to a single code.

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

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

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

The Milk Meter Tolerance 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.

Aaron Yanker (Colorado) is the newly appointed Milk Meter Tolerance Task Group Chair. The Task Group met to review the proposed changes to the tolerances to ensure full vetting by industry and the weights and measures community.

The Task group met March 6, April 24, and June 11, 2024. Many of the task group members were not present at the March 6, 2024 meeting but participants forwarded information concerning the tolerances to Aaron for discussion at the April 24, 2024 meeting. At the April 24 and June 11, 2024 meeting the NCWM Milk Meter Tolerance Task Group discussed combining all the HB 44 applications that address milk meters, as well as reaching out to the original submitters for clarity, and discussed the direction for Block 3 items in preparation for discussions at the 2024 NCWM Annual Meeting.

NIST OWM has no recommendation. The proposed tolerances are those currently used in OIML standards and seem to be a good starting point for discussion. We generally support, whenever possible, efforts to harmonize with OIML standards, but care should be taken to examine the increased tolerance and any adverse results that arise compared to the previously used tolerances.

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 manufacturer 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 completely 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 its operation 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 costs 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 CO_2 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 also will influence the accuracy of the magnetic flow-meter mounted in the system. Milk entrains air unlike petroleum liquids which do not. As you know, the flow meter will count anything that passes through the meter – liquid as well as air – and it is therefore essential that as much air as possible is removed from the milk before it reaches the flow-meter. However, it is widely recognized that it is not possible to remove all the air from the milk, which will result in an inaccuracy.
>
> It is therefore essential that the tolerances for vehicle mounted milk pump systems using magnetic flow-meters for determining milk volume reflects todays way of collecting milk. This means that

existing tolerance for milk meters cannot be used when the milk meter is a part of a system where different system parts will influence the accuracy of the count. Such milk metering systems will need to be classified with their own tolerances.

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

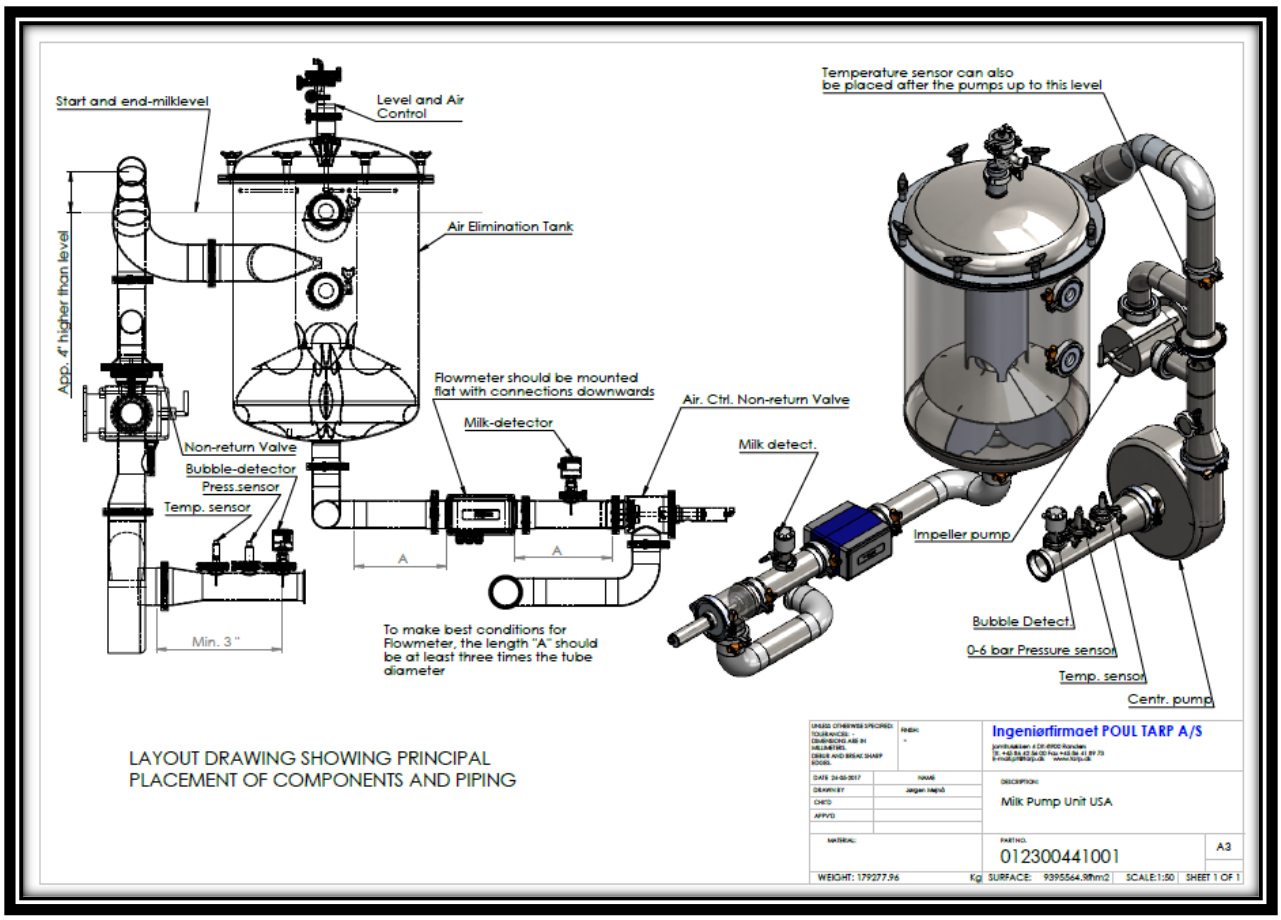
We hope that the NCWM will consider our proposal and we will be more than happy to meet with you and answer any questions you may have. We believe that a change of tolerance is necessary in order for the Handbook 44 to reflect today´s milk collection and the technical progress within milk collection.

Yours sincerely

POUL TARP
President POUL TARP A/S

The POUL TARP milk pump system holds an MID approval which is recognized and in accordance with guidelines and standards described in the OIML – International Organization of Legal Metrology

The standards related to metrological aspects come from OIML R 117-1 for liquids (Dynamic measuring systems for liquids other than water, part 1: Metrological and technical requirements) and documents OIML D 11 (General requirements for electronic measuring instruments) and OIML D 31 (General requirements for software-controlled measuring instruments).



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.

Leigh Hamilton (Piper) provided a presentation concerning the piper system and stated in their presentation that Piper currently has an NTEP Certificate of Conformance (CC) 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 CC. Charlie Stutesman discussed complications involved in measurement of product using various methodologies and the potential shortcomings of Piper's NTEP CC.

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 NTEP CC should be amended to qualify the system for draft sizes up to 300 gallons. Michael Keilty (Endress + Hauser) commented with concerns with Piper's NTEP CC. 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 might have failed the testing.

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

Tim Chesser (Arkansas) questioned whether the flow meter used in the system is appropriate and noted that there are many unanswered questions surrounding this issue. Jim Willis (New York) recommended a Developing status for this item. Kevin Schnepp (California) stated that although 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 July 2020 Annual Meeting, due to the 2020 COVID-19 pandemic, was adjourned to January 2021, at which time the Janaury session was held as a virtual meeting. Due to time constraints, only those items designated as 2020 Voting Items were addressed. All other items were addressed in the subsequent 2021 NCWM Interim Meeting.

At the 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 Tolerance TG worked via e-mail communication and reviewed and discussed the proposed milk meter tolerances in Agenda Item VTM-20.2. The Milk Meter Tolerance TG also discussed the tolerances that are included in NIST HB 44 for milk meter applications addressed in various other code sections of HB 44 which include the Section 3.31. VTMs, Section 4.42. Farm Milk Tanks, Section 3.37.. Mass Flow Meters, and Section 3.35. Milk Meters. 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 Tolerance 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 mMeter tolerances. Charlie Stutesman requested that this item move forward as a Voting item. The Committee also heard from Clark Cooney (California) who noted support for the items having Developing status 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 Tolerance Task Group to adopt OIML tolerances for milk meters in the VTM code, that this item be given 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 Tolerance TG and that align with OIML tolerances.

At the 2021 NCWM Annual Meeting, Charlie Stutesman provided an update on the Milk Meter Tolerance 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 provide 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 nonretroactive date was added to the tolerances, then, what tolerances would apply to existing meters that had been manufactured and tested prior to the nonretroactive 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 NCWM voted against adding a nonretroactive date to the proposed tolerance table and the Item Under Consideration to modify the tolerances failed to receive the 27 votes from the House of State Representatives, so the item failed and was returned to the S&T Committee. The S&T Committee agreed to a Developing status for this item.

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

Table 2. Tolerances for Vehicle-Mounted Milk Meters

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

Over 500	**Add ~~0.002~~ 0.006 gallons per indicated gallon over 500**	**Add ~~0.001~~ 0.005 gallons per indicated gallon over 500**

At the NCWM 2022 Interim Meeting, Charlie Stutesman (Chair of the Milk Meter Tolerance 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 NIST HB 44 Code Sections 3.31 Vehicle Tank Meters and 3.35 Milk Meters and the need to have the tolerance be applied to both vehicle mounted and stationary 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 tolerances 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 Tolerance 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, milk metering systems and related test methods, specifications and tolerance in an effort to harmonize requirements across all the codes.

The Committee agreed to an Assigned status for the item.

At the NCWM 2022 Annual Meeting, the Milk Meter Tolerance TG Chair Stutesman, provided a status update on 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 needed on the Milk Meter Tolerance TG.

At the Committee's work session, the Committee agreed to keep an Assigned 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 to fill the vacancy created in 2022.

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

At the 2024 NCWM Interim Meeting open hearings, the Committee heard from Aaron Yanker, the newly appointed chairperson of the Milk Meter Tolerance Task Group. The Committee agreed with the TG Chair that these items should remain assigned, and the scope of the Task Group should be expanded to study the possibility of creating a new section in the handbook to capture all devices that measure milk. To facilitate better discussion and the possibility of new proposals, the Committee has blocked VTM 20.2 and MLK-23.2

together. OWM suggested the Task Group solicit input from affected stakeholders and conduct a thorough review of the items' history. The Committee requests the Task Group provide an update on the Block 3 items, as well as the feasibility of establishing a new section in the handbook during the 2024 NCWM Annual Meeting.

At the 2024 NCWM Annual Meeting open hearings the chair of the Milk Meter Tolerance Task Group noted that the item was ready for voting. The S&T Committee agreed with upgrading the item to Voting status but since the item was designated with an Assigned status, then due process was needed to move the item forward as a voting item. The S&T Committee made no changes to this item. The item could be given a Voting Status at the 2025 Interim Meeting.

Note: Since MLK-23.2 and VTM-20.2 are now combined under S&T Agenda Item Block 3 subsequent reporting for all upcoming NCWM meetings and regional meetings will be to simultaneously address both items.

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 Tolerance Task Group was 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 a nonretroactive requirement was made. Questions were raised as to what would happen to devices that are currently in the field? During the 2021 NCWM Annual Meeting this item was removed from the voting calendar and the NCWM S&T Committee gave the proposal Developing status and NIST OWM supported Developing status.

The WWMA S&T Committee recommended the status remain Developing. During the 2021 S&T Committee 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 status." The Committee looks forward to hearing from the Task Group.

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

Due to time constraints during Open Hearings, the S&T Committee did not take comments on Assigned Items. The Committee did allow the submitters 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 Tolerance Task Group) updated the bodythat there was currently no Chairfor the Task Group and no updates.

The WWMA 2023 S&T Committee recommended this item remain Assigned to the NCWM Milk Meter Tolerance Task Group for further development and looks forward to a Chair being assigned and an update provided. This Committee also recommended Item VTM-20.2 be blocked with Item MLK-23.2.

At the 2024 WWMA Annual Meeting Aaron Yanker, NCWM Milk Meter Tolerance Task Group Chair, stated the Task Group has met several times in the last year and determined the two milk meter related items that had been blocked are fully developed. The Chair has met with the original submitter of the two items and concluded the items are developed. The Milk Meter Tolerance Task Group recommends the blocked items be assigned a Voting status.

The 2024 WWMA S&T Committee recommends a Voting status.

Southern Weights and Measures Association

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

At the 2023 SWMA Annual Meeting it was recognized that this item is an Assigned item, but Dr. Matt Curran, Florida, recommended blocking Item VTM-20.2 with Item MLK-23.2.

The Committee recommended that the item remain an Assigned item.

At the 2024 SWMA Annual Meeting, the S&T Committee heard the following comments from Matt Curran who noted that the proposal expands the tolerance and doesn't feel there is a justification for this increase in the tolerance, believing it would lead to an increase in lost product cutting into the dairy industry's profit margins. Matt Curran recommended moving forward with voting status but opposes the item.

The Committee recommends the item be assigned voting status.

Northeastern Weights and Measures Association

During the 2021 NEWMA 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. Jim Willis commented that the tolerance of 0.5 % is considered too large by some, but we have 0.4 % specified in the handbook for checking a milk tank with a meter.

Jimmy Cassidy (Massachusetts) asked if any systems currently meet the requirements in the handbook? Jim 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, Jim Willis commented as a member of the Milk Meter Tolerance TG indicating that the TG made strides and hopes to have the 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 Tolerance 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 Tolerance Task Group.

During the 2023 NEWMA Annual Meeting, Jim Willis reported that the Task Group does not have a Chair and work on this item has not moved forward. Jim Willis 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, and manufacturers can meet the tolerances currently in the handbook, they recommended withdrawal. Massachusetts, Pennsylvania, and New York concurred. Upon consensus of the body, the NEWMA S&T Committee recommended this item be withdrawn.

During the 2024 NEWMA Annual Meeting, Jim Willis (NY) gave an update from Milk Meter Tolerance Task Group. The Task Group is looking at all items within the block to determine if they are still relevant since most meters are receiving NTEP approval at the current tolerance level and the original submitter of the items has not been active within the Task Group. The Task Group has also received permission to expand its scope to look into incorporating all milk measuring devices into one code.

The Committee recommended to maintain an Assigned status and the body concurred.

At the 2024 NEWMA Interim Meeting, Jim Willis commented as a Task Group member and believes the items are fully developed. Mike Smith (NY) commented that the tolerances in both tables are the same and will be a disservice to the dairy industry. Using historical data, NY created a spreadsheet on actual milk weights from small dairies and with these tolerances farmers could lose between $76,000 - $93,000 per year. Mike Smith agrees with the intent of a percentage-based tolerance to be uniform with other VTM codes, but the percentages are too high. Cheryl Ayer (NH) commented that the percentages could also be in favor of the farmers. Mike Smith responded that there is no wear and tear in the meters and if the calibration changes, it is not linear, but constant. Michael Peeler (NJ) and Jim Willis recommended Voting status.

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

Central Weights and Measures Association

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

CWMA S&T Committee recommended that the item be assigned to Milk Meter Tolerance 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 Milk Meter Tolerance Tolerance Task Group. Moving forward and staying with the original tolerances that were proposed. Requests to expand the item's scope has been submitted. There will be a Task Group meeting prior to the July 2022 NCWM Annual Meeting. And is hoping to move forward and elevate the item to Voting status for next cycle.

The CWMA S&T Committee recommended this proposal 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 Assigned to the Task Group.

During the 2024 CWMA Interim Meeting, the Committee received no comments on this item.

The Committee recommends a Voting Status for this item.

B3-MLK-23.2 A Table T.1. Tolerances for Milk Meters

(NOTE: During the 2024 Interim Meeting, the Committee agreed to block individual items VTM-20.2 and MLK-23.2 into new Item Block 3)

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 for larger test drafts.

The Submitter requested a Voting status for this Item.

NIST OWM Executive Summary

B3-MLK-23.2 Table T.1. Tolerances for Milk Meters

NIST OWM Recommendation: NIST OWM has no recommendation.

The proposed tolerances are those currently applied in OIML standards and seem to be a good starting point for discussion. We generally support, whenever possible, efforts to harmonize with OIML standards, but care should be taken to examine the increased tolerance and any adverse results that arise compared to the previously used tolerances. The S&T Committee at the 2024 Interim Meeting agreed to combine VTM-20.2 and MLK 23.1. NCWM Milk Meter Tolerance Task Group Chair Aaron Yankers (Colorado) held task group meetings March 6 and April 24, 2024 to discuss the proposal. The Task Group is reviewing and discussing various tolerances being applied for milk meter applications and Aaron continues to collect feedback from the Task Group concerning the proposed changes.

B3-MLK-23.2 Table T.1. Tolerances for Milk Meters

- The Task Group held two meetings to discuss the direction for the milk meters items. The Task Group discussed combining the milk meter requirements from all other codes in NIST Handbook 44 into a single new code section and is also reaching out to the original submitters of Block 3 items for clarity.
- The codes in NIST HB 44 that address the measurement of milk are NIST HB 44 Sections 3.31., 3.35., 3.37., and 4.42.
- Sections 3.31. Vehicle-Tank Meters and 3.35. Milk Meters currently have the same tolerances. Section 3.37. Mass Flow Meters has a different tolerance. Section 4.42. Farm Milk Tanks applies to farm milk tanks used for the commercial measurement of milk. The farm milk tank tolerances are different than the meter tolerances.
- NIST OWM supports the update of milk meter tolerances in NIST HB 44 for clarity. If OIML tolerances are adopted care should be taken to adopt those tolerances that are appropriate for this application where the U.S. only tests the complete system.
- If the Task Group plans to combine all milk measuring codes the group should consider:
  - For a VTM milk meter the product depletion test is considered as part of the official test of this meter type.
  - The tolerances for a farm milk tank are different than tolerances for the milk metering applications in NIST HB 44.

Table 2. Summary of Recommendations
B3-MLK-23.2 – Table T.1. Tolerances for Milk Meters

	Status Recommendation	Note*	Comments
Submitter	Voting		
OWM		5	
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 or not considered
3. No meeting held
4. Not submitted on agenda
5. No recommendation

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

	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 NCWM Milk Meter Tolerance 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 NIST HB 44 Section 3.35 Milk Meters Code.

Aaron Yanker (Colorado) is the Milk Meter Tolerance Task Group Chair. The Task Group met to review the proposed changes to the tolerances to ensure they are fully vetted by industry and the weights and measures community.

The Task Group met March 6 and April 24, 2024. Many of the task group members were not present at the March 6, 2024 meeting but participants forwarded information concerning the tolerances to Aaron for discussion at the April 24, 2024 meeting. At its April 24, 2024 meeting the NCWM Milk Meter Tolerance

Task Group discussed combining all of the HB 44 milk meter codes and reaching out to the original submitters for clarity.

NIST OWM has no recommendation. The proposed tolerances are those currently used in OIML standards and seem to be a good starting point for changes to the tolerances. Generally we support, whenever possible, efforts to harmonize with OIML standards, but care should be taken to examine the increased tolerance and any adverse results that arise compared to the previously used tolerances.

Summary of Discussions and Actions:

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

At the NCWM 2023 Annual Meeting the Chair of the Specifications and Tolerances Committee asked for a volunteer to chair the Task Group.

At the NCWM 2024 Interim Meeting during open hearings, the Committee heard from Aaron Yanker, the newly appointed chairperson of the Milk Meter Tolerance Task Group. The Committee agrees with the chairperson that these items should remain assigned, and the scope of the task group should be expanded to study the possibility of creating a new section in the handbook to capture all devices in commercial use to measure milk. To facilitate better discussion and the possibility of new proposals, the Committee has blocked these items together. The Committee requests the Task Group provide an update on the items in the block, as well as the feasibility of establishing a new section in the handbook during the 2024 Annual Meeting.

The S&T Committee agreed to combine Items MLK 23.2 and VTM-20.2 in a block item and further designated the block item with an Assigned status.

At the 2024 NCWM Annual Meeting Open Hearings the Chair of the Milk Meter Tolerance Task Group noted that the item was ready for voting. The S&T Committee agreed with the Voting status, but since the item had held an assigned status, to ensure due process, it could not be elevated to Voting status at the 2024 Annual Meeting. The Committee indicated the item could be given Voting status at the 2025 NCWM Interim Meeting.

Note: Since Items MLK-23.2 and VTM-20.2 are now combined in Block 3 subsequent reporting for all NCWM meetings and regional meetings will fall under the same sections for both items.

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 item be combined with Item VTM-20.2 and further recommended their assignment to the NCWM Milk Meter Tolerance Task Group. In the original justification, the submitter had also 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.

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

Aaron Yanker representing the NCWM Milk Meter Tolerance Task Group updated the body that there is currently no Chair for the Task Group and no updates.

The WWMA 2023 S&T Committee recommended this item remain Assigned to the NCWM Milk Meter Tolerance Task Group for further development and looks forward to a Chair being appointed and an update provided. The Committee also recommended this item be blocked with Item VTM-20.2.

At the 2024 WWMA Annual Meeting Aaron Yanker, NCWM Milk Meter Tolerance Task Group Chair, reported the Task Group has met several times in the last year and determined the two items in this block are fully developed. The Chair has met with the original submitter of the two items and concluded the items are developed. The Milk Meter Tolerance Task Group recommends the blocked items be assigned a Voting status.

The 2024 WWMA S&T Committee recommends a Voting status.

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 NCWM Milk Meter Tolerance Task Group.

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

At the 2023 SWMA Annual Meeting, Matt Curran recommended blocking this item with VTM 20.2.

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.

During the 2024 NEWMA Annual Meeting, Jim Willis (NY) gave an update from Milk Meter Task Group. The TG is looking at all items within the block to determine if they are still relevant since most meters are receiving NTEP approval at the current tolerance level and the original submitter of the items has not been active within the TG. The TG has also received permission to expand its scope to look into incorporating all milk measuring devices into one code.

The Committee recommended to maintain an Assigned status and the body concurred.

At the 2024 NEWMA Interim meeting, Jim Willis (NY) commented as a TG member and believes the items are fully developed. Mike Smith (NY) commented that the tolerances in both tables are the same and will

be a disservice to dairy industry. Using historical data, NY created a spreadsheet on actual milk weights from small dairies and with these tolerances farmers could lose between $76,000 - $93,000 per year. Mike agrees with the intent of a percentage-based tolerance to be uniform with other VTM codes, but the percentages are too high. Cheryl Ayer (VT) commented that the percentages could also be in favor of the farmers. Mike Smith responded that there is no wear and tear in the meters and if the calibration changes, it is not linear, but constant. Michael Peeler (NJ) and Jim Willis (NY) recommended a voting.

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

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 recommended this item remain as Assigned to the NCWM Milk Meter Tolerance Task Group.

At the 2023 CWMA Interim Meeting, the Committee recommended this item be blocked with Item VTM-20.2 and remain as assigned to the NCWM Milk Meter Tolerance Task Group so that a chair can be appointed and established concerns continue to be addressed.

During the 2024 CWMA Annual Meeting, the Committee received no comments on this item. The Committee recommended this block remain as an Assigned item.

At the 2024 CWMA Interim Meeting, the Committee received no comments on this item. The Committee recommends a Voting Status for this item.

References:

NIST OWM Analysis and Executive Summary reports **https://www.nist.gov/pml/weights-and-measures/publications/owm-technical-analysis**

National Conference on Weights and Measures Publication 15 (2023) and 16 (2022) **https://www.ncwm.com**

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

AAR

Association of American Railroads

ABWS

Automatic Bulk Weighing System

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 Council 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

PUB

Publication

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