

Report of the Specifications and Tolerances (S&T) Committee

Mahesh Albuquerque, Committee Chair
Colorado

300 INTRODUCTION

This is the final report of the Specifications and Tolerances (S&T) Committee (hereinafter referred to as the “Committee”) for the 101st Annual Meeting of the National Conference on Weights and Measures (NCWM). This report is based on the Interim Report offered in the NCWM Publication 16, “Committee Reports,” testimony at public hearings, comments received from the regional weights and measures associations and other parties, the addendum sheets issued at the Annual Meeting, and actions taken by the membership at the voting session of the Annual Meeting. The Informational items shown below were adopted as presented when this report was approved. This report contains those recommendations to amend National Institute of Standards and Technology (NIST) Handbook 44 (2016), “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.”

Table A identifies the agenda and appendix items by reference key, title of item, page number, and the appendices by appendix designations. The acronyms for organizations and technical terms used throughout the agenda are identified in Table B. The first three digits of the Reference Key Numbers of the items are assigned from the Subject Series List. The status of each item contained in the report is designated as one of the following: **(D) Developing Item:** the Committee determined the item has merit; however, the item was returned to the submitter or other designated party for further development before any action can be taken at the national level; **Informational (I) Item:** the item is under consideration by the Committee but not proposed for Voting; **(V) Voting Item:** the Committee is making recommendations requiring a vote by the active members of NCWM; **(W) Withdrawn Item:** the item has been removed from consideration by the Committee.

Table C provides a summary of the results of the voting on the Committee’s items and the report in its entirety. Some Voting Items are considered individually; others may be grouped in a consent calendar. Consent calendar items are Voting Items that the Committee has assembled as a single Voting Item during their deliberation after the open hearings on the assumption that the items are without opposition and will not require discussion. The Voting Items that have been grouped into consent calendar items will be listed on the addendum sheets. Prior to adoption of the consent calendar, the Committee entertains any requests from the floor to remove specific items from the consent calendar to be discussed and voted upon individually.

Proposed revisions to the handbook(s) are shown as follows: 1) deleted language is indicated with a **bold face font using strikeouts** (e.g., ~~this report~~), 2) proposed new language is indicated with an **underscored bold faced font** (e.g., new items), and 3) nonretroactive items are identified in *italics*. When used in this report, the term “weight” means “mass.”

Note: The policy of NIST and NCWM is to use metric units of measurement in all of their publications; however, recommendations received by NCWM technical committees and regional weights and measures associations have been printed in this publication as submitted. Therefore, the report may contain references to U.S. customary units.

Subject Series List

Introduction	300 Series
NIST Handbook 44 – General Code.....	310 Series
Scales.....	320 Series
Belt-Conveyor Scale Systems	321 Series
Automatic Bulk Weighing Systems	322 Series
Weights.....	323 Series
Automatic Weighing Systems	324 Series
Weigh-In-Motion Systems used for Vehicle Enforcement Screening.....	325 Series
Liquid-Measuring Devices	330 Series
Vehicle-Tank Meters	331 Series
Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices	332 Series
Hydrocarbon Gas Vapor-Measuring Devices.....	333 Series
Cryogenic Liquid-Measuring Devices.....	334 Series
Milk Meters	335 Series
Water Meters	336 Series
Mass Flow Meters	337 Series
Carbon Dioxide Liquid-Measuring Devices.....	338 Series
Hydrogen Gas-Metering Devices	339 Series
Electric Vehicle Refueling Systems	33X Series
Vehicle Tanks Used as Measures	340 Series
Liquid Measures	341 Series
Farm Milk Tanks	342 Series
Measure-Containers.....	343 Series
Graduates.....	344 Series
Dry Measures	345 Series
Berry Baskets and Boxes.....	346 Series
Fabric-Measuring Devices.....	350 Series
Wire-and Cordage-Measuring Devices	351 Series
Linear Measures	352 Series
Odometers	353 Series
Taximeters.....	354 Series
Timing Devices	355 Series
Grain Moisture Meters	356 Series
Near-Infrared Grain Analyzers.....	357 Series
Multiple Dimension Measuring Devices	358 Series
Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices	359 Series
Other Items	360 Series

Table A
Table of Contents

Reference Key	Title of Item	Page S&T
300	INTRODUCTION	1
310	NIST HANDBOOK 44 - GENERAL CODE	7
310-1	V G-S.1. Identification. – (Software	7
310-2	V G-S.9. Metrologically Significant Software Updates.....	14
320	SCALES.....	15
320-1	W S.1.1.3. Automated Batching Systems (See Related Item 360-3).....	15
320-2	V S.5.4. Relationship of Load Cell Verification Interval to the Scale Division	18
320-3	V N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales and N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales.	25
322	AUTOMATIC BULK WEIGHING SYSTEMS	28
322-1	D A. Application, S Specifications, N. Notes, UR. User Requirements	28
322-2	W N.1. Testing Procedures. and T. Tolerances	35
325	WEIGH-IN-MOTION SYSTEMS USED FOR VEHICLE ENFORCEMENT SCREENING	42
325-1	I A. Application. and Sections Throughout the Code to Address Commercial and Law Enforcement.....	42
330	LIQUID MEASURING DEVICES	52
330-1	V S.1.6.3. Return toZero (See Related Items 331-1 and 332-1)	52
330-2	V S.X.X. Card Operated Retail Motor Fuel Devices	56
330-3	V N.4.5. Verification of Linearization Factors	58
330-4	D Recognize the Use of Digital Density Meters.....	62
331	VEHICLE-TANK METERS	64
331-1	V S.1.1.5. Return to Zero, S.1.1.6. Initial Zero Indication – Electronic Devices (See Related Items 330-1 and 332-1).....	64
331-2	V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 332-4, 334-1, 335-1, 337-1, 338-1 and 339-1).....	66
331-3	D S.3.7. Manifold Hose Flush System.....	67
331-4	V N.4.6. Verification of Linearization Factors.	72
332	LPG AND ANHYDROUS AMMONIA LIQUID-MEASURING DEVICES.....	76
332-1	V S.1.4.2. Return to Zero, S.1.4.3. Initial Zero Indication – Electronic Devices. (See Related Items 3301 and 3311).....	76
332-2	V S.1.4.3. Provisions for Power Loss, S.1.5.1.1. Unit Price., S.1.5.1.2. Product Identity., S.1.6. For Retail Motor Vehicle Fuel Devices Only., S.1.7. For Wholesale Devices Only., UR.2.7. Unit Price and Product Identity., and UR.2.8. Computing Device.	78
332-3	V S.2.1. Vapor Elimination	84
332-4	V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 334-1, 335-1, 337-1, 338-1 and 339-1).....	86
332-5	D N.3. Test Drafts.....	88
332-6	I N.4.2.3. For Wholesale Devices	93
332-7	V UR.2.3. Vapor-Return Line	95

334	CRYOGENIC LIQUID-MEASURING DEVICES	97
334-1	V Table S.252. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 335-1, 337-1, 338-1, and 339-1).....	97
335	MILK METERS	98
335-1	V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 337-1, 338-1, and 339-1).....	98
337	MASS FLOW METERS	100
337-1	V Table S.3.5. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 335-1, 338-1, and 339-1).....	100
337-2	V Appendix D – Definitions: Diesel Liter Equivalent (DLE) and Diesel Gallon Equivalents (DGE) for Compressed Natural Gas and Liquefied Natural Gas; Definition of Gasoline Gallon Equivalent and Gasoline Liter Equivalent for Compressed Natural Gas; S.1.2. Compressed Natural Gas and Liquefied Natural Gas Dispensers; S.1.3.1.1. Compressed Natural Gas Used as an Engine Fuel; S.1.3.1.2. Liquefied Natural Gas Used as an Engine Fuel; S.5.2. Marking of Diesel and Gasoline Volume Equivalent Conversion Factor; Compressed Natural Gas, S.5.3. Marking of Diesel Volume Equivalent Conversion Factor; Liquefied Natural Gas, UR.3.1.1. Marking of Equivalent Conversion Factor for Compressed Natural Gas, UR.3.1.2. Marking of Equivalent Conversion Factor for Liquefied Natural Gas, and UR.3.8. Return of Product to Storage, Retail Compressed Natural Gas and Liquefied Natural Gas	102
337-3	D N.3. Test Drafts.....	108
338	CARBON DIOXIDE LIQUID-MEASURING DEVICES	110
338-1	V Table S.2.5. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 335-1, 337-1, and 339-1).....	110
338-2	V S.3.1. Vapor Elimination	112
339	HYDROGEN GAS-METERING DEVICES.....	113
339-1	V Table S.3.3. Categories of Sealing and Methods of Sealing (See Related Items 3312, 3324, 3341, 3351, 337-1, and 338-1).....	113
339-2	V Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas-Measuring Devices.....	115
354	TAXIMETERS	119
354-1	V S.1.2. Advancement of Indicating Elements.....	119
354-2	V S.2. Basis of Fare Calculations	124
354-3	V S.3.2. Flag	125
354-4	V Appendix D - Definitions: Flat Rate and Negotiated Rate.....	127
354-5	D USNWG on Taximeters – Taximeter Code Revisions and Global Positioning System-Based Systems for Time and Distance Measurement	128
354-6	W Transportation Network Systems – Draft Code	130
358	MULTIPLE DIMENSION MEASURING DEVICES	139
358-1	V Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems, Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.1.a.	139
358-2	V Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems, Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.1.a.	141
360	OTHER ITEMS.....	150
360-1	D Electric Watthour Meters Code under Development	150

360-2	W	Appendix A – Fundamental Considerations, 2.1. Acceptance and Maintenance Tolerances	152
360-3	I	Appendix D – Definitions: Batching System (See Related Item 320-1).....	157
360-4	V	Appendix D – Definitions: Calibration Parameter	159
360-5	D	Appendix D – Definitions: Remote Configuration Capability.....	161

Appendices		Page
A	Item 320-2: SMA’s Presentation Slides – V_{min}	A1
B	Item 325-1: Rinstrum WIM Presentation	B1
C	Items 330-3 and 331-4: (Draft) Guidance on Empirical Analysis.....	C1

Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
API	American Petroleum Institute	NCWM	National Conference on Weights and Measures
CC	Certificate of Conformance	NEWMA	Northeastern Weights and Measures Association
CNG	Compressed Natural Gas	NIST	National Institute of Standards and Technology
CWMA	Central Weights and Measures Association	NGSC	NCWM Natural Gas Steering Committee
DGE	Diesel Gallon Equivalent	NTEP	National Type Evaluation Program
DLE	Diesel Liter Equivalent	OIML	International Organization of Legal Metrology
DOT	Department of Transportation	OWM	Office of Weights and Measures
FALS	Fuels and Lubricants Subcommittee	RMFD	Retail Motor Fuel Dispenser
FHWA	Federal Highway Administration	S&T	Specifications and Tolerances
GGE	Gasoline Gallon Equivalent	SD	Secure Digital
GLE	Gasoline Liter Equivalent	SI	International System of Units
GMM	Grain Moisture Meter	SMA	Scale Manufacturers Association
GPS	Global Positioning System	SWMA	Southern Weights and Measures Association
IEC	International Electrotechnical Commission	TC	Technical Committee
LMD	Liquid Measuring Devices	USNWG	U.S. National Work Group
LNG	Liquefied Natural Gas	WIM	Weigh-in-Motion
MMA	Meter Manufacturers Association	WWMA	Western Weights and Measures Association

Table C
Summary of Voting Results

<i>Reference Key Number</i>	<i>House of State Representatives</i>		<i>House of Delegates</i>		<i>Results</i>
	<i>Yeas</i>	<i>Nays</i>	<i>Yeas</i>	<i>Nays</i>	
Consent Calendar: 310-1, 310-2, 320-2, 320-3, 330-1, 330-3, 331-1, 331-2, 331-4, 332-1, 332-2, 332-3, 332-4, 332-7, 334-1, 335-1, 337-1, 338-1, 338-2, 339-1, 354-2, 354-3, 354-4, 358-1, 358-2, 358-3, 360-4	38	0	45	0	Adopted
330-2	36	3	39	10	Adopted
337-2	30	7	30	11	Adopted
339-2	29	7	40	6	Adopted
354-1	35	1	49	0	Adopted
To Accept the Report	Voice Vote				Adopted

Details of All Items
(In order by Reference Key)

310 NIST HANDBOOK 44 - GENERAL CODE**310-1 V G-S.1. Identification. – (Software)**

(This item was Adopted.)

Source:

This item originated from the NTEP Software Sector and first appeared on NCWM S&T Committee’s 2007 agenda as Developing Item Part 1, Item 1 and in 2010 as Item 310-3.

Purpose:

Provide marking requirements that enable field verification of the appropriate version or revision for metrological software, including methods other than “permanently marked,” for providing the required information.

Item under Consideration:

Amend *NIST Handbook 44*: G-S.1. Identification as follows:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;
- (b) a model identifier that positively identifies the pattern or design of the device;
 - (1) *The model identifier shall be prefaced by the word “Model,” “Type,” or “Pattern.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.). The abbreviation for the word “Model” shall be “Mod” or “Mod.” Prefix lettering may be initial capitals, all capitals, or all lowercase.*
[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)
- (c) *a nonrepetitive serial number, except for equipment with no moving or electronic component parts and ~~not built for purpose software-based software devices~~ software;*
[Nonretroactive as of January 1, 1968]
(Amended 2003 **and 2016**)
 - (1) *The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.*
[Nonretroactive as of January 1, 1986]
 - (2) *Abbreviations for the word “Serial” shall, as a minimum, begin with the letter “S,” and abbreviations for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., S/N, SN, Ser. No., and S. No.).*
[Nonretroactive as of January 1, 2001]

- (d) the current software version or revision identifier for not-built-for-purpose software-based devices; **manufactured as of January 1, 2004 and all software-based devices (or equipment) manufactured as of January 1, 2022;**

[Nonretroactive as of January 1, 2004]

(Added 2003) **(Amended 2016)**

(1) *The version or revision identifier shall be:*

- i. *prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision;*

[Nonretroactive as of January 1, 2007]

(Added 2006)

Note: If the equipment is capable of displaying the version or revision identifier but is unable to meet the formatting requirement, through the NTEP type evaluation process, other options may be deemed acceptable and described in the CC.

(Added 2016)

- ii. ***continuously displayed or be accessible via the display. Instructions for displaying the version or revision identifier shall be described in the CC. As an alternative, permanently marking the version or revision identifier shall be acceptable providing the device does not always have an integral interface to communicate the version or revision identifier.***

[Nonretroactive as of January 1, 2022]

(Added 2016)

- (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.). **Prefix lettering may be initial capitals, all capitals, or all lowercase.***

[Nonretroactive as of January 1, 2007]

(Added 2006) **(Amended 2016)**

- (e) a National Type Evaluation Program (NTEP) Certificate of Conformance (CC) number or a corresponding CC Addendum Number for devices that have a CC.

(1) *The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms “NTEP CC,” “CC,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.)*

[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

(Amended 1985, 1991, 1999, 2000, 2001, 2003, ~~and~~, 2006, **and 2016**)

Background/Discussion:

The Item under Consideration above replaces that which was presented at the 100th NCWM Annual Meeting in July 2015 at the request of the NTEP Software Sector Committee and includes additional modifications made by the Committee at the 101st Annual Meeting in July 2016.

Among other tasks, the NTEP Software Sector was charged by the NCWM Board of Directors to recommend NIST Handbook 44 specifications and requirements for software incorporated into weighing and measuring devices, which

may include tools used for software identification. During its October 2007 meeting, the Sector discussed the value and merits of required markings for software, including possible differences in some types of software-based devices and methods of marking requirements. After hearing several proposals, the Sector agreed to the following technical requirements applicable to the marking of software:

1. The NTEP CC Number must be continuously displayed or hard-marked;
2. The version must be software-generated and shall not be hard-marked;
3. The version is required for embedded (Type P) software;
4. Printing the required identification information can be an option;
5. Command or operator action can be considered as an option in lieu of a continuous display of the required information; and
6. Devices with Type P (embedded) software must display or hard-mark the device make, model, and serial number to comply with G S.1. Identification.

In 2008, the Software Sector developed and submitted a proposal to the NCWM S&T Committee to modify G-S.1. and associated paragraphs to reflect these technical requirements. Between 2008 and 2011, this item appeared on the S&T Committee's main agenda and the Committee and the Sector received numerous comments and suggestions relative to the proposal. The Sector developed and presented several alternatives based on feedback from weights and measures officials and manufacturers. Among the key points and concerns raised during discussions over this period were how to address the following:

- (a) **Limited Character Sets and Space.** – How to address devices that have limited character sets or restricted space for marking.
- (b) **Built-for-Purpose vs. Not-Built-for-Purpose.** – Whether or not these should be treated differently.
- (c) **Ease of Access.** – Ease of accessing marking information in the field.
 - Complexity of locating the marking information
 - Use of menus for accessing the marking information electronically
 - Limits on the number of levels required to access information electronically
 - Possibility of single, uniform method of access
- (d) **Hard Marking vs. Electronic.** – Whether or not some information should be required to be hard marked on the device.
- (e) **Continuous Display.** – Whether or not required markings must be continuously displayed.
- (f) **Abbreviations and Icons.** – Establishment of unique abbreviations, identifiers, and icons and how to codify those.
- (g) **Certificate of Conformance Information.** – How to facilitate correlation of software version information to a CC, including the use of possible icons.

Further details on the alternatives considered can be found in the Committee's Final Reports from 2008 to 2015.

OWM's 2014 Amendments to the Proposal:

Prior to the 2014 NTEP Weighing Sector (WS) meeting, members of OWM's Legal Metrology Devices Program (LMDP) amended the proposal appearing on the Committee's agenda in 2014; this was done after being asked by the NTEP Software Sector (SS) to provide additional input and draft modifications to paragraphs G-S.1. and G.S.1.1. in consideration of the goals of the SS and the comments provided during the 2014 open hearings of the S&T Committee relating to this item. *Technical Advisors note: It was OWM's amended version of the proposal that was reviewed by the Sectors at the joint meetings of the WS and SS in 2014, and the MS and SS in 2015 and, after slight modification, was voted on and approved at the NCWM Annual Meeting in 2016.*

The following is a list of the goals provided by the SS in modifying G-S.1. and G.S.1.1. as communicated to the members of OWM's LMDP:

1. Remove the existing distinction between software identification requirements for built-for-purpose and not-built-for-purpose devices.
2. Require that all software-based devices have a software version or revision identifier for metrologically significant software.
3. Require that certified software versions or revision identifiers for metrologically significant software are recorded on the CC for access by inspectors. Software itself does not require serial numbers.
4. Require that a software-based device's version or revision identifier shall be accessible via the display and user interface and only if the device's display is incapable of displaying the identifier or has no display and/or interface; then permanently marking the version or revision identifier shall be acceptable (e.g., a digital load cell).
5. Nonretroactive as of January 1, 2016, if passed by the NCWM in July 2015.

OWM's LMDP developed the following proposed alternative changes to G-S.1. (based on the SS's request for additional input on how best to meet its goals) and forwarded them to the Chairman of the SS for consideration at the 2014 WS/SS joint meeting:

Amend NIST Handbook 44: G-S.1. as follows:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;
- (b) a model identifier that positively identifies the pattern or design of the device;
 - (1) *The model identifier shall be prefaced by the word "Model," "Type," or "Pattern." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod." Prefix lettering may be initial capitals, all capitals, or all lowercase.*
[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)
- (c) *a nonrepetitive serial number, except for equipment with no moving or electronic component parts and ~~not built for purpose software-based devices~~ software;*
[Nonretroactive as of January 1, 1968]
(Amended 2003)

- (1) *The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.*
[Nonretroactive as of January 1, 1986]
- (2) *Abbreviations for the word “Serial” shall, as a minimum, begin with the letter “S,” and abbreviations for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., S/N, SN, Ser. No., and S. No.).*
[Nonretroactive as of January 1, 2001]
- (d) **the current software version or revision identifier for not-built-for-purpose software-based devices; manufactured as of January 1, 2004 through December 31, 2015, and all software based devices or equipment manufactured as of January 1, 2016;**
[Nonretroactive as of January 1, 2004]
 (Added 2003) **(Amended 20XX)**
- (1) *The version or revision identifier shall be:*
- i. *prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision;*
[Nonretroactive as of January 1, 2007]
 (Added 2006)
- ii. **directly linked to the software itself; and**
[Nonretroactive as of January 1, 2016]
(Added 20XX)
- iii. **continuously displayed* or be accessible via the display menus. Instructions for displaying the version or revision identifier shall be described in the CC. As an exception, permanently marking the version or revision identifier shall be acceptable providing the device does not have an integral interface to communicate the version or revision identifier.**
[Nonretroactive as of January 1, 2016]
(Added 20XX)
- *The version or revision identifier shall be displayed continuously on software-based equipment with a digital display manufactured as of January 1, 20XX and all software-based equipment with a digital display as of January 1, 20YY.**
- (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.).*
[Nonretroactive as of January 1, 2007]
 (Added 2006)
- (e) *an National Type Evaluation Program (NTEP) Certificate of Conformance (CC) number or a corresponding CC Addendum Number for devices that have a CC.*
- (1)** *The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms “NTEP CC,” “CC,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.)*
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

(Amended 1985, 1991, 1999, 2000, 2001, 2003, ~~and~~, 2006 ~~and~~ 201X)

OWM's LMDP did not propose any changes to subparagraph G-S.1.1. since the SS had indicated earlier that it may be possible to eventually eliminate G-S.1.1. Additionally, OWM's LMDP made it known to the SS that the shaded portion of G-S.1.(d)(1)iii. of their proposed alternative changes, did not reflect any of the goals communicated by the SS and was being offered for consideration with the understanding that:

1. this change will make it easier in the future for inspectors to be able to identify software installed in equipment;
2. a reasonable amount of time for the changes to take effect can be specified; and
3. it is probable that improvements in technology over time will make it easier for equipment manufacturers to comply.

2014 Joint Meeting of the NTEP Weighing and Software Sectors:

At its 2014 meeting, the WS met jointly with the SS to consider the proposal as amended by OWM's LMDP. After further amending it, the two Sectors agreed to submit the revised proposal to the weights and measures regional associations for consideration and requested the item's status be changed from Developing to Informational. It was also decided during the joint meeting that no changes to G-S.1.1. were necessary since the two sectors had agreed that the term "not-built-for-purpose software-based devices" in G-S.1.(d) would be retained. See the 2014 Weighing Sector Meeting Summary for additional details and to view the changes made to the proposal at the joint WS/SS meeting.

2015 Joint Meeting of NTEP Measuring and Software Sectors:

At its 2015 meeting, the MS met jointly with the SS to consider the proposal that had been revised at the joint meeting of the WS and SS in 2014. Some additional changes were made to the proposal at the MS/SS meeting to address some remaining concerns. See the 2015 SS Meeting Summary for details.

The two Sectors (MS and SS) agreed to forward the proposal to each of the regional S&T Committees and ask they consider assigning it a Voting status. They also recommended that the National Committee consider making this a Voting item in 2016.

See the 2015 S&T Committee's Annual Report to view a summary of the comments that the Committee received on the revised proposal to amend paragraphs G-S.1. Identification and G-S.1.1. Location of Marking Information for Not-Built-For-Purpose, Software-Based Devices and the actions taken by the Committee on this item.

2016 NCWM Interim Meeting:

At its 2016 NCWM Interim Meeting open hearings, the Committee received comments in support of the proposal from regulatory officials and industry representatives alike. Mr. Michael Keilty (Endress & Hauser Flowtec AG USA), in his capacity as Chairman of the Measuring Sector, reported that the Measuring Sector had reviewed the most recent proposal at its 2015 meeting and members of the Sector supported the language as written. Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that its members supported the proposal. Ms. Tina Butcher (NIST, OWM) noted that OWM continues to support the efforts of the Software Sector (SS) and believes the current proposal is close to being agreeable to members of the different Sectors who have participated in its development. In its analysis of the proposal, OWM questioned whether or not it would be clear to those *not* involved in the development of the language, what is meant by, "a device that does not *always* have an integral interface" in G-S.1.(d)(1)ii. With respect to this concern, OWM had contacted the Chairman of the SS who explained that some meter manufacturers had indicated that they offer an optional display with some products. For production purposes, it would be preferable to hard mark all such devices, not knowing if they will be deployed with a display. OWM suggested, should the Committee also believe that the language is not clear, it might consider amending the proposal by adding additional clarification to improve understanding. OWM offered the following for consideration:

ii. continuously displayed...device does not always have an integral interface to communicate (i.e., a display is offered as optional equipment by the manufacturer) the version or revision identifier.

OWM also suggested the following change to the proposed note in (1) i. of the proposal:

Note: If the equipment is capable of displaying the version or revision identifier but is unable to meet incapable of complying with the formatting requirement, other options may be deemed acceptable through the NTEP type evaluation process, and described in the CC.

(Added 20XX17)

Ms. Butcher also noted that in considering the proposed removal of the language “directly linked to the software itself” in ii. of the previous version of the proposal, OWM recognizes that if it is possible to independently modify the version number without any changes to the software itself (or vice versa), this would facilitate fraud. Thus, it is important that type evaluation criteria be included in NCWM Publication 14 to verify that neither one can be changed without changing the other. Consideration might be given to proposing the addition of a requirement discussed by the SS in 2010 as a *future* proposal in NIST Handbook 44 or NCWM Publication 14. Ms. Butcher shared the following proposed requirement that had been discussed by the SS in 2010:

Software-based electronic devices shall be designed such that the metrologically significant software is clearly identified by the version or revision number and this identification shall be directly and inseparably linked to the software itself. The version or revision number may consist of more than one part, but at least one part shall be dedicated to the metrologically significant software.

In discussing this item, members of the Committee agreed that the language in the current proposal could perhaps be made clearer, yet they were reluctant to change the proposal given its wide acceptance by all the different parties involved in its development. Consequently, the Committee agreed to recommend this item as shown in the Item Under Consideration for Vote.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee received a number of comments in support of the proposal and no comments in opposition.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA supports the work of the Software Sector; supports this item as written; and recommended the item move forward as a Voting item.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, also voiced support for the item as written.

Ms. Tina Butcher (NIST, OWM) stated that OWM continues to support the efforts of the Software Sector and believes the current proposal, if adopted, is likely to achieve the goals established by that Sector as communicated to OWM in 2014. She reiterated a previous OWM suggestion to insert parenthesis around the words “or equipment” in G-S.1.(d) of the proposal and asked the Committee to insert this into the current proposal. She also asked that the Committee consider creating a new item for consideration in the 2016 - 2017 NCWM cycle which would propose the addition of some new language into paragraph G-S.1. to address the SS’s earlier removal of the language, “directly linked to the software itself.” In making this suggestion, Ms. Butcher noted that NIST, OWM believes it is important that type evaluation criteria be included in NCWM Publication 14 to verify that any change to metrologically significant elements of software used in the device coincides with an update to the version number for that software. The ability to independently change either the version number or the software without a corresponding change to the other would facilitate the perpetration of fraud.

During the Committee’s open hearings, the Committee agreed the words “or equipment” in G-S.1.(d) of the proposal should be contained inside of parentheses as suggested by NIST, OWM and the Committee amended the proposal accordingly, as shown in Item Under Consideration. With respect to OWM’s second suggestion that the Committee create a new item for consideration in the 2016 - 2017 NCWM cycle, members of the Committee asked the NIST Technical Advisor if OWM might do this, rather than the Committee, since it was OWM’s suggestion. The Committee agreed to recommend the item, as amended, for Vote.

Regional Association Comments:

At its 2015 Annual Meeting, the WWMA reviewed the amended proposal. During opening hearings, it was noted that the SMA would discuss this proposal at their November meeting. The NTEP Software Sector had agreed to replace the proposal that appeared in the agenda of the 2015 Annual Meeting with this proposal. The WWMA recommended that this item be an Informational item.

At its fall 2015 Interim Meeting, the CWMA received comments that this item is a revision from the original. A representative of Mettler-Toledo commented that a key change was the removal of a requirement that the software version be linked with the software itself. The industry representative indicated the item is ready to be moved to a Voting status, although there has been no input or comments from the scale manufacturers sector. The CWMA recommended that this item be a Voting item and reaffirmed this position at its spring 2016 Annual Meeting.

At its fall 2015 Interim Meeting, NEWMA reported that it believes this item, which has been developing for a number of years, has shown significant progress; however, it is not ready for a Vote. NEWMA recommended that the item remain a Developing item. At its spring 2016 Annual Meeting, NEWMA reported it believes the item is fully developed and recommended it be presented for Vote at the upcoming NCWM Annual Meeting.

At its 2015 Annual Meeting, the SWMA recommended that this item be a Voting item as proposed based on the comments heard during open hearings and the Committee's position last year on the item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

310-2 V G-S.9. Metrologically Significant Software Updates

(This item was Adopted.)

Source:

NTEP Software Sector (2016)

Purpose:

Clarify that metrologically significant software shall be sealable.

Item under Consideration:

Amend NIST Handbook 44 General Code as follows:

G-S.9. Metrologically Significant Software Updates. – A software update that changes the metrologically significant software shall be considered a sealable event.

(Added 2016)

Background/Discussion:

The NTEP Software Sector believes that metrologically significant software is equally as important as other sealable parameters. While G-S.8. could be construed as requiring software to be sealable, it would be better to make the requirement explicit. G-S.8 refers to changing adjustable components, which may be interpreted as not being applicable to software.

The Software and Measuring Sector attendees, as well as the lab representatives, are in consensus that the proposed G-S.9. should be moved forward to the S&T Committee to be considered as a Voting item in 2016. The proposal was also reviewed with the Weighing Sector in 2014 and gained their consensus.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting open hearings, several regulatory officials and industry representatives voiced support for the proposal. Ms. Tina Butcher (NIST, OWM) commented that it is only reasonable to expect

metrologically significant software updates to be protected using a physical seal or other means of security. Mr. Michael Keilty (Endress & Hauser Flowtec AG USA), speaking on behalf of the Measuring Sector, agreed with NIST, OWM that this is a reasonable expectation. Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA supports the efforts of the Software Sector and recommends the item move forward as a Voting item.

The Committee did not receive any comments opposing this proposal and, considering the comments heard in support, the Committee agreed to recommend the item for Vote.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee received comments in support of the item from Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, and Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA. Ms. Tina Butcher (OWM) reiterated the comments OWM provided at the 2016 NCWM Interim Meeting that it is reasonable to expect metrologically significant software updates to be protected with a physical seal or other means of security.

Hearing no comments in opposition to the proposal and in consideration of the comments heard in support of it, the Committee agreed to present the item for Vote.

Regional Association Comments:

At its fall 2015 meeting, the WWMA did not receive any comments on this item during opening hearings. The WWMA S&T Committee supports and appreciates the Software Sector’s work on this item. The WWMA forwarded the item to NCWM, recommending that it be a Voting item.

At its 2015 fall Interim Meeting, the CWMA received comments from a representative of Mettler-Toledo indicating this item is ready to be moved to Voting status. A Minnesota regulatory official also supported the concept and commented that the item should move to Voting status. The CWMA forwarded this item to NCWM and recommended that it be a Voting item. The CWMA also recommended the item move forward as a Voting item at its spring 2016 Annual Meeting, reporting that it feels this item is fully developed and that the comments received during the meeting were in support of the item.

NEWMA reported, at its fall 2015 Interim Meeting, that it believes the metrologically significant software changes should be considered sealable parameters. NEWMA forwarded this item to NCWM and recommended that it be a Voting item. NEWMA also recommended a Voting status on the item at its spring 2016 Annual Meeting.

At its fall 2015 meeting, the SWMA heard no comments in opposition to this item and forwarded it to NCWM, recommending that it be a Voting item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

320 SCALES

320-1 W S.1.1.3. Automated Batching Systems (See Related Item 360-3)

(This item was Withdrawn.)

Source:

Richard Suiter Consulting (2016)

Purpose:

Assist weights and measures officials in determining the accuracy and correctness of batching systems already in the marketplace. The proposed language will also assist NTEP in future evaluations of these systems.

Item under Consideration:

Amend NIST Handbook 44 Scales Code as follows:

S.1.1.3. Automated batching Systems. – On an automated batching system making more than one draft, between drafts the system must return to a “center-of-zero” condition before a subsequent draft can begin. If the system fails to return to a “center-of-zero” condition the system shall interrupt the weighing sequence and shut down until the non-zero condition has been corrected.
[Nonretroactive as of January 1, 201X]

Background/Discussion:

Automated batching systems have existed in the marketplace for quite some time. NTEP has issued CCs for a number of these systems. There has always been the assumption that the systems would be required to meet NIST Handbook 44, Section 2.20. Scales. For systems with an NTEP CC, NTEP has used Section 2.20. to conduct the evaluation. There has been some concern in the more recent past regarding the ability of the systems to return to zero between drafts. While this is implied by other paragraphs in the section, it is not perfectly clear. This proposal will clarify that the systems are in fact required to return to zero at the end of each draft.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee agreed to group Items 320-1 and 360-3 together and receive comments simultaneously on these two items. The Committee acknowledged receiving written comments in opposition to both items in the group from Mr. Henry Oppermann (Weights and Measures Consulting, LLC).

Mr. Russ Vires (Mettler-Toledo, LLC) speaking on behalf of the SMA reported that the SMA opposes Item 320-1 for the following reasons:

- NIST Handbook 44 does not specify that other applications must return to a center-of-zero reference.
- There is no definition for an automated batching system in NIST Handbook 44.
- The technical merit for the proposed change is unclear.
- The SMA has concerns about how this change may affect equipment design and impact users of these systems.

With respect to Item 360-3, the SMA supports the item, but proposes the word “raw” be removed from the definition.

Mr. Rick Harshman (NIST, OWM) commented that OWM agrees with the SMA’s comment that the technical merit of the proposal in Item 320-1 is unclear. OWM does not believe the changes proposed are needed because:

1. requirements have already been established in the Scales Code to ensure that scales, including those used in an automated batching operation, return to zero once the load is removed from the load-receiving element; and
2. the “Zero-Load Balance Change” test in Scales Code paragraph N.1.9. confirms whether or not a scale consistently returns to zero once the load has been removed.

This test is considered part of the basic performance test of any scale (two exceptions being test procedures for ABWSs and single-draft, manually operated receiving hopper scales installed below grade and used to receive grain).

Mr. Harshman explained that to verify return to zero on an automated weighing system (including an automated batching system), it is necessary to observe the weighing system while in automatic operation. By observing the system in automatic operation, officials are able to tell whether or not:

- the value recorded for each draft weighed is the same as the value indicated for those drafts once loading has ceased and the weight of the load has stabilized; and

- all of the product for each draft discharges or is otherwise removed from the weighing/load-receiving element and that the scale then returns to zero before the next loading cycle commences.

If the scale is not returning to zero at the end of the discharge cycle, the scale should be rejected for failure to return to a zero-load balance condition.

An additional safeguard intended to ensure scales begin a weighing operation from a zero-load reference condition is Scales Code paragraph UR.4.1., which requires scale operators to maintain scales on zero at all times when the load-receiving element is empty.

Mr. Harshman noted NIST, OWM is aware of some automated weighing systems that do not consistently return to zero following the discharge of product during the discharge cycle due to: the density of the products being weighed; and the susceptibility of the product being weighed to cling to the weighing/load-receiving element; etc. Some of these systems do not meet the current NIST Handbook 44 definition of an “automatic bulk weighing system” nor the provisions of the ABWS Code. Product remaining in a weigh hopper or drum following the discharge cycle (often referred to as a “heel”) on a system that is automatic in operation results in a zero-load balance change. To determine accurately the amount of product discharged in each draft, the system must take into account the weight of each remaining heel and subtract it from the weight indicated for its corresponding load. It would not be appropriate in such cases for there to be an interlock that halts automatic operation and requires intervention of an operator to determine the cause of failure to return to zero. Furthermore, if intervention were to simply re-zero the scale, such action would result in false weighments.

With regard to adding a definition for “batching system” as proposed in Item 360-3, Mr. Harshman indicated that it is OWM’s view that there would be no benefit to adding the definition unless Item 320-1 is adopted.

Mr. Richard Suiter (Richard Suiter Consulting) explained that the intent of his proposal in Item 320-1 was to merely add an additional safeguard intended to apply to those applications where the system does not normally return to zero following discharge of the product during the discharge cycle. Mr. Suiter acknowledged the existence of some automated weighing systems that will typically retain a heel following discharge of the product during the discharge cycle. He agreed that more work was needed to draft requirements that could be applied to such systems.

With respect to Item 360-3, he encouraged the Committee to consider adopting the definition of “batching system” and reminded the Committee that the term is used in the Scales Code of NIST Handbook 44. He indicated that he had no objection to deleting the word “raw” from the proposed definition as recommended by the SMA.

In considering Item 320-1, the Committee, during its work session, agreed with the concept that an interlock might provide an added safeguard for some systems to start the next weighing cycle from a proper zero-load reference (e.g., systems that typically return to zero following discharge of the product). However, the Committee agreed to Withdraw this item based on concerns over the impact it might have on those automated weighing systems that do not consistently return to zero following discharge of the product, as was reported by OWM. The Committee agreed that if the correction made by an operator were to simply zero the scale when the change in zero was caused by a heel remaining on the weighing/load-receiving element, such action would likely result in an inaccurate weight determination.

With respect to Item 360-3, the Committee agreed to amend the proposed definition by deleting the word “raw” as suggested by the SMA and as shown in Item Under Consideration for Item 360-3. The Committee further agreed to present the Item 360-3 for Vote at the Annual Meeting.

Regional Association Comments:

At its 2015 Annual Meeting, the WWMA heard support for moving this item forward as a Voting item from an industry representative. Ms. Tina Butcher, NIST OWM, commented that a similar item was submitted to the CWMA and recommended a status of Developing so that the two items can be reconciled. The WWMA believes that this item has merit and forwarded it to NCWM, recommending it be a Voting item.

At its 2015 Interim Meeting, the CWMA received comments from Mr. Richard Suiter, an industry consultant, indicating he submitted this proposal as a “clean-up” item related to batching systems including the concern of the return to zero, which is made clear in this proposal. The CWMA forwarded the item to NCWM and recommended that it be a Voting item.

NEWMA reported at the 2015 Interim Meeting, it believes the item has merit and forwarded it to NCWM recommending it as a Voting item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

320-2 V S.5.4. Relationship of Load Cell Verification Interval to the Scale Division

(This item was Adopted.)

Source:

Scale Manufacturers Association (2016)

Purpose:

Clarify the relationship of V_{min} to d with multiple independent load receivers.

Item under Consideration:

Amend NIST Handbook 44 Scales Code as follows:

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

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

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

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

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

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

- the complete weighing/load-receiving element or scale has been evaluated for compliance with T.N.8.1. Temperature under the NTEP;
- the complete weighing/load-receiving element or scale has received an NTEP Certificate of Conformance; and
- the complete weighing/load-receiving element or scale is equipped with an automatic zero-tracking

mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-tracking mechanism is permissible, provided the scale cannot function normally while in this mode.

[Nonretroactive as of January 1, 1994]

(Added 1993) (Amended 1996 **and 2016**)

Background/Discussion:

Recently it was discovered that there appears to be one group of people who interpret paragraph S.5.4. as saying that N is equal to the total number of ALL load cells in a scale comprised of two or more independent weighing platforms (like those commonly found in highway weigh stations), while others believe that N in the formulae contained in this paragraph refers to just the number of load cells in a SINGLE independent load receiving platform comprising part of the overall multiple-platform scale. Clarification is needed so that the interpretation of this section of the handbook remains consistent.

The submitter provided the following statements along with a presentation which is available online at <http://www.ncwm.net/meetings/interim/publication-15>.

Relationship of the Minimum Load Cell Verification Interval, v_{\min} , with the Scale Division, d , in Scales Comprised of Multiple Independent Load-Receiving Elements

Over the years, industry and weights and measures officials have held different opinions regarding the relationship of the minimum load cell verification interval, v_{\min} , to the scale division, d , when the weighing system is comprised of multiple independent load-receiving elements. There are those who feel that only the number of load cells used in each SINGLE load receiver should be used in the relationship while others feel that you should also use the total number of load cells in ALL of the independent load receiving elements comprising the scale system.

Some may be confused regarding just what is the “minimum load cell verification interval, v_{\min} .” The majority of scales use one or more load cells where the working or measuring range of the load cell(s) is significantly less than the load cell’s capacity. In these applications, the value of the load cell minimum verification interval and load cell utilization are important. The minimum load cell verification interval is defined as the smallest value of a quantity (mass) which may be applied to a load cell without exceeding the maximum permissible error. To express it mathematically, $v_{\min} = E_{\max} / Y$ where E_{\max} is the load cell’s rated capacity and Y represents a value specified by the load cell manufacturer.

The minimum measuring range, MMR, can be found by:

$MMR = v_{\min} \times n_{\max} / E_{\max}$ so for a Class IIIIL load cell with a 50,000 lb capacity and a 1.5 lb v_{\min} the MMR is calculated as:

$$MMR = 1.5 \text{ lb} \times 10\,000 \text{ divisions} / 50\,000 \text{ lb} = 0.3 \text{ or } 30 \% \text{ of the cell's capacity}$$

This minimum measuring range can be applied over any part of the measuring range between the load cell’s minimum load, E_{\min} , and the load cell’s rated capacity, E_{\max} .

With this in mind in multiple load cell applications, the square root of the number of load cells, N, is used to account for the random errors found in a group of two or more load cells. That is, some load cell errors may be positive while others may be negative.

The multiple load-receiving elements are completely independent which means that they are not physically connected to adjacent load receivers and have their load cell output(s) converted to a digital value independently of the other load-receiving elements in the scale or weighing system. They have their own displayed weight value also set aside from the other displayed values. In this case, the measuring range and hence the v_{\min} of the load cell(s) used in the load receiving element are also independent and separate from the

measuring range of the load cell(s) used in the other load-receiving elements. For this reason, the relationship of the minimum load cell verification interval to the scale division is independent of the same relationships in the other load-receiving elements and should therefore be determined using the number of the load cells in or the lever multiple of the single independent load receiver.

In 1990 the NCWM voted to accept a Specifications and Tolerances Committee recommendation that stated in part:

Multiple weighing elements (e.g., three axle-load scales permanently installed adjacent to one another or with a dead space between the weighing elements) used simultaneously to obtain a single weight in commercial applications shall be deemed to be a single system which shall meet the requirements of the applicable accuracy class.

This recommendation stemmed from the question as to whether the total weight should be limited to 10 000 divisions and took place BEFORE the relationship of V_{\min} to d was added in 1993. When this discussion took place, no consideration was given to the relationship of the minimum load cell verification to the scale division. In 1997 a footnote was added to Table 3 Parameters for Accuracy Classes in NIST Handbook 44 which states in part:

⁴ *...On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{\max} for the summed indication shall not exceed the maximum specified for the accuracy class.*

This footnote concerns the maximum number of divisions for the load-receiving elements and for the summing indicator, if so equipped. It has nothing to do with the minimum load cell verification interval and its relationship to the scale division d and number of load cells in the load-receiving element, N .

It seems that a precedent was already set in 1986 with the addition of Paragraph T.N.4.1. in NIST Handbook 44. This paragraph states:

T.N.4.1. Multiple Indicating/Recording Elements – *In the case of a scale or weighing system equipped with more than one indicating element or indicating element and recording element combination, where the indicators or indicator/recorder combination are intended to be used independently of one another, tolerances shall be applied independently to each indicator or indicator/recorder combination.*

(Amended 1986)

Granted, this paragraph pertains to indicating elements, but the same line of reasoning applies to multiple load-receiving elements where, when the load-receiving elements are intended to be used INDEPENDENTLY of each other, tolerances and other requirements are to be applied to each individual load-receiving element.

Further still, consider three independent electromechanical load-receiving elements placed side by side and used to weigh the axles of a vehicle. Each load-receiving element has its own displayed weight. A single total weight display that takes into account rounding errors is used to display the gross weight. Assume that each load receiver has its own unique multiple. If you believe that the relationship of v_{\min} to the division value, d , is to be determined by the characteristics of the whole weighing system, how then would you apply the formula in S.5.4. for load receivers with lever systems? It states:

$$V_{\min} d / * \text{ scale multiple}$$

You can apply this equation to each load receiver, but how would you apply it to the whole weighing system?

Consider three independent load receivers each with its own NTEP certificate and each with its own digital indicating element and one summing device that sums their outputs taking into consideration rounding errors. This is a common type of weighing system and one that should be and is allowed by NTEP. The design of the

load receiving elements is irrelevant. It makes no difference whether they are all mechanical or electronic or a combination of the two. The important thing is that they are all NTEP certified and that the indicator that shows the sum adds no error to the weighing system. If, however, the combination of these load-receiving elements is to be considered as a single scale, then you can consider it as essentially consisting of three NTEP certified digital load cells and a summing digital indicator. The design and technology used by the load cells is again irrelevant. It is simply a scale having three load cells and an indicator. If the former configuration is used, it should not be necessary to consider the total number of load cells in the weighing system but rather to simply consider only each scale's characteristics.

Because the summed display is NOT an additional scale and has no measuring function and is simply nothing more than the mathematical sum of the individual weights, applying the v_{\min} relationship to the total number of load cells in all of the load-receiving elements contained in the weighing system has no metrological basis.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting S&T Committee open hearings, the Committee acknowledged it had received a written letter in opposition to the proposal from Mr. Henry Oppermann (Weights and Measurers Consulting, LLC). A short slide presentation in support of the proposal was provided by Mr. Eric Golden (Cardinal Scale). The Committee received numerous comments in support of the proposal from industry representatives and regulatory officials alike, including Mr. Constantine Cotsoradis (Flint Hill Resources), Mr. John Lawn (Rinstrum, Inc.), Mr. Dick Suiter (Richard Suiter Consulting), Mr. Richard Shipman (Rice Lake Weighing Systems), and Mr. Nathan Gardner (Oregon). In commenting in favor of the proposal, Mr. Cotsoradis also recommended amending the proposal that the term "load-receiving element" be changed to "weighing/load-receiving element" as it is more commonly referenced. Mr. Russ Vires (Mettler-Toledo), speaking on behalf of the SMA, noted that the SMA supported the v_{\min} relationship as specified in the proposal. In written comments provided to the Committee, the SMA further noted that the v_{\min} relationship is a function of each individual load receiving element and not a combination of multiple load receiving elements. Once load cell signals have been digitized for a receiving element, they have no effect on the adjacent receiving elements. This item is a technical clarification of the v_{\min} relationship and does not affect other NIST Handbook 44 scale requirements.

Ms. Tina Butcher (NIST, OWM) commented it is OWM's belief that the changes proposed by this item are to address a particular multi-platform vehicle scale system that is unable to comply with the existing v_{\min} formula specified in Scales Code paragraph S.5.4. It has been reported that this devices' failure to comply with the formula is due to the type and capacity of the load cells used throughout. To OWM's knowledge, there has been no evidence provided thus far to suggest that other multi-platform systems of same or similar configuration cannot comply with the formula. This leads OWM to question the rationale of changing an existing requirement to satisfy the needs of one design, when possibly all others are able to comply with the existing requirement.

The 1990 S&T Committee was asked to provide an interpretation of NIST Handbook 44 requirements to multi-platform vehicle scales consisting of three or more individual weighing elements used simultaneously to obtain a gross weight for commercial transactions. The individual weighing elements are used to obtain axle-load weights to determine compliance with highway laws and, because the entire vehicle is weighed as a single draft, the summed weight may be used for commercial transactions.

The 1990 S&T Committee recommended that multiple weighing elements (e.g., three axle-load scales permanently installed adjacent to one another or with a dead space between the weighing elements) used simultaneously to obtain a single weight in commercial applications be deemed to be a single system which shall meet the requirements of the applicable accuracy class. The classification of a scale or weighing system into an accuracy class should be based upon its application and method of use, not on the design of the device. The Committee noted that the significance of this interpretation is that not only must each independent weighing device meet the requirements of NIST Handbook 44, but the entire weighing system must meet all requirements that would apply if the device were a single scale.

OWM noted that the 1990 S&T Committee recommended the following criteria be applied to multiple-weighing devices interfaced with a single indicating element:

1. The number of divisions in the weight indicator displaying the summed weight of all weighing elements of a scale consisting of multiple weighing elements (weighing simultaneously) shall not exceed the maximum permitted for the accuracy class (10 000 for class III and III L). The capacity by division must be marked on the weight display of the summing indicator.
2. Separate weight displays for individual weighing elements must have separate capacity statements. The number of divisions for each weighing element must satisfy the requirement for the number of scale divisions for the accuracy class. The scale division values for each weighing element and the weight display that is summing the weight values must be the same.
3. The capacity of the summed weight display shall not exceed the sum of the capacities of the individual weighing elements.
4. If one weighing element is overloaded and blanks out, then the summing weight display must also blank out.
5. All scale sections in the multiple weighing elements used simultaneously must agree within the absolute value of the maintenance tolerances (T.N.4.4.) as if the scale had a single weighing element.

It is not known whether the 1990 S&T Committee considered the application of the v_{\min} formula when discussing this issue.

An OWM concern of larger implication than this v_{\min} conflict is whether or not the weights and measures community will continue to support and officials continue to apply the criteria recommended by the S&T Committee in their 1990 Report should this item be adopted.

Mr. Richard Suiter (Richard Suiter Consulting) stated that he was a member of the 1993 S&T Committee and believes now that the Committee had “gotten it wrong.” The v_{\min} formula should apply to each independent weighing/load receiving element and indicator comprised of such systems when each performs its own analog to digital conversion.

Mr. Ross Andersen (New York, retired) stated he had voted in favor of the existing requirement in 1989, but believes now it was a mistake. The v_{\min} formula should only apply to the independent scales in such a system since the summing indicator serves to do nothing more than sum the indications of the different platforms. He likened the operation of such a system to weighing multiple loads on a single platform and summing their weights. In the case of the multi-platform system, he stated that each independent weighing/load-receiving element and indicator should be treated and tested as a single independent scale. He acknowledged that any one of the independent platforms could be used to weigh an entire load providing the entire load fits onto that particular platform.

Mr. Rick Harshman (NIST, OWM) stated that he agreed each independent weighing/load-receiving element and indicator should be tested as a single independent scale, but there is also the need to test all three platforms as a single scale because the typical application of the system is to weigh vehicles that are distributed over all three platforms. The total weight of a vehicle is thus determined by summing the indications of the different indicators in the system, which constitutes a commercial weight and is why the 1990 S&T Committee had deemed such configurations to be a single system having to meet the requirements of the applicable accuracy class. Mr. Andersen disagreed on the need to test all three platforms as a single scale.

Mr. Gardner indicated that he supported Mr. Harshman’s statement regarding the need to test the different platforms independently and also in combination, as if a single vehicle scale, but also supported the proposal as written.

An industry representative noted the existence of some mechanical lever system scales that require the use of more than one load cell to adapt them for electronic indication. This being the case, he questioned whether or not the proposed strike out portion of the equation in (b) of the proposal was appropriate. *NIST Technical Advisor’s Note: It is believed that the proposed changes to the equation in (b) of the proposal were based on an assumption that all electro-mechanical scales would have only one load cell. If only a single load cell, there would be no need for “ $\sqrt{N} x$ ” to be part of the equation because “N” is defined in the paragraph as being the number of load cells in the system and would always be 1. The square root of one is equal to one and when multiplied by the value of another factor in*

an equation will provide a product equal to that factor. Mr. Darrell Flocken (NCWM NTEP Specialist) agreed with the industry comments and suggested to Mr. Golden there be no changes proposed for that particular portion of the proposal due to the probable existence of such systems. Mr. Golden agreed and recommended the proposal be amended to reflect that there be no changes to the equation in part (b) of the paragraph.

During its work session, the Committee considered the different criteria listed in the Committee's 1990 Final Report, which the 1990 Committee had intended to be applied to such systems. Members of the current Committee concluded that the application of the v_{\min} formula to scale systems such as those in which the current proposal is intended to apply had likely not been considered by the 1990 Committee. Members of the Committee agreed that the application of the v_{\min} formula should, therefore, be considered a stand-alone issue, separate from any of the conditions provided by the 1990 Committee, which members of the Committee indicated they still support. The Committee agreed to amend the proposal to reflect there be no changes to part (b) as recommended by Mr. Golden and in consideration of all the comments received in support of the proposal, agreed to forward the item for vote as shown in Item Under Consideration.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee granted Mr. Eric Golden (Cardinal Scale Manufacturing) the opportunity to provide a short presentation on the merits of the item on behalf of the SMA. A copy of the slides presented by Mr. Golden have been inserted into Appendix A of this Report. Mr. Russ Vires (Mettler Toledo, LLC), speaking on behalf of the SMA, reported that the SMA supports the adoption of this item. The position of the SMA is that the v_{\min} relationship is a function of each individual load receiving element and not a combination of multiple load receiving elements. Once load cell signals have been digitized for a receiving element, they have no effect on the adjacent receiving elements. This item is a technical clarification of the v_{\min} relationship formula and does not affect other NIST Handbook 44 scale requirements. Eliminating inconsistencies is important in the proper application of the NIST Handbook 44 code and test procedures.

Mr. Richard Harshman (NIST, OWM) acknowledged that this is a confusing issue and that at the heart of the matter is the question of how to properly apply the v_{\min} formula to multi-platform vehicle scales consisting of three or more independent weighing elements used simultaneously to obtain a gross weight for commercial transactions. The 1990 S&T Committee considered how NIST Handbook 44 requirements are intended to apply to these systems. That Committee's interpretation was that not only must each independent weighing device meet the requirements in NIST Handbook 44, but the entire weighing system must also meet all requirements that would apply if the device were a single scale. What has caused confusion is whether or not the 1990 Committee considered the application of the v_{\min} formula in providing its interpretation.

Mr. Harshman reported that some who support this proposal have noted that Paragraph S.5.4. was first added to NIST Handbook 44 in 1993 and, therefore, was not a part of the S&T Committee's discussion in 1990. Mr. Henry Oppermann (Weights and Measures Consulting, LLC) has made evident in previous written comments to the Committee that v_{\min} was being discussed at that time; its application to multi-platform vehicle scale systems was considered in 1989 by the NTEP Weighing Sector (WS) as evidenced by that Sector's 1989 summary report. OWM's review of that summary report confirmed the WS did consider/discuss how NIST Handbook 44 requirements should apply to these systems. Additionally, the report provides indication that the application of the v_{\min} formula was part of that discussion. The report also indicates that the Sector did not reach a consensus on these issues.

NIST, OWM agrees additional clarification needs to be added to paragraph S.5.4. to make clear its application to such scale systems. As reported in its earlier analysis of this item, OWM believes the changes proposed by this item are to address a particular multi-platform vehicle scale system that is unable to comply with the existing v_{\min} formula specified in Scales Code paragraph S.5.4. when the total number of the load cells for all weighing load-receiving elements in that system is inserted as a variable in the formula. It had been reported that this device's failure to comply with the formula is due to the type and capacity of the load cells used throughout. There has been no indication thus far to suggest that other multi-platform systems of same or similar configuration cannot comply with the formula when the total number of load cells for all weighing/load-receiving elements in those systems is inserted as a variable in the formula. For this reason, OWM continues to question the rationale of changing an existing requirement to satisfy the needs of one design, when possibly all others of the same design are able to comply with the existing requirement.

OWM reiterates the comment it made during the 2016 Interim meeting that a concern of larger implication than this v_{\min} conflict is whether or not the weights and measures community will continue to support and officials continue to apply the criteria recommended by the S&T Committee in their 1990 Report should this item be adopted. The SMA has stated that this item is a technical clarification of the v_{\min} relationship formula and is not intended to affect other NIST Handbook 44 scale requirements. If the Committee agrees with this SMA comment and the changes being proposed are ultimately adopted, OWM encourages the Committee to provide a clear statement in its final reporting of this item reinforcing the 1990 S&T Committee's interpretation of how NIST Handbook 44 requirements are to apply to these systems.

Mr. Ross Andersen (New York, retired) indicated that he participated in the 1989 discussions that took place within the WS to determine how NIST Handbook 44 requirements should apply to these systems. There was a divide on this issue within that Sector with representatives of industry unanimously agreeing that requirements should only apply to the independent scales used in these systems and regulators contending that requirements should apply to not only the independent scales, but also, the system as a whole. Mr. Andersen stated that he believes the 1990 Committee made a mistake in its interpretation. Requirements should only apply to the individual scales used in these systems because the indicator that provides the totalized indication is not itself a scale. It serves only to sum the indications of the different scales that are part of the system. Its indication would be no different than that which would be displayed from a handheld calculator that was used to manually sum the indications of the independent scales. He also indicated that he disagreed with OWM's recommendation to the Committee to provide a clear statement enforcing the 1990 Committee's interpretation. In his view, this issue should be reopened for discussion.

Mr. Harshman responded to Mr. Andersen's comments by stating that OWM is not opposed to reopening the issue, but disagreed with the opinion that NIST Handbook 44 requirements should only apply to the independent scales used in the system and not the system as a whole.

The Committee also received comments from several state officials, voicing support for the proposal.

In discussing this issue during its work session, members of the Committee agreed that additional clarification is needed in Scales Code paragraph S.5.4. to explain how the v_{\min} formula is to apply to such multi-platform vehicle scale systems. The Committee considered different configurations of multi-platform vehicle scale systems known to exist in the commercial marketplace and how the changes proposed to paragraph S.5.4. might affect the application of the V_{\min} formula to these systems. It was agreed that the changes proposed by this item only address the application of the V_{\min} formula to a particular configuration; that is, one in which the weighing/load receiving element of each scale in the system is independent of the others and has its own analog to digital conversion circuitry and displayed weight.

The Committee also considered the 1990 Committee's interpretation of how NIST Handbook 44 requirements are intended to apply to these systems and the SMA's comment that its proposal is a technical clarification of the v_{\min} relationship formula and is not intended to affect other NIST Handbook 44 scale requirements. The Committee agreed that the 1990 Committee's interpretation of how NIST Handbook 44 requirements are to be applied to these systems is still valid today and viewed the current changes proposed by the SMA as a separate issue apart from that interpretation. The Committee believes the changes proposed by this item are appropriate and agreed to recommend the item for vote.

Regional Association Comments:

At its fall 2015 Annual Meeting, the WWMA reported that several scale companies and the SMA gave testimony in support of this item. The SMA also offered a presentation on the item clarifying their position. Written testimony in opposition to this item was submitted by Mr. Henry Oppermann (Weights and Measures Consulting). The WWMA S&T Committee agreed with the concept as proposed and forwarded this item to the NCWM, recommending that it be a Voting item.

The CWMA, at its 2016 Annual Meeting, forwarded this item to NCWM and recommended that it be a Voting item.

NEWMA recommended the item for vote at its fall 2015 Interim Meeting. At its spring 2016 Annual Meeting, NEWMA reported it believes that the proposal will clarify the correct application of the V_{\min} formula to

multi-independent platform vehicle scale systems equipped with a totalized indicator. NEWMA again forwarded the item to NCWM, recommending it for Vote.

At its 2015 Annual Meeting, the SWMA grouped this item with another new item during the open hearings and both items were heard simultaneously. These were viewed as competing items and the Committee felt that only one, if any, could be moved forward. Based on the discussion during the open hearings the Committee decided to recommend moving this item forward as a Voting item. The SWMA forwarded this item to NCWM, recommending that it be a Voting item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

320-3 V N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales and N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales.

(This item was Adopted.)

Source:

NIST Office of Weights and Measures (2016)

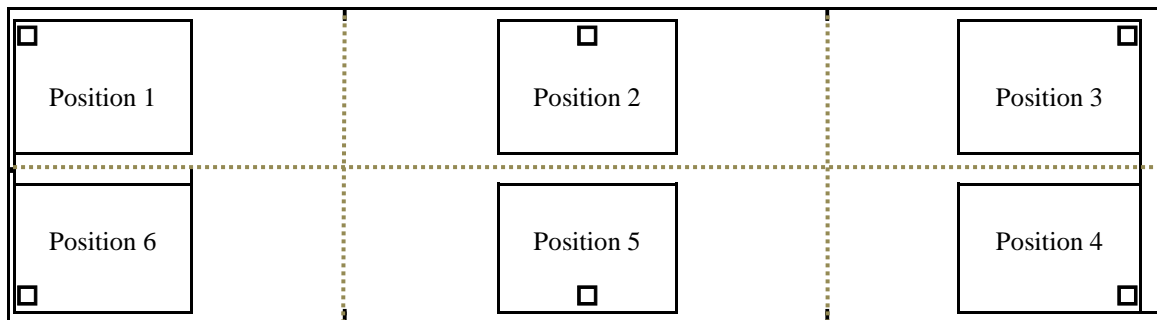
Purpose:

Eliminate inconsistencies in the shift test procedures for two-section livestock scales in the Scales Code of NIST NIST Handbook 44.

Item under Consideration:

Amend NIST NIST Handbook 44 Scales Code as follows:

N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales. – A minimum test load of 5000 kg (10 000 lb) or one-half of the rated section capacity, whichever is less, shall be placed, as nearly as possible, successively over each main load support as shown in the diagram below. For livestock scales manufactured between January 1, 1989, and January 1, 2003, the required loading shall be no greater than one-half CLC. ~~(Two-section livestock scales shall be tested consistent with N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel Load Weighers, and Portable Axle Load Weighers.)~~



N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales. – A shift test shall be conducted using the following prescribed test loads and test patterns, provided: When a single field standard weight is used, the prescribed test load shall be applied centrally in the prescribed test pattern. When multiple field standard weights are used as the prescribed test load, the load shall be applied in a consistent pattern in the shift test positions throughout the test and applied in a manner that does not concentrate the load in a test pattern that is less than when that same load is a single field standard weight on the load-

receiving element. ~~†~~The shift test load ~~does shall~~ not exceed one-half the rated section capacity or one-half the rated concentrated load capacity whichever is applicable, using either:

- (a) a one-half nominal capacity test load centered as nearly as possible, successively at the center of each quarter of the load-receiving element as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 1; or
- (b) a one-quarter nominal capacity test load centered as nearly as possible, successively over each main load support as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 2.

(Added 2007) (**Amended 2016**)

Background/Discussion:

The prescribed test patterns and test loads for conducting a shift test on two-section livestock scales are specified in paragraph N.1.3.3.3. However, the last sentence (appearing in parenthesis) of paragraph N.1.3.3.2. specifies that two-section livestock scales are to be tested consistent with paragraph N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers. The test loads and test procedures specified in paragraph N.1.3.7. are not consistent with those specified in paragraph N.1.3.3.3. NIST, OWM believes that the test patterns and test loads specified in paragraph N.1.3.3.3. are correct and for this reason the last sentence appearing in paragraph N.1.3.3.2. should be deleted.

NIST, OWM notes that paragraph N.1.3.3.3. was first added to NIST Handbook 44 in 2008 (adopted by the NCWM in 2007) to address the test patterns and test loads that apply to shift tests conducted on two-section livestock scales. Previous to this paragraph being added, the test patterns and test loads that applied to section tests of two-section livestock scales were specified in paragraph N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers, which is now paragraph N.1.3.7. OWM also notes that the sentence proposed for deletion in paragraph N.1.3.3.2. already existed in the Handbook prior to 2008 (e.g., in the 2007 version of NIST Handbook 44, it appeared in paragraph N.1.3.4.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales, which is now paragraph N.1.3.3.2.).

NIST, OWM believes it is likely that the sentence proposed for deletion in existing paragraph N.1.3.3.2. was purposely left remaining by the 2007 S&T Committee to capture that part of N.1.3.7. intended to eliminate instances where test weights are concentrated in a pattern that overload the load-bearing points (e.g., when multiple test weights are stacked, resulting in the test load being concentrated in a small area of the platform). In support of this notion, OWM notes that in the 2007 S&T Committee Final Report, the Committee includes example illustrations showing acceptable and unacceptable applications of test weight to a livestock scale with a section capacity of 1000 lb. The changes OWM is proposing to paragraph N.1.3.3.3. are to incorporate that portion of paragraph N.1.3.7. into paragraph N.1.3.3.3. that OWM believes the 2007 S&T Committee wanted captured in the shift test procedures applicable to two-section livestock scales.

2016 NCWM Interim Meeting:

During the 2016 Interim Meeting open hearings, Ms. Tina Butcher (OWM) reported the purpose of this item is to eliminate a current conflict between two scales code paragraphs in NIST Handbook 44 (i.e., paragraphs N.1.3.3.2. and N.1.3.3.3.) as follows:

- The title of N.1.3.3.2. implies the paragraph is intended to apply to livestock scales *with more than two sections* and combination vehicle/livestock.
- The title of N.1.3.3.3. implies the paragraph is intended to apply *to two-section livestock scales*.
- The conflict is caused by a parenthetical statement at the end of paragraph N.1.3.3.2., which states, “Two-section livestock scales shall be tested consistent with N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers.”

Ms. Butcher noted NIST, OWM's Legal Metrology Devices Program worked in consultation with GIPSA to draft the current proposal in an effort to resolve this issue.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA commented that SMA supported the item as written.

In considering this item, the Committee agreed there is an inconsistency in the current language in the two paragraphs identified by OWM and that the change proposed would properly eliminate the conflict. The Committee agreed to slightly amend the proposal editorially and present it for vote as shown in Item Under Consideration.

2016 NCWM Annual Meeting:

AT the 2016 NCWM Annual Meeting, the Committee received a recommendation from Mr. Paul Lewis (Rice Lake Weighing Systems) to replace paragraph N.1.3.3.3. of the Item Under Consideration with the following:

N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales. – A shift test shall be conducted using the following prescribed test loads and test patterns. When a single field standard weight is used, it shall be placed, as nearly as possible over each main load support. When multiple field standard weight are use as the prescribed test load, the load shall be placed, as nearly as possible over each main load support in a consistent pattern throughout the test and applied in a manner that does not constitute stacking of weights. The shift test load shall not exceed one-half the rated section capacity or one-half the rated concentrated load capacity whichever is applicable, using either.

Mr. Lewis, in making the recommendation, indicated that the replacement paragraph being offered only editorially changed the wording in the paragraph of the proposal and not the intent of the paragraph.

Mr. Cary Ainsworth (GIPSA), commented that GIPSA supports the proposal as it appears in the Item Under Consideration.

Ms. Tina Butcher reiterated the comments OWM provided at the 2016 NCWM Interim Meeting as noted in the discussion above. She also noted that OWM's Legal Metrology Devices Program worked in consultation with GIPSA to draft the current proposal in an effort to resolve this conflict.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA reported that the SMA supports the adoption of this item. Eliminating inconsistencies is important in the proper application of the NIST Handbook 44 code and test procedures.

During the Committee's work session, members of the Committee considered the revised paragraph offered by Mr. Lewis as replacement to paragraph N.1.3.3.3. in the proposal. Mr. Rick Harshman (NIST, OWM), Technical Advisor to the Committee, stated that the proposed revisions to paragraph N.1.3.3.3., which appear underlined and in bold-faced print in the proposal, were copied from Scales Code paragraph N.1.3.7. The intent of adding this language to the paragraph is to provide guidance on the application of the test weight when multiple field standards are used for the prescribed test load during a shift test. Mr. Harshman indicated that he believed the revised paragraph offered by Mr. Lewis significantly changed the proposal because nowhere in paragraph N.1.3.7. (or paragraph N.1.3.3.3. in the Item Under Consideration) does it specify that the test weights cannot be stacked. Upon reviewing the two paragraphs (i.e., paragraph N.1.3.3.3. in the Item Under Consideration and the revised version offered by Mr. Lewis as replacement), Committee members agreed with OWM's assessment. Consequently, and in consideration of the comments received in support of the proposal, the Committee agreed to recommend the item for Vote with no changes.

Regional Association Comments:

At its 2015 Annual Meeting, the WWMA received comment from Ms. Tina Butcher, NIST OWM, that this change is intended to eliminate inconsistencies in NIST Handbook 44, and not intended to change the test procedure. The WWMA S&T Committee agreed that the proposal helps to clarify N.1.3.3.2. and N.1.3.3.3., and also noted there are a couple of minor editorial changes required in the proposal in N.1.3.3.3. The WWMA supports this item and forwarded it to NCWM, recommending that it be a Voting item.

The CWMA supported this item and forwarded it to NCWM, recommending at both its fall 2015 Interim Meeting and spring 2016 fall Meeting that it be a Voting item.

NEWMA reported this item has merit and that this change eliminates inconsistencies in NIST Handbook 44 as it intends. This item helps clarify N.1.3.3.2. and N.1.3.3.3. NEWMA forwarded the item to NCWM and recommended at both its fall 2015 Interim Meeting and spring 2016 Annual Meeting that it be a Voting item.

The SWMA heard comments in support of this item at its 2015 Annual Meeting. The SWMA reported it believes the recommended changes will eliminate inconsistencies in the shift test procedures for two-section livestock scales. The SWMA understands there are in fact single 10 000 lb standards in use and believes that the proposed language doesn't require the use of such single standard, but only permits use. The SWMA forwarded the item to NCWM, recommending that it be a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

322 AUTOMATIC BULK WEIGHING SYSTEMS

322-1 D A. Application, S Specifications, N. Notes, UR. User Requirements

Source:

Kansas (2016)

Purpose:

Modernize the ABWS code to more fully reflect the types of systems in use and technology available while still maintaining the safeguards of the current code.

Item under Consideration:

Amend NIST Handbook 44, 2.22. Automatic Bulk Weighing Systems Code as follows:

A. Application

A.1. General. – This code applies to ~~automatic bulk~~ weighing systems, ~~that is, weighing systems capable of adapted to the automatic~~ automatically weighing ~~of a commodity in~~ successive drafts of a bulk commodity without human intervention, predetermined amounts automatically recording the no-load and loaded weight values and accumulating the net weight of each draft.
(Amended 1987)

S. Specifications

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

S.1.1. Zero Indication. – ~~Provisions An Automatic Bulk Weighing System (ABWS)~~ shall ~~be made to~~ indicate and record a no-load reference value and, if the no-load reference value is a zero value indication, to indicate and record an out-of-balance condition on both sides of zero.

S.1.5. Recording Sequence. – ~~Provision An ABWS~~ shall ~~be made so that~~ indicate all weight values ~~are indicated until the completion of the~~ recording of the indicated value is completed.

S.1.6. Provision for Sealing Adjustable Components on Electronic Devices. – Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of the device.

S.1.7. No Load Reference Values. – An ABWS shall indicate and record weight values with no load in the load-receiving element. No load reference values must be recorded at a point in time after product flow from the load receiving element is stopped and before product flow into the load receiving element has started. Systems may be designed to stop operating if a no load reference value falls outside of user designated parameters. If this feature is designed into the system then the no load reference value indicated when the system is stopped must be recorded, an alarm must activate, weighing must be inhibited, and some type of human intervention must be required to restart the system after it is stopped.

S.1.8. Loaded Weight Values. – An ABWS shall indicate and record loaded weight values for each weighing.

S.1.9. Net Weight Values. – An ABWS shall calculate and record net weight for each weighing.

S.1.10. Net Weight Accumulation. – An ABWS shall automatically accumulate and record the sum of all net weight values for each weighing process.

S.3. Interlocks and ~~Gate Control~~Product Flow Control.

S.3.1. ~~Gate Position~~Product Flow Control. – Provision An ABWS shall ~~be made to~~ clearly indicate to the operator product flow status the position of the gates leading directly to and from the ~~weigh hopper~~load receiving element. Many types of equipment can be used to control the flow of product into and out of a load receiving element automatically including but not limited to gates, conveyors, augers, robots, pipes, tubes, elevators, buckets, etc.

S.3.2. Interlocks. – Each automatic bulk weighing system shall have operating interlocks to provide for the following:

- (a) Product cannot be cycled and weighed if the weight recording element is disconnected or subjected to a power loss.
- (b) The recording element ~~can only cannot print record~~ a weight if ~~either of the gates equipment controlling product flow to or from the load-receiving element is in a condition that allows product to enter or leave the load receiving element, leading directly to or from the weigh hopper is open.~~ **either of the gates equipment controlling product flow to or from the load-receiving element is in a condition that allows product to enter or leave the load receiving element, leading directly to or from the weigh hopper is open.**

S.3.3. ~~Overfill Sensor~~And Interference Detection.

- (a) ~~The system must have a means to detect when Tthe weigh hopperload-receiving element shall be equipped with anis overfilled. When an overfill condition exists sensor which will cause the feedproduct flow to the load receiving element must be stopped, gate to close,an alarm must activate,activate an alarm, and inhibit weighing must be inhibited until the overfill condition has been corrected, and some type of human intervention must be required to restart the system. An alarm could be many things including a flashing light, siren, horn, flashing computer screen, etc. The intent of an alarm is to make the operator aware there is a problem which needs corrected.~~ **The system must have a means to detect when Tthe weigh hopperload-receiving element shall be equipped with anis overfilled. When an overfill condition exists sensor which will cause the feedproduct flow to the load receiving element must be stopped, gate to close,an alarm must activate,activate an alarm, and inhibit weighing must be inhibited until the overfill condition has been corrected, and some type of human intervention must be required to restart the system. An alarm could be many things including a flashing light, siren, horn, flashing computer screen, etc. The intent of an alarm is to make the operator aware there is a problem which needs corrected.**

(Added 1993)

- (b) ~~If the system is equipped with aDownstream storage devices and other equipment, permanent or temporary, lower garner or surge bin, that garner shall also which have the potential to interfere with weighing when overfilled or not functioning properly must have a means to prevent interference. When interference exist the system must stop, an alarm must activate, product flow must stop, weighing must be inhibited until the interference has been corrected, and some type of human intervention is required to restart the system,be equipped with an overfill sensor which will cause the gate of the~~ **If the system is equipped with aDownstream storage devices and other equipment, permanent or temporary, lower garner or surge bin, that garner shall also which have the potential to interfere with weighing when overfilled or not functioning properly must have a means to prevent interference. When interference exist the system must stop, an alarm must activate, product flow must stop, weighing must be inhibited until the interference has been corrected, and some type of human intervention is required to restart the system,be equipped with an overfill sensor which will cause the gate of the**

~~weigh hopper to remain open, activate an alarm, and inhibit weighing until the overfill condition has been corrected.~~

[Nonretroactive as of January 1, 1998]

(Amended 1997)

N. Notes

N.1. Testing Procedures.

N.1.1. Test Weights. – The increasing load test shall be conducted using test weights equal to at least 10 % of the capacity of the system:

- (a) on automatic ~~grain~~-bulk-weighing systems installed after January 1, 1984 used to weigh grain; and

UR. User Requirements

UR.4. System Modification. – Components of ~~T~~the weighing system, shall not be modified except when the modification has been approved by a competent engineering authority, preferably that of the engineering department of the manufacturer of the scale, and the official with statutory authority having jurisdiction over the scale.

(Amended 1991)

Background/Discussion:

The submitter provided the following points of discussion:

- There are many systems in use that don't meet the definition for a "scale" or an "Automatic Bulk Weighing System" or anything else in the Handbook. These changes will make it easier for regulators/inspectors to determine if a system should be evaluated as an "ABWS".
- The wording "automatic bulk weighing systems" should not be used in the definition of the same.
- The no load and loaded weight recordings are important, but they are specifications and should not be included in the application code.
- The current code does not clearly define at what level of automation a system would be considered an ABWS versus a scale with some accessory equipment (hopper, tank, etc.). This is an attempt to more clearly distinguish which systems should be considered ABWS's.
- Human intervention could be many things. Some examples include but are not limited to pushing a reset button, turning power off then back on, typing a password, or entering a statement into a system log. The intent with including the term "human intervention" is to not include all systems which have a high degree of automation, only the ones that cycle repeatedly and can potentially operate without anyone present to observe weighing malfunctions.
- There are many types of load receiving elements that will work with an ABWS to include but not limited to tanks and hoppers so the previous language referring to hoppers was removed and replaced with the generic but accurate term "load receiving element".
- The old language implied separate sensors (e.g., bindicators) were required. Newer systems have already bypassed the use of separate sensors and utilize the weight indications to identify an overfilled condition, similar to how the indications are used to regulate product flow into the load receiving element for some devices. Concerns for this approach have been raised for situations when an indicator is not functioning properly. That is a legitimate concern, but my reply then is: What is the backup for an indicator not indicating

properly on any other type of device? This is something we know happens with other devices and commonly may not be detected until a device inspection and test is completed. Thus, one reason routine inspections and testing are required.

- Many types of equipment can be used to control the flow of product into and out of a load receiving element automatically including but not limited to gates, conveyors, augers, robots, pipes, tubes, elevators, and buckets. Examples would be a conveyor delivering product – in such a case the recording element should not record if the conveyor is still moving or in the case of a pneumatic transfer tube the recording element should not record if the blower forcing air through the tube is still operating. Therefore, the old language referring to gates was removed and replaced with more generic terminology, which can be applied to any equipment used to control product flow not just gates.
- Many types of equipment can be used for downstream commodity storage including but not limited to hoppers, tanks, bins, flat storage, trucks, totes, rail cars and pits. The language referring to “lower garner,” “surge bin,” etc. has been removed and replaced with a more terms such as “downstream storage devices” to allow for all potentials types of product handling equipment.
- A downstream storage device itself may not interfere with the weighing process directly, but it also cannot create a situation in which an overflow condition or some other malfunction of the equipment interferes with the weighing process. An example would be a grain storage hopper located under a weigh hopper in a position which when grain is mounded up above the storage hopper the grain touches the bottom of the weigh hopper and interferes with the weighing process. For this example, if the storage hopper can be lowered far enough below the weigh hopper so that the mounded grain when it reaches its’ maximum potential height cannot touch the weigh hopper then it would not need the capability to detect an overflow condition. The same scenario would apply to a truck parked under the load receiving element, or a conveyor under the load receiving element. Wording was added to ensure interference does not occur and if it does that the system activates controls to prevent weightment errors.

The original code was written for very specific equipment for a very specialized use. This is a fairly drastic change from the original and introduces some new terminology that may present some confusion or uncertainty to those who were fairly familiar with the existing code. Some individuals feel the proposed changes may add some uncertainty as to what systems should or shouldn’t be considered an ABWS.

2016 NCWM Interim Meeting:

At the Committee’s 2016 Interim Meeting open hearings, Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA commented that SMA looks forward to the further clarification of this item.

Ms. Tina Butcher (OWM) noted the single-most important factor in determining whether or not an automated weighing system needs to take into account the no-load reference and gross-load reference to determine an accurate net weight for individual drafts weighed is the system’s ability to consistently return to zero following discharge of the load. This determination must be made on a case-by-case basis and will vary depending on the design of the system and the products being weighed.

OWM recognizes the need for NIST Handbook 44 to include requirements that address some *automated* weighing systems currently in the marketplace that, for one reason or another, fail to meet the definition of an ABWS or the application of the ABWS Code. As is the case with an ABWS, these systems are also used to weigh bulk commodities in an automatic operation. A number of these weighing systems do not consistently return to zero following discharge of a draft load due to:

- the density of the commodity being weighed and its susceptibility to cling;
- structural deformations in the load-receiving element (which trap and prevent product from being completely discharged);
- venting issues; and
- system vibration; etc.

Ms. Butcher noted, for example, that NIST, OWM is aware of *some* seed treatment systems that will automatically fill to some targeted load (preset by the system operator) by weighing multiple drafts *automatically* and *without* operator intervention. Similar automated systems used to weigh other products are also known to exist. When these systems are operational, not all of the weighed product necessarily gets discharged with the draft load. The remaining product is typically referred to as a “heel.” Some of these systems only record the gross weight of the different drafts weighed; yet, the “heel” remaining for each draft load cycled through the system needs to be taken into account for an accurate determination of the net quantity to be made. OWM believes this proposal is an attempt to address such systems. Ms. Butcher also acknowledged the existence of weighing systems that *do* consistently return to zero following discharge of the product when being operated in automatic mode. She stated that for these systems, the Scales Code is intended to apply.

Ms. Butcher further reported that OWM believes more work is needed to develop the proposal. She suggested that the submitter might propose that the definition of “automatic bulk weighing systems” be amended to apply to systems that weigh bulk commodities in an automatic operation, but because of their design, fail to meet the current definition and the existing code. Proposed amendments to the ABWS Code could then be developed to address such systems.

Mr. Doug Musick (Kansas) noted that the current proposal is an initial attempt to update the current ABWS Code to address some newer automated weighing systems known to exist in the marketplace. He reported that some of these newer systems are not able to comply with the existing ABWS Code, which provides indication of the need to update the current code. He agreed with OWM that more work was needed to further develop the proposal and requested additional input and assistance from those willing to provide it.

The Committee agreed that more work was needed to develop the item and assigned it a Developing status. The Committee recommends that the item’s submitter review the 2015 SWMA S&T Annual Report for additional proposed revisions to the proposal by that region’s S&T Committee.

2016 NCWM Annual Meeting:

During its 2016 NCWM Annual Meeting open hearings, the Committee received an update on this item from Mr. Doug Musick (Kansas). Mr. Musick reported that work on the proposal is ongoing and he soon planned to submit an updated version of proposal to the Committee. He reiterated a comment made at the 2016 Interim Meeting that the proposal is an attempt to update the current ABWS Code to address some newer automated weighing systems known to exist in the marketplace today that aren’t able to comply with the existing ABWS Code.

Ms. Tina Butcher, (NIST, OWM) stated that OWM looks forward to being able to review an updated proposal to “modernize” the ABWS Code to more fully reflect the different types of systems currently in the marketplace. OWM noted in earlier comments that it recognizes the need for NIST Handbook 44 to include requirements that address some automated weighing systems currently in the marketplace that, for one reason or another, fail to meet the definition of an ABWS or the application of the ABWS Code, yet, are being used to weigh bulk commodities in an automatic operation. When operated in an automatic mode, a number of these weighing systems do not consistently return to zero following discharge of a draft load. OWM believes this proposal is an attempt to address such systems.

Mr. Russ Vires (Mettler- Toledo, LLC), speaking on behalf of the SMA reported that the SMA takes no position on this item at this time and looks forward to future analysis from OWM.

In consideration of the comments received, the Committee agreed to recommend this item move forward as Developing to allow for additional time to fully develop the proposal.

Regional Association Comments:

The CWMA did not consider this item at its fall 2015 Interim Meeting due to time constraints. At its spring 2016 Annual Meeting, the CWMA reported that it believes this item has merit and recommended it be forwarded to the NCWM as a Developing item.

NEWMA recommended at both its fall 2015 Interim Meeting and spring 2016 Annual Meeting that the item a Developing item citing the need for additional work.

The SWMA received comments regarding potential unintended consequences as well as editorial changes the Committee considered necessary. Comments have been provided to the submitter by a member and the Committee looks for further development of the item. The SWMA forwarded the item to NCWM with recommended changes shown below and recommended that it be a Developing item.

A. Application

A.1. General. – This code applies to ~~automatic bulk weighing systems, that is, weighing systems capable of adapted to the automatic~~ automatically weighing of a commodity in successive drafts of a **bulk** commodity without operator **human** intervention. ~~predetermined amounts automatically recording the no load and loaded weight values and accumulating the net weight of each draft.~~

(Amended 1987)

S. Specifications

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

S.1.1. Zero Indication. – ~~Provisions~~ An automatic bulk weighing system **Automatic Bulk Weighing System (ABWS)** shall be made to indicate and record a no-load reference value and, if the no-load reference value is a zero value indication, to indicate and record an out-of-balance condition on both sides of zero.

S.1.5. Recording Sequence. – ~~Provision~~ An automatic bulk weighing system **ABWS** shall be made so that indicate all weight values **are indicated until the completion of the** recording of the indicated value **is completed.**

S.1.6. Provision for Sealing Adjustable Components on Electronic Devices. – Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of the device.

S.1.7. No Load Reference Values. – An automatic bulk weighing system **ABWS** shall indicate and record weight values with no load in the load-receiving element. No load reference values must be recorded at a point in time after product flow from the load receiving element is stopped and before product flow into the load receiving element has started. Systems may be designed to stop operating if a no load reference value falls outside of user designated parameters. If this feature is designed into the system then the no load reference value indicated when the system is stopped must be recorded, an alarm must activate, weighing must be inhibited, and some type of operator **human** intervention must be required to restart the system after it is stopped.

S.1.8. Loaded Weight Values. – An automatic bulk weighing system **ABWS** shall indicate and record loaded weight values for each weighing.

S.1.9. Net Weight Values. – An automatic bulk weighing system **ABWS** shall calculate and record net weight for each weighing.

S.1.10. Net Weight Accumulation. – An automatic bulk weighing system **ABWS** shall automatically accumulate and record the sum of all net weight values for each weighing process.

S.3. Interlocks and ~~Gate Control~~ Product Flow Control.

S.3.1. Gate ~~Position~~ Product Flow Control. – ~~Provision~~ An automatic bulk weighing system **ABWS** shall be made to clearly indicate to the operator **product flow status** the position of the gates leading directly to and from the ~~weigh hopper~~ load receiving element. Many types of equipment can be used to control the flow of product into and out of a load receiving element automatically including but not limited to gates, conveyors, augers, robots, pipes, tubes, elevators, buckets, etc.

S.3.2. Interlocks. – Each automatic bulk weighing system shall have operating interlocks to provide for the following:

- (a) Product cannot be cycled and weighed if the weight recording element is disconnected or subjected to a power loss.
- (b) The recording element can only cannot print record a weight if either of the gates equipment controlling product flow to or from the load-receiving element is in a condition that allows product to enter or leave the load receiving element, leading directly to or from the weigh hopper is open.

S.3.3. Overfill ~~Sensor~~ And Interference Detection.

- (a) The system must have a means to detect when ~~T~~the weigh hopperload-receiving element shall be equipped with anis overfilled. When an overfill condition exists sensor which will cause the feedproduct flow to the load receiving element must be stopped, -gate to close,an alarm must activate,activate an alarm, and inhibit weighing must be inhibited until the overfill condition has been corrected, and some type of operator human intervention must be required to restart the system. An alarm could be many things including a flashing light, siren, horn, flashing computer screen, etc. The intent of an alarm is to make the operator aware there is a problem which needs corrected.

(Added 1993)

- (b) If the system is equipped with aDownstream storage devices and other equipment, permanent or temporary, -lower garner or surge bin, that garner shall also which have the potential to interfere with weighing when overfilled or not functioning properly must have a means to prevent interference. When interference exist the system must stop, an alarm must activate, product flow must stop, weighing must be inhibited until the interference has been corrected, and some type of operator human intervention is required to restart the system.be equipped with an overfill sensor which will cause the gate of the weigh hopper to remain open, activate an alarm, and inhibit weighing until the overfill condition has been corrected.

[Nonretroactive as of January 1, 1998]

(Amended 1997)

N. Notes

N.1. Testing Procedures.

N.1.1. Test Weights. – The increasing load test shall be conducted using test weights equal to at least 10 % of the capacity of the system:

- (a) on automatic ~~grain~~-bulk- weighing systems installed after January 1, 1984, used to weigh grain; and

UR. User Requirements

UR.4. System Modification. – Components of Tthe weighing system, shall not be modified except when the modification has been approved by a competent engineering authority, preferably that of the engineering department of the manufacturer of the scale, and the official with statutory authority having jurisdiction over the scale.

(Amended 1991)

322-2 W N.1. Testing Procedures. and T. Tolerances

(This item was Withdrawn.)

Source:

Oregon (2015)

Purpose:

Modify the test method to reflect as-used dynamic conditions.

Item under Consideration:

Amend NIST Handbook 44, Automatic Bulk Weighing Systems Code as follows:

N.1.4. Material Tests. – Procedure

1. **Start up the automatic bulk weighing system, including the surrounding equipment, which is normally in use when instrument is itself in use.**
2. **Run the system for five weigh cycles (or more if necessary) to ensure normal working conditions.**
3. **Halt the automatic bulk weighing system and record the indication of total mass.**
4. **Run the weighing for not less than five cycles at maximum capacity, minimum capacity and one close to minimum totalized load.**
5. **Halt the automatic bulk weighing system and record the indication of total mass after each run.**
6. **Determine the material test error from the difference between the indicated totalized mass and the total mass of material as determined on the reference scale.**

Either pass a quantity of pre-weighed material through the Automatic Bulk Weighing system in a manner as similar as feasible to actual loading conditions, or weigh all material that has passed through the Automatic Bulk Weighing System. Means for weighing the material test load will depend on the capacity of the system and availability of a suitable reference scale for the test. To assure that the test load is accurately weighed and determined, the following precautions shall be observed:

- (a) **The containers, whether railroad cars, trucks, or boxes, must not leak, and shall not be overloaded to the point that material will be lost.**
- (b) **The actual empty or tare weight of the containers shall be determined at the time of the test. Stenciled tare weight of railway cars, trucks or boxes shall not be used. Gross and tare weights shall be determined on the same scale.**
- (c) **When a pre-weighed test load is passed through the scale, the loading system shall be examined before and after the test to assure that the system is empty and that only the material of the test load has passed through the scale.**
- (d) **Where practicable, a reference scale should be tested within 24 hours preceding the determination of the weight of the test load used for a Automatic Bulk Weighing System material test.**

A reference scale which is not “as found” within maintenance tolerance should have its accuracy re-verified after the Automatic Bulk Weighing System test with a suitable known weight load if the “as found” error of the Automatic Bulk Weighing System material test exceeds maintenance tolerance values.*

(e) If any suitable known weight load other than a certified test weight load is used for re-verification of the reference scale accuracy, its weight shall be determined on the reference scale after the reference scale certification and before commencing the Automatic Bulk Weighing System material test.*

(f) The test shall not be conducted if the weight of the test load has been affected by environmental conditions.

**Note: Even if the reference scale is within maintenance tolerance it may require adjusting to be able to meet paragraph N.1.4.1. Accuracy of Material.*

N.1.4.1. Accuracy of Material. – The quantity of material used to conduct a material test shall be weighed on a reference scale to an accuracy within 1/3 of the smallest tolerance to be applied. Scales typically used for this purpose include Class III and III L scales or a scale without a class designation as described in NIST Handbook 44, Section 2.20., Table T.1.1. Tolerances for Unmarked Scales.

N.1.4.2. Associated Equipment. – All associated equipment in local vicinity shall be in operation at time of test. This would include items such as conveyors; tote dumps, cleaning drums, rock separators, etc.

N.1.4. N.1.5. Zero-Balance or No-Load Reference Value Change Test. – A test for change of zero-balance or no-load reference value shall be conducted on all scales after the removal of any test load. The change shall not be more than the minimum tolerance applicable.

N.1.5. N.1.6. Discrimination Test. – *A discrimination test shall be conducted on all automatic indicating scales with the weighing device in equilibrium at zero-load and at maximum test load, and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained.*
[Nonretroactive as of January 1, 1986]

N.1.5.1. N.1.6.1. Digital Device. – On a digital device, this test is conducted from just below the lower edge of the zone of uncertainty for increasing-load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests.

(Added 1987)

T.3. Basic Tolerance Values.

T.3.2. For Systems Used to Weigh Grain. – The basic maintenance tolerance shall be 0.1 % **and apply to both the** test load and **material test.**

T.3.3. For All Other Systems. – The basic maintenance tolerance shall be 0.2 % **and apply to both the** test load **and material test.**

(Amended 1986)

T.5. Repeatability.

T.5.1. Static Test Load. – The results obtained by several weighings of the same load under reasonably static test conditions tests shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.

(Added 1986)

T.5.2. Material Test. – **variation in the values obtained during the conduct of material tests shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.**

Background/Discussion:

Based on feedback from the previous year, the State of Oregon has submitted this modified proposal to be more consistent with OIML.

The purpose of this proposal is to change the test and tolerances to reflect the way these devices are actually used. These are not “static” devices. They are “dynamic.” Being dynamic they have many additional factors affecting their accuracy compared to static devices. Some of these additional factors are: timing of flow controls and conveyors, additional vibration from system while trying to capture weight, operation of software, characteristics of materials being weighed, environmental situations.

While evaluating Automatic Bulk Weighing Systems in the State of Oregon, it was found that devices meeting static testing tolerances were in fact weighing with errors as high as 6 %. Through investigation it was found that a high percentage of the Automatic Bulk Weighing Systems in the state were in fact weighing in error when operating in their normal dynamic mode. These same devices would have received approval using only static methods. Oregon reported in September 2015 that it continues to find issues with these devices, which are not directly related to static calibration of the devices. Each new installation is initially static tested to establish a base line and then approved or disapproved based on the outcome of the material test.

The fundamentals of testing call for “testing as used.” This proposal lays out a method to do exactly that “test as used.” Some facilities may find it difficult to accommodate the material test method. There may be substantial cost in restructuring facilities to allow for either the capture or introduction of test material. Furthermore, adopting this proposal would align with another dynamic device type; Belt Scales, NIST Handbook 44, Section 2.21.

See the 2015 S&T Committee Final Report for additional details and background information on this issue.

2016 NCWM Interim Meeting:

During the 2016 NCWM Interim Meeting, the Committee received comments from the submitter of the item and others suggesting the item had been sufficiently developed and was ready for Vote. Mr. Nathan Gardner (Oregon) stressed the need for conducting a material test (in addition to a static test) on ABWS by explaining that these systems are used to weigh bulk material in multiple drafts as the material is dynamically run through the system. He indicated these systems need to be tested as they are used; that is, by using reference material of known value and running it through the system in a material test. He further evidenced the need to perform a material test on ABWSs by noting that belt-conveyor scale systems are used to weigh material dynamically and the accuracy of these systems are verified using material tests. Mr. Gardner assured everyone that if they were not performing material tests on these systems, large errors were going unnoticed. He indicated that the problems discovered in Oregon involved all products; fish being probably the worst. He also indicated that Oregon rejects a high percentage of ABWS even after a service company believes they have adjusted them correctly. With regard to whether a material test should be an optional test, Mr. Gardner reported that Oregon would be willing to entertain the idea of making it an optional test.

Ms. Tina Butcher (NIST, OWM) reported that OWM continues to believe a material test may have merit and that the additional detail provided by the State of Oregon regarding the proposed test procedures was appreciated. Although the original proposal to add a material test to the ABWS had been amended to address some of the earlier comments and recommendations provided by OWM and others at the 2015 NCWM Interim and Annual Meetings, further refinement was still needed. Some remaining and additional concerns are as follows:

- It may not be practical to perform a material test on all ABWSs due to the large capacities of some systems and/or the types of commodities weighed.
- It should be specified whether or not the material test is mandatory or optional and if optional, under what conditions is it optional.
- The test procedures in the current proposal are difficult to follow. For example:

- It seems that Steps 1 and 2 are performed to warm up the system (i.e., “to ensure normal working conditions”). Step 3 gives the impression that something was done in Step 2 that establishes the test load, yet it is not clear if that is actually the case given that the system was run for five weigh cycles.
 - NIST, OWM wants clarification on why a warm up is needed considering that a warm up is not typically performed before using the system for commercial transactions.
 - How and when is the weight of the reference material being determined?
 - A “weigh cycle” needs to be defined.
 - Maximum capacity, minimum capacity, and minimum totalized load need to be explained. These markings are not required on an ABWS and will not likely be understood. To the point, is “maximum capacity” the nominal capacity of the hopper (See definition of “nominal capacity, hopper scale” in NIST Handbook 44) or the amount of product in weight that the hopper will hold when full?
 - In Step 5, what constitutes a “run”? Is it five cycles?
 - Some of the individual items under proposed paragraph N.1.4. might be better suited for an EPO, rather than part of the Notes Section of the code.
- Might the proposed requirements be reorganized so they can be more easily followed?
 - With respect to the weighing of the reference material, it needs to be specified that when the weight of the reference material is determined (i.e., by weighing it when loaded onto a vehicle), the vehicle shall only be weighed as a single draft. This is important because UR.3.3. Single-Draft Vehicle Weighing only applies to vehicle scales. It is assumed that there will be occasions when reference material will need to be weighed on railroad cars. Railroad track scales can be used to weigh cars in multiple drafts. If the weight of the reference material is determined by split weighing the car containing it, it will likely not be accurate enough to use as a standard in testing.
 - Is a repeatability test using material really needed if it has already been proven that the scale repeats when tested statically? If it is determined that a repeatability test is also to be conducted using material, additional guidance on how to perform the test is suggested (e.g., using same test load, etc.).

Ms. Butcher also asked if members of the National Industrial Scale Association (NISA) might be consulted and requested to assist in the final development of this proposal. NIST, OWM believes that a number of its members might have an interest in this work and they may be willing to share their expertise.

Mr. Gardner indicated the State of Oregon would be willing to work with NIST, OWM to resolve any conflicts and that the test procedures in the proposal for conducting a material test had been developed from the OIML standard that applies to automatic bulk weighing systems.

Mr. Richard Suiter (Richard Suiter Consulting) commented that a key issue to conducting a material test is having a suitable reference scale available to weigh the material and getting the reference test load correct. He noted that officials may experience better success by weighing the material on a reference scale after completing the material test. He further stated that if using material normally weighed through the ABWS, one may not be able to return the product.

Mr. Doug Musick (Kansas) commented that the State of Kansas would support adding a material test to the ABWS Code providing the test is optional.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported that the SMA can support this item if the following three issues discussed in the S&T Report from the 2016 Interim Meeting are incorporated in the proposal before the July Annual Meeting:

- Reorganize the requirements in the proposal so they can be more easily followed;
- Improve the understanding of the test procedures; and
- Recognize that a material test would be optional and conducted at the discretion of the official.

During the Committee's work session, several members of the Committee acknowledged that OWM had indicated the proposal needed additional refinements. The Committee, however, also recognized an urgency to act quickly on this issue given Oregon's testimony regarding the possibility of large errors going unnoticed and the size of some of errors that had been reported. It was mentioned that Oregon had indicated a willingness to work with OWM to resolve any concerns. Mr. Gardner, who was in attendance, reaffirmed his agreement to work with OWM, and Mr. Rick Harshman (OWM Technical Advisor) acknowledged agreement to work with the State of Oregon to try and develop a final proposal that could be considered at the Annual Meeting. Consequently, the Committee agreed to present this item for Vote at the Annual Meeting with the understanding there would be some additional changes likely made to:

- reorganize the requirements in the proposal that they can be more easily followed;
- improve understanding of the test procedures; and
- recognize that a material test would be optional and conducted at the discretion of the official.

The Committee also agreed that it would downgrade the status of the item at the Annual Meeting if the changes noted could not be completed and a final amended version of the proposal posted on the NCWM website well in advance of the Annual Meeting to allow ample time for review and consideration by the voting membership.

2016 NCWM Annual Meeting

At its 2016 NCWM Annual Meeting open hearings, the Committee heard an update on this item from its submitter, Mr. Nathan Gardner (Oregon). Mr. Gardner reported that Oregon had revised the proposal since the 2016 Interim Meeting to address many of the concerns that had been identified at that meeting. He noted that although there still may be some gaps in the proposal, Oregon prefers the procedures be added to the ABWS Code so that other states too can begin performing the material test, which would be of great benefit given the large errors discovered by Oregon in tests it conducted.

The Committee also heard comments from Mr. Richard Harshman (NIST, OWM) suggesting the need for additional refinement to the proposal. Mr. Harshman questioned whether or not the Committee might be trying to move forward too quickly on the proposal before it has been adequately developed.

Mr. Harshman reported that during the 2016 Interim Meeting, the Committee agreed to assign a Voting status to this item with the understanding additional changes would likely be made by the submitter to address concerns OWM had expressed at that meeting. Mr. Harshman noted that OWM reviewed a revised proposal it received from the submitter in May 2016. That proposal addressed many of OWM's concerns; however, in reviewing the proposal, OWM identified a couple of significant gaps that still needed to be addressed as follows:

- a. There is no "Notes" paragraph included in the proposal specifying the conditions in which repeatability tests are to be performed (e.g., at or near the same test load, at the same flow rate, etc.). The proposal includes a repeatability tolerance (proposed paragraph T.5.2.) but no corresponding "Notes" paragraph to specify how repeatability tests are to be performed.
- b. There is no minimum test load specified in the proposal. That is, the proposal does not specify how much material needs to be run through the system for a material test in order to be considered a valid test.

Upon completion of its review of the revised proposal, OWM contacted the submitter and explained that these gaps were not discovered in its earlier review of the proposal, but were made evident by OWM's evolving understanding of the proposed procedures and how a material test might be performed on an ABWS. OWM believes these gaps can be eliminated over time fairly easily through the development of a small number of new paragraphs. There are also some additional, less significant "cleanups" that can be made to the proposal that would improve understanding.

Mr. Harshman noted that OWM appreciates the submitters urgency in wanting to add requirements and test procedures for a material test into the ABWS Code, but more importantly than getting them added quickly is that they be unambiguous and easy to follow so that they can be applied consistently. This should be an underlying consideration for any requirement proposed for addition to the handbook. Mr. Harshman further stated that the current testing procedures in the ABWS Code do not preclude officials from performing a material test if they believe such testing is needed to confirm the accuracy of the system under normal, automatic operation, or when investigating a consumer complaint.

As a final comment, Mr. Harshman reported that NIST, OWM prefers there be additional stakeholder involvement in the development of the requirements and procedures, which will serve to better ensure they are appropriate. As suggested in earlier OWM comments, might the National Industrial Scale Association (NISA) be consulted and asked to assist? OWM believes a number of its members might have an interest in this work and may be willing to share their expertise.

Ms. Kristin Macey (California) commented that California would also prefer there to be added stakeholder involvement in the development of the procedures for the material test.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC) commented that the objective of the material test is to determine accuracy of the device under actual conditions of use. He questioned how all of the dynamic factors are being addressed by the current static test procedures and noted that a fundamental principle of weights and measures is to test a device as it is used.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, stated that the SMA can support this item providing the following issues discussed in the 2016 S&T Interim Report from the 2016 are incorporated in the proposal:

1. reorganize the requirements in the proposal so they can be more easily followed;
2. improve the understanding of the test procedures; and
3. recognize that a material test would be optional and conducted at the discretion of the official.

During the Committee's work session, Mr. Gardner, who was in attendance, was asked by a Committee member what action he preferred the Committee take on the proposal. He indicated that he preferred the proposal be presented for Vote. Members of the Committee were then asked to provide an indication of whether or not they agreed that the item should be presented for vote. A Committee member questioned which proposal would be presented for vote (i.e., the proposal shown in the Item Under Consideration of NCWM Publication 16 or the revised proposal that Mr. Gardner had submitted to OWM in May 2016, which had also been shared with the Committee). It was agreed that the proposal in NCWM Publication 16 would need to be presented for Vote because the revised proposal had not been made available to members of the NCWM for review. Mr. Gardner was then asked again, the action he preferred the Committee take, given this new revelation that the proposal to be presented for Vote would be Oregon's original proposal; which appears in the Item Under Consideration in NCWM Publication 16. He again indicated that he preferred the item be presented for Vote. Members of the Committee were then asked again to provide an indication of whether or not they agreed that the item should be presented for Vote. The majority of members indicated their desire to present the item for Vote and so it was decided, although the decision was not to be final.

The Committee was asked to revisit the item at the request of Mr. Richard Harshman (NIST Technical Advisor to the Committee) when it met the next day to conclude its work session. Mr. Harshman explained to the Committee that during the previous evening, he had again reviewed the original proposal and was unable to follow the different steps

outline in proposed paragraph N.4.1. Material Test; nor was it clear to him the purpose of some of those steps. He asked members of the Committee to review those steps to determine if they too had difficulty following them. He stressed the need for officials to be able to apply test procedures consistently throughout and questioned whether this could be done based on the procedures in the proposal. He noted that the submitter had removed those steps in the revised version of the proposal based on an NIST, OWM recommendation that they be removed and developed later for inclusion into a NIST EPO. Removing them from the proposal would also expedite getting a final proposal developed and presented to the NCWM for consideration. He indicated too that there were gaps in the proposal; one of them being that there is a repeatability tolerance specified under the Tolerances Section of the proposal and not a corresponding “Notes” paragraph to provide instructions on how to perform the test. He asked the Committee to reconsider its decision to present the item for vote given these concerns; noting that if he couldn’t understand how to apply the test procedures, it is likely that field officials too will have difficulty understanding how to apply them. He stated that the OWM comments provided during the Committee’s 2016 open hearings were based on the revised proposal Oregon had sent to OWM in May. The revised proposal includes improvements that were made by the submitter to the original proposal.

Following Mr. Harshman’s explanation and the resulting discussions that ensued, Mr. Mahesh Albuquerque (Chair of the Committee) again requested a Vote on whether the item should move forward for Vote or be downgraded and returned to the submitter for further development. The majority of the Committee members voted in favor of downgrading the status of the item to Developing to provide additional time for the submitter to address the remaining concerns.

Upon learning of the Committee’s decision to downgrade the status of the item to Developing, Mr. Gardner requested Mr. Albuquerque Withdraw the item.

Regional Association Comments:

The WWMA heard testimony from two regulators in support of this item at its 2015 Annual Meeting. The WWMA S&T Committee sees merit in this proposal and agrees that a dynamic test is appropriate for this type of weighing device. The WWMA recommended that this be a Voting item.

At its fall 2015 Interim Meeting, the CWMA reported it believes this item should be amended to allow regulatory officials to determine when it would be necessary. The CWMA recommended the item remain as an Information item. At its spring 2016 meeting, the CWMA reported that it would consider the item fully developed and would support it as a Voting item providing the following three issues discussed in the S&T Report from the 2016 NCWM Interim Meeting are incorporated in the proposal before the July Annual Meeting:

1. reorganize the requirements in the proposal so they can be more easily followed;
2. improve the understanding of the test procedure; and
3. recognize that a material test would be optional and conducted at the discretion of the official.

At its fall 2015 Interim Meeting, NEWMA reported it believes this item has merit and supports it but does not believe it is ready for a Vote. NEWMA recommended that it be an Informational item. At its spring 2016 Annual Meeting, NEWMA agreed to downgrade the status of this item from Voting to Informational. This will provide the additional time necessary for OWM and the submitter to make additional changes, if needed.

The SWMA has heard several concerns during past meetings and received a written communication before this meeting expressing concerns over the proposed procedures. The SWMA recommended that this item remain as a Developing item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

325 WEIGH-IN-MOTION SYSTEMS USED FOR VEHICLE ENFORCEMENT SCREENING

325-1 I A. Application. and Sections Throughout the Code to Address Commercial and Law Enforcement Applications

Source:

Rinstrum, Inc. and Right Weigh Innovations (2016)

Purpose:

To recognize a higher accuracy class and appropriate requirements in the Weighing-In-Motion Tentative Code to add commercial and law enforcement applications. In particular, scales meeting the higher accuracy classes would be permitted for use in commercial applications and for highway law enforcement.

Item under Consideration:

There is no specific proposal under consideration at this time. The submitter's original proposal has been removed from this part of the report at the submitter's request and is now included as part of the Background/Discussion for this item. The following synopsis was developed by the submitter of the item following the 2016 NCWM Annual Meeting to replace the original proposal that earlier appeared in this section of the report:

Rinstrum and Right Weigh Innovation submitted a proposal last year to modify the tentative WIM Code for Screening and Sorting. The idea was to keep all WIM applications within the same Code section of NIST Handbook 44. Rinstrum proposed to add slow-speed devices to the existing Screening and Sorting Code with two separate applications; one for commercial legal-for-trade and one for direct law enforcement. In consideration of the changes proposed, there would be three different applications covered by the same Code, which was causing some confusion. Because of the legal-for-trade application, it was suggested that that modification probably belonged in the Scales Code.

The 2016 NCWM Interim Meeting saw Rinstrum request the NCWM President to form a WIM Task Group to bring together regulators and private sector stakeholders to discuss Weigh-In-Motion technology. Rinstrum sought a Developing status so that it could maintain ownership of the proposal and continue to work on its development. A WIM Task Group has been formed, currently with 18 members representing Federal, State and Private Sector stakeholders. Technical advisors from NIST and NTEP contribute to the strength of the WIM Task Group. If you are interested in WIM technology, we will gladly add you to the WIM Task Group membership.

The WIM Task Group is conducting regular meetings and following an agenda to analyze the device performance and create suitable Code that is well reasoned and appropriate for inclusion in NIST Handbook 44. The first action of the WIM Task Group was to order an evaluation by the State of Illinois at an existing installation site to confirm the device meets Class IIIIL tolerance. Next a decision was made to separate the Commercial Application from the Law Enforcement Application and to focus on the Commercial Application first. The Task Group will evaluate the requirement for use of reference test load vs. using the scale under test as a reference. Consideration will be given to axle weight fluctuations as a result of suspension movement and what tolerance should be applied. Additional items on the agenda include the use of a single tolerance and creation of a Test Procedure and NTEP checklist. A sample of language to modify the Scales Code is currently being circulated within the Task Group for review and comments. The Task Group is engaged in this process and is thoroughly vetting the ideas and proposals presented so that it can make appropriate recommendations to the conference.

Rinstrum manufactures the axleWEIGHr in-motion scale, which is a slow speed WIM axle scale system capable of being able to perform to within Class IIIIL maintenance tolerance, according to Rinstrum. Rinstrum has indicated that the axleWEIGHr is a niche product, which creates a new segment for axle weighing devices. The axleWEIGHr calculates the GVW and weighs individual axles while a truck crosses the scale at 1-3 MPH. Rinstrum has also indicated the most common applications for its device will be

agricultural farmers, small trucking companies or manufacturers that are interested to determine GVW and axle weights before the vehicle enters the public roadway.

Background/Discussion:

The proposed requirements are based in part on requirements in OIML R 134, “Automatic instruments for weighing road vehicles in motion and measuring axle loads.” Test data and experience at multiple test sites demonstrate this system can meet the performance requirements that are proposed.

The following represents the submitter’s original proposal that earlier appeared as the Item Under Consideration for this item and was replaced following the 2016 NCWM Annual Meeting:

Amend NIST Handbook 44, Section 2.25. Weigh-In-Motion Systems Used for Vehicle Enforcement Screening – Tentative Code as follows:

A.1. General. – This code applies to systems used to weigh vehicles, while in motion.

- (a) For the purpose of screening and sorting the vehicles based on the vehicle weight to determine if a static weighment is necessary.
- (b) For commercial legal for trade applications.
- (c) For direct law enforcement applications.

A.2. Axle-Load Scales – The requirements for axle-load scales apply to such scales in official use for the enforcement of traffic and highway laws or for the collection of statistical information by government agencies and axle-load scales that meet the requirements of the Tentative Code for commercial use.

A.23. The code does not apply to weighing systems intended only for the collection of statistical traffic data.

A.34. Additional Code Requirements. – In addition to the requirements of this code, Weigh-In-Motion Screening Systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

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

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

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

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

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

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

S.1.3. Maximum Value of Division Size. – ~~The value of the system division “d” for a Class A, Weigh-In-Motion System shall not be greater than 50 kg (100 lb).~~

- (a) **The value of the system division “d” for a Class A, Weigh-In-Motion System shall not be greater than 50 kg (100 lb).**
- (b) **The value of the system division for “d” for a Class B or III L, Weigh-In-Motion System shall not be greater than 10 kg (20 lb).**

S.1.4. Value of Other Units of Measure.

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

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

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

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

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

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

- (a) Vehicle speed is below the minimum or above the maximum speed as specified.
- (b) The maximum number of vehicle axles as specified has been exceeded.
- (c) A change in vehicle speed greater than that specified has been detected.

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) lane identification (required if more than one lane at the site has the ability to weigh a vehicle in-motion);
- (c) vehicle speed;
- (d) number of axles;
- (e) weight of each axle;

- (f) **if applicable** identification and weight of axles groups;
- (g) **if applicable** axle spacing;
- (h) total vehicle weight;
- (i) all fault conditions that occurred during the weighing of the vehicle;
- (j) **if applicable** violations, as identified in paragraph S.2.1., that occurred during the weighing of the vehicle; and
- (k) time and date.

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

S.2. System Design Requirements.

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

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

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

S.3. Design of Weighing Elements.

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

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

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

- (a) WIM Systems for screening and sorting, meeting the requirements of this code shall be designated as accuracy Class A.
- (b) WIM Systems for commercial and law enforcement applications, meeting the requirements of this code shall be designated:
 - (1) Class III L for the dynamic gross vehicle weight calculations; or
 - (2) Class B for dynamic law enforcement applications.

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

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

- (a) Accuracy Class;
- (b) Value of the System Division “d”;
- (c) Operational Temperature Limits;
- (d) Number of Instrumented Lanes (not required if only one lane is instrumented);
- (e) Minimum and Maximum Vehicle Speed;
- (f) Maximum Number of Axles per Vehicle;
- (g) Maximum Change in Vehicle Speed during Weighment; and
- (h) Minimum and Maximum Load.

S.5.1. Location of Marking Information. – The marking information required in G-S.1. of the General Code and S.5. shall be visible after installation. The information shall be marked on the system or recalled from an information screen.

N. Notes

N.1. Test Procedures.

N.1.1. Selection of Test Vehicles. – All dynamic testing associated with the procedures described in each of the subparagraphs of N.1.5. shall be performed with a minimum of two test vehicles.

- (a) The first test vehicle may be a two axle, six tire, single unit truck; that is, a vehicle with two axles with the rear axle having dual wheels. The vehicle shall have a ~~maximum~~ **minimum** Gross Vehicle Weight of 10 000 lbs.
- (b) The second test vehicle shall be a ~~five axle~~, single trailer truck with a maximum Gross Vehicle Weight of 80 000 lbs.

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

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

N.1.1.2. Determining Reference Weights for Axle, Axle Groups and Gross Vehicle Weight. – The reference weights shall be the average weight value of a minimum of three static weighments of all single axle, axle groups and gross vehicle weight.

Note: The axles within an axle group weighed only as 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 to 85 to 95 % of their legal maximum Gross Vehicle Weight **or as typical in normal use.** The “load” shall be non-shifting and shall be positioned to present as close as possible, an equal side-to-side load.

~~N.1.3. **Reference Scale.** – Each reference vehicle shall be weighed statically on a multiple platform vehicle scale comprised of three individual weighing/load receiving elements, each an independent scale. The three individual weighing/load receiving elements shall be of such dimension and spacing to facilitate 1) the single-draft weighing of all reference test vehicles, and 2) the simultaneous weighing of each single axle and axle group of the reference test vehicles on different individual elements of the scale; gross vehicle weight determined by summing the values of the different reference axle and reference axle groups of a test vehicle. The scale shall be tested immediately prior to using it to establish reference test loads and in no case more than 24 hours prior. To qualify for use as a suitable reference scale, it must meet NIST Handbook 44, Class III L maintenance tolerances.~~

N.1.3. **Reference Scale.** – Each reference vehicle shall be weighed statically on a certified scale to determine the Gross Vehicle Weight. To qualify for use as a suitable reference scale, it must meet NIST Handbook 44, Class III L maintenance tolerances. The scale shall be tested immediately prior to using it to establish reference test loads and in no case more than 24 hours prior.

(a) For law enforcement applications the reference vehicle shall be weighed on a certified multiple platform vehicle scale comprised of three individual weighing/load-receiving elements, each an independent scale. The three individual weighing/load receiving elements shall be of such dimension and spacing to facilitate 1) the single-draft weighing of all reference test vehicles, and 2) the simultaneous weighing of each single axle and axle group of the reference test vehicles on different individual elements of the scale; gross vehicle weight determined by summing the values of the different reference axle and reference axle groups of a test vehicle.

Note: If the distance to an off-site reference scale will significantly impact the accuracy of the reference weights then the scale under test may be used as the reference scale.

(b) For commercial applications for the gross vehicle weight calculations only, the reference vehicle shall be weighed statically on either the same scale, a certified multiple platform vehicle scale or a single platform vehicle scale with sufficient length to accommodate single draft weighing of the reference vehicle.

N.1.3.1. **Location of a Reference Scale.** – The location of the reference scale must be considered as vehicle weights will change due to fuel consumption.

N.1.4. **Test Speeds.** – All dynamic tests shall be conducted within 20 % above the rated minimum and 20 % below the rated maximum speed limits.

N.1.5. **Test Procedures.** For law enforcement scales.

N.1.5.1. **Static Test Procedures.** – For Type Approval Evaluation and initial verification the axle-load scale designed for commercial use shall be tested statically to NIST Handbook 44 Class III Tolerances. For subsequent verification the scale will be tested to NIST Handbook 44 Class III L maintenance tolerances.

N.1.5.12. Dynamic Load Test. – The dynamic test shall be conducted using the test vehicles defined in N.1.1. The test shall consist of a minimum of 20 runs for each test vehicle at the speed as stated in N.1.4.

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

N.1.5.23. Vehicle Position Test. – During the conduct of the dynamic testing ensure that the vehicle stays within the defined roadway along the width of the sensor. The test shall be conducted with 10 runs with the vehicle centered along the width of the sensor, five runs with the vehicle on the right side along the width of the sensor, and five runs with the vehicle on the left side along the width of the sensor. Only gross vehicle weight is used for this test and the tolerance for each weight shall be based on the tolerance value specified in T.2.3.

N.1.5.34. 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.

N.1.6. Test Procedure for Commercial Gross Vehicle Weight Calculation Scales.

N.1.6.1. As-Used Test Procedures. – **A weighing system shall be tested in a manner that represents the normal method of operation.**

N.1.6.2. Static Test Procedures. – **For Type Approval Evaluation and initial verification the axle-load scale designed for commercial use shall be tested statically to NIST Handbook 44 Class III Tolerances. For subsequent verification the scale will be tested to NIST Handbook 44 Class III L maintenance tolerances.**

N.1.6.3. Dynamic Test. – **The dynamic test shall be conducted using the test vehicles defined in N.1.1. The test shall consist of a minimum of five runs for each test vehicle at the speed as stated in N.1.4.**

At the conclusion of the dynamic test there will be a minimum of five weight readings for the gross vehicle weight of the test vehicle. The tolerance for each weight reading shall be based on NIST Handbook 44 Class III L maintenance tolerances.

T. Tolerances

T.1. Principles.

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

T.2. Tolerance Values for Accuracy Class A.

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

T.2.2. Tolerance Values for Dynamic Load Tests for Screening and Sorting devices. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.2.

Table T.2.2.
Tolerance for Accuracy Class A

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

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

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

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

T.3. Tolerance Values for Dynamic Weighing Systems Used Commercially and for Direct Law Enforcement. – The tolerance values applicable during dynamic load testing are as specified in Table T.2.2.

Table T.3.
Tolerance for Commercial and Law Enforcement Dynamic Scales.

<u>Load Description</u>	<u>Tolerance as a Percentage of Applied Test Load</u>
<u>Axle Load</u>	<u>± 0.5 %</u>
<u>Axle Group Load</u>	<u>± 1 %</u>
<u>Gross Vehicle Weight</u>	<u>Class III L Maintenance Tolerance</u>

T.3.4. Influence Factors. – The following factors are applicable to tests conducted under controlled conditions only.

T.3.4.1. Temperature. – Systems shall satisfy the tolerance requirements under all operating temperature unless a limited operating temperature range is specified by the manufacturer.

T.45. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed the tolerance value as stated in Table T.2.2. or Table T.3. as applicable.

UR. USER REQUIREMENTS

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

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

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

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

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

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

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

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

UR.2.4. Axle-Load Scales Approaches. – **At each end of an axle-load scale there shall be a straight, paved, and level approach in the same plane as the platform. The approaches shall be the same width as the platform and of sufficient length to insure the level positioning of vehicles on the approaches throughout the weighing process.**

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

2016 NCWM Interim Meeting:

During the 2016 NCWM Interim Meeting, Mr. John Lawn (Rinstrum, Inc.) presented a short slide presentation on a slow speed WIM system that Rinstrum, Inc., manufactures. A copy of the slides from his presentation has been inserted into Appendix B of this report. Mr. Lawn explained that he had originally hoped the proposal could be considered for vote in 2016, but had decided to request it move forward as Developing in 2016 to allow time for Rinstrum to address some of the concerns that had been raised through the review process and to better familiarize the weights and measures community with the equipment. He also indicated that he understood the need for Rinstrum to provide data in support of their claim that the equipment is capable of conforming to the tolerances specified in the proposal. Rinstrum’s plan going forward is to amend the current proposal to address all the issues and have a new proposal ready in time to be considered for Vote in 2017.

Ms. Tina Butcher (OWM) noted that the adoption of this proposal would, for the first time ever, make it permissible for WIM vehicle systems installed in the U.S. to be used not only for direct law-enforcement applications, but also for commercial applications. She further explained that while OWM encourages the expansion of the code to recognize such applications, the proposal needs to be thoroughly vetted by all the different parties affected by the changes being proposed, including (but not necessarily limited to):

- truck weight enforcement officials;
- representatives from the judicial system;
- WIM equipment manufacturers;
- weights and measures officials;
- FHWA and other transportation officials; and
- members of the trucking industry.

The submitter and others have acknowledged the proposal needs a considerable amount of additional development before it is ready to move forward for Vote. Ms. Butcher recommended the proposal remain in a Developing status until such time that the WIM WG or other representative group has reviewed and considered its merits.

Ms. Butcher further reported that in OWM's analysis of this item, there were several areas identified as needing additional development to include:

- The procedures developed by the WIM WG for establishing reference test loads for testing WIM systems used in law enforcement screening may not provide the level of accuracy needed (i.e., combined error and uncertainty less than one-third applicable tolerance) for testing commercial and law-enforcement WIMs given the more stringent tolerances proposed for these applications.
- Studies have shown that axle and tandem axle weights fluctuate depending on the position of a truck on a scale. How will this be addressed in the procedures for establishing the reference test loads for testing axle and axle-groups?
- Under what conditions are officials willing to accept a single tolerance (i.e., Class IIIIL Maintenance tolerance) for commercial applications?
- Why is there not an acceptance tolerance proposed? Is it because the amount of error in the WIM system is not expected to change as a result of routine, continued use?
- If a single tolerance is accepted, will this be limited to certain applications?

She also noted that as the proposal is further developed, additional changes to format and structure of the code may be needed to clearly delineate requirements for commercial WIM applications from those used for law-enforcement.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA reported that the SMA opposes the inclusion of these changes in the Weigh-In-Motion for Vehicle Enforcement Screening Code. The SMA supports the idea identified, but feels additional clarification and development is required.

A couple of regulatory officials commented in support of maintaining the Developing status of the proposal.

The Committee agreed with the submitter's request and recommended the item move forward as Developing.

2016 NCWM Annual Meeting:

During the Committee’s open hearings at the 2016 NCWM Annual Meeting, Mr. John Lawn (Rinstrum, Inc.) reported that the current proposal is no longer being considered and that an NCWM Task Group has formed to assist in the further development of a proposal to replace it. He provided a brief update on some of the discussions that had taken place within the Task Group, which had met a day earlier. He stated that the Task Group had already agreed that the proposal needed to be changed to separate the requirements for WIM systems used in commercial application from those used for direct enforcement. He requested that the Committee replace the proposal included in the Item Under Consideration with a synopsis, which he offered to draft and provide to the Committee given that the current proposal was no longer being considered.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, stated that the SMA takes no position on this item at this time and looks forward to recommendations from the newly formed Weigh-In-Motion Task Group.

In consideration of Mr. Lawn’s request to do so, the Committee agreed to replace the proposal in the Item Under Consideration with a synopsis to be developed by him. The Committee also changed the status of the item to Information because an NCWM Task Group, under the direction of the Committee, is now assisting in the development of a proposal. This change in status is an indication that the Committee has taken responsibility for the additional development of this item.

Regional Association Comments:

At its fall 2015 Interim Meeting, the CWMA heard a presentation from Mr. John Lawn of Rinstrum proposing the commercial use of weighing in-motion systems. He indicated that participants from the Western Weights and Measures Association provided good feedback for them to improve the proposal, which resulted in this new proposal. An industry consultant indicated the item could be ready for Voting status, especially since it would be considered a tentative code. Mr. Long commented that he would attend the Interim meeting and make the presentation then. The CWMA agreed that the item was sufficiently developed and forwarded it to NCWM recommending that it be a Voting item. At its spring 2016 Annual Meeting, the CWMA recommended the item be presented as a Developing Item on the NCWM Agenda, reporting that it feels this item has merit and the comments received were in support of it, but it is in need of Development.

At its fall 2015 Interim Meeting, NEWMA recommended this item as a Voting item since the code is still tentative. At its spring 2016 Annual Meeting, NEWMA recommended the item be forwarded to NCWM as a Developing item.

The SWMA reported, at its 2015 Annual Meeting, it believes this item has merit but needs further development. The SWMA forwarded the item to NCWM, recommending that it be a Developing item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

330 LIQUID MEASURING DEVICES

330-1 V S.1.6.3. Return to Zero (See Related Items 331-1 and 332-1)

(This item was Adopted.)

Source:

Maryland (2016)

Purpose:

Prohibit operation of the reset mechanism during delivery.

Item under Discussion:

Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

S.1.6.3. Return to Zero.

- (a) The primary indicating elements, and primary recording elements if the device is equipped to record, shall be readily returnable to a definite zero indication. However, a key-lock operated or other self-operated device may be equipped with cumulative indicating or recording elements, provided that it is also equipped with a zero-return indicating element.
- (b) It shall not be possible to return primary indicating elements, or primary recording elements beyond the correct zero position.

(c) Primary indicating elements shall not be resettable to zero during a delivery.(Amended 1972 **and 2016**)**Background/Discussion:**

While many devices include a provision to prevent the reset operation from occurring during a delivery, this language is not directly specified in all measuring codes. Consequently, the proposals include suggested language to add this provision to the LMD, VTM, and LPG and NH₃ codes.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Items 330-1, 331-1, and 332-1 and comments were taken simultaneously as the Committee considered them companion items. A summary of comments heard on all three items are as follows:

Ms. Tina Butcher (NIST, OWM) offered comments intended to apply to all items in the group and to only specific items in the group. With respect to adding the sentence, “A reset mechanism...during a delivery” proposed for each code, Ms. Butcher stated OWM agrees with the proposed addition of a requirement that prohibits the operation of a zero-reset mechanism during a delivery in each of these codes. If a reset mechanism can be operated during a delivery, this may allow an inadvertent or intentional reset of the indications to zero. If such a reset occurred, it would not allow for an accurate accounting of the quantity during a delivery and may facilitate fraud. The prohibition for operating the reset mechanism while a metering system is in operation has been applied for some time during type evaluations. She noted that for additional sentence clarity, OWM suggests that the reference to a “reset mechanism” be qualified with the term “zero” to read “zero-reset mechanism.”

With respect specifically to Item 331-1, Ms. Butcher indicated OWM concurs with the key points outlined in the justification for the item. Current language in NIST Handbook 44 VTM and LPG and NH₃ codes specifies the operator is to reset a register to zero if it advances when initially activated. It is the responsibility of the operator to ensure the device is reset to zero prior to every operation, but in the real world, operators are often rushed and may not take time to rezero the device. Additionally, drivers are sometimes given only one delivery ticket for a customer and don't reset the indications because they can't make a delivery without a replacement ticket. She further noted that this can easily lead to facilitation of fraud. Including a specification to help ensure that the system is designed to automatically reset to zero prior to the start of a delivery would:

- help eliminate these concerns;
- improve the accuracy of transactions; and
- facilitate the delivery process for the operator.

She suggested the Committee also consider adding a new requirement to limit the quantity that can be suppressed similar to existing paragraph S.1.6.1. in the LMD code. She indicated the corresponding LMD Code paragraph S.1.6.3. Return to Zero uses a bulleted format, which may make the paragraph easier to read and apply. NIST, OWM suggests that a similar formatting be used for paragraph S.1.1.5. Return to Zero. She also suggested the Committee may want to consider adding a user requirement to the VTM Code similar to paragraph UR.3.1. Return of Indicating and Recording Elements to Zero in the LMD Code.

With respect specifically to Item 332-1, Mr. Butcher stated that NIST, OWM agrees with the proposed addition of the new paragraph addressing initial zero indications; such a requirement will help ensure that transactions start on zero with little need for operator intervention.

Mr. Ross Andersen (New York, Retired) commented “during the delivery” is not the critical part of the proposal. It is what a reset mechanism does that is critical; it is the actual function that ends the delivery. He encouraged the Committee to make sure the language makes clear that the delivery is done and the meter is reset.

Mr. Dmitri Karimov (Liquid Controls, LLC) stated he agreed with the reset mechanism portion of the proposals but that more technical work was needed on pressurization and for that reason was opposed to adding the proposed new paragraph titled “Initial Zero Indication – Electronic Devices” in 331-1 and 332-1. He noted that there is a big difference in the pressurization of a RMFD and a VTM due to hose length. There is a lot more quantity of product involved in a VTM hose in comparison to RMFD hose. There could be as much as two gallons of product in a VTM hose. Mr. Jim Petinatto (FMC Technologies) followed up by stating masking pressurization hides abuse. Masking doesn’t help the operators.

Mr. Ken Ramsburg (Maryland) stated that the intent of proposal was not to mask multiple gallons, but to have the device start on zero.

During the Committee’s work session, members of the Committee acknowledged there seemed widespread support to adding a sentence prohibiting the operation of a zero-reset mechanism during a delivery into each of these codes. With respect to the sentence being proposed, the NIST Technical advisor noted that during the Meter Manufacturers Association Meeting held the previous Sunday, some members of the MAA had expressed a concern with some of the language in the sentence. Members of the MAA had developed and agreed to the following preferred language to replace the sentence being proposed in each of the three codes:

Primary indicating elements shall not be resettable to zero during a delivery.

The Committee agreed that the sentence developed and recommended by the MAA was clearer and might also address the concern raised during the open hearings regarding reset being the function that ends a delivery. Consequently, the Committee agreed to replace the sentence being proposed in each of the proposals with that recommended and preferred by the MAA.

Members of the Committee also acknowledged that the comments received from industry suggested additional work was needed to develop requirements that address pressurization in both the VTM and LPG and Anhydrous Ammonia Measuring Devices codes. In consideration of the “industry” comments, the Committee agreed to delete the proposed new paragraph titled, “Initial Zero Indication – Electronic Devices” from each of these agenda items as follows:

Delete from Agenda Item 331-1:

S.1.1.6. Initial Zero Indication - Electronic Devices. – A device shall display a definite zero indication upon initial activation of the delivery mode. The measurement, indication of delivered quantity, and (for computing devices) the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero. Pressurization of any discharge hose shall not result in the register advancing beyond the initial zero indication. [Nonretroactive as of January 1, 20XX]

Delete from Agenda Item 332-1:

S.1.4.3. Initial Zero Indication - Electronic Devices. – A device shall display a definite zero indication upon initial activation of the delivery mode. The measurement, indication of delivered quantity, and (for computing devices) the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero. Pressurization of any discharge hose shall not result in the register advancing beyond the initial zero indication. [Nonretroactive as of January 1, 20XX]

The changes agreed to by the Committee are reflected in the Item Under Consideration for each of the three items. The Committee agreed to present each item for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee agreed to group together Agenda Items 330-1, 331-1, and 332-1 and take comments on these items simultaneously. Mr. Kenneth Ramsburg (Maryland), submitter of the proposal, questioned why the pressurization paragraphs had been removed from the initial proposal. Mr. Harshman (NIST, OWM Technical Advisor to the Committee) reported that the paragraphs had been removed at the recommendation of the MMA during the 2016 Interim Meeting. The MMA had indicated to the Committee further development was needed concerning requirements addressing pressurization due to the amount of product contained in the delivery hose of a VTM (or LPG and anhydrous ammonia measuring device) in comparison to the delivery hose of a RMFD. Because of the difference in the amount of product remaining in the hose after a delivery, the MMA had concluded pressurization could not be treated the same for these devices. Mr. Ramsburg then asked when the proposals would become enforceable, if adopted. Mr. Harshman indicated they would become enforceable on January 1, 2017. Ms. Tina Butcher (NIST, OWM) noted that the portion of the proposals still remaining is retroactive and, therefore, would become enforceable with the adoption of the 2017 version of NIST Handbook 44 for each of these items.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA supported the items as drafted. He indicated that the pressurization language, which had been removed from the proposals, would cause problems for industry, if adopted. He also stated that if Maryland wants pressurization to be addressed in NIST Handbook 44, the MMA would be willing to try and develop some draft language that could be considered.

Ms. Tina Butcher (NIST, OWM) stated that OWM believes the Committee made the right decision to remove pressurization paragraphs from Item 331-1 and 332-1. She also indicated that OWM believes Maryland's initial proposal has merit and suggested that the Committee consider adding a new item to its carryover agenda for the coming NCWM cycle to address the pressurization issue.

Hearing no comments in opposition the Committee agreed to present Items 330-1, 331-1, and 332-1 for Vote; each without change as shown in Item Under Consideration. Members of the Committee were opposed to adding a new carry-over item to the Committee's agenda to address pressurization, as suggested by OWM, without the State of Maryland's commitment to finalize development of the proposal, including working with the MMA to help develop it. The Committee, not knowing whether or not Maryland intended to further pursue this issue, agreed that Maryland would be able to submit a new proposal to address this issue, should it believe such action is necessary.

Regional Association Comments:

The CWMA reported that it received no comments on this item at its spring 2016 Annual Meeting. The CWMA recommended the item move forward as a Voting Item on the NCWM Agenda.

At its spring 2016 Annual Meeting, NEWMA reported it believes this item would improve harmonization of the LMD, VTM, and LPG/NH₃ codes with other measuring device codes. NEWMA recommended forwarding this item as a Voting item to NCWM.

The SWMA, at its fall 2015 Annual Meeting grouped this item in a batch consisting of Items 330-1, 331-1 and 332-1 and all items were heard together. The Committee believes the items have merit. The SWMA forwarded the items to NCWM, recommending that they be Voting items.

330-2 V S.X.X. Card Operated Retail Motor Fuel Devices

(This item was Adopted.)

Source:

North Carolina (2016)

Purpose:

To clarify justification of testing 3-minute time out for credit card operated RMFD.

Item under Discussion:

Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

S.1.6.10. Pay-At-Pump Retail Motor-Fuel Devices. – Once a device has been authorized, it must de-authorize within two minutes if not activated. Re-authorization of the device must be performed before any product can be dispensed. If the time limit to de-authorize the device is programmable, it shall not accept an entry greater than two minutes.

[Nonretroactive as of January 1, 2017]

(Added 2016)

Background/Discussion:

This paragraph represents how the feature is tested in an NTEP evaluation in accordance with the NCWM Publication 14 checklist. However, it is not clearly supported by NIST Handbook 44. General Code, paragraph G-S.2. Facilitation of Fraud is vague on this issue. There is great concern regarding the use of credit cards and the potential for accidental or intentional fraud.

2016 NCWM Interim Meeting:

At the Committee’s 2016 NCWM Interim Meeting open hearings, Ms. Tina Butcher (NIST, OWM) commented that NTEP evaluations of card-activated retail motor-fuel systems include various tests to verify that the process of authorizing a sale with a credit or debit card doesn’t allow a card to be inappropriately accessed. These tests and procedures are specified in NCWM Publication 14. The procedures include a requirement that a dispenser, having been “authorized” with a credit or debit card, must “de-authorize” if not turned on after a period of three minutes. While this situation can be and has been addressed during type evaluation through General Code paragraph G-S.2. Facilitation of Fraud, OWM believes the proposed change to the LMD Code would:

- provide specific language to help address this gap;
- improve uniformity in application; and
- provide specificity to manufacturers who are designing such systems.

Ms. Butcher noted that the Measuring Sector reviewed and refined the language in the proposal prior to its submission and that there are similar “time-out” requirements in the Vehicle-Tank Meters Code, but none currently in the LMD Code.

Ms. Butcher also reported that OWM suggests simplifying the first sentence of the proposal to read:

Once a card has been accepted and the device authorized, the device must de-authorize within three minutes if the device is not activated or there is no initial product dispensed.

Mr. Tom McGee (PMP Corporation) stated that the language in the proposal needed to be broader in terms of the activation mechanism and noted the existence of metering systems that can be activated using a cell phone and possibly other similar devices. Ms. Julie Quinn (Minnesota) stated that she supports the proposal as a Voting item and agrees that “card operated” needs to be expanded. Further, Ms. Quinn stated that three minutes is too long and should be

shortened. Ms. Fran Elson-Houston (Ohio) wondered if it was possible to add provisions requiring deactivation of the device if foreign objects (e.g., skimmers) were affixed to it.

In consideration of the Comments received during the open hearings, the Committee agreed to:

- amend the title of the paragraph to recognize additional means of activating a dispenser;
- reduce the time limit in which a dispenser would need to de-activate from three minutes to two minutes, plus make some additional amendments to the language to make it clearer; and
- add a non-retroactive enforcement date to the paragraph.

The Committee agreed to present the item, as amended by the Committee, for vote at the Annual Meeting. All the changes agreed to by the Committee are included in the proposal as shown in the Item Under Consideration.

2016 NCWM Annual Meeting

At the 2016 NCWM Annual Meeting open hearings Ms. Tina Butcher (NIST, OWM) stated the proposed change to the LMD code would provide specific language to help address intentional or inadvertent misuse of a customer's card; provide for uniformity in application; and provide specificity to manufacturers who are designing such systems. OWM also recommended that the Committee consider NEWMA's recommendation to change the time limit to three minutes as was originally proposed by the submitter.

Mr. Mike Sikula (New York) commented that there may be customers that need three minutes.

Dr. Matthew Curran (Florida) stated two minutes would help prevent fraud as three minutes was more than enough time to pull away from a dispenser and allow someone to pull up and begin fueling under activation from the previous customer.

The Committee, in consideration of the comments heard during the open hearings on two minutes versus three minutes, agreed to present Item 330-2 for Vote without change as shown in Item Under Consideration.

Regional Association Comments:

The CWMA agreed at its spring 2016 Annual Meeting to recommend the item be a Voting item on the NCWM Agenda and reported there were no comments heard on this item and that it believes the item is fully developed.

At both its fall 2015 Interim Meeting and spring 2016 Annual Meeting, NEWMA agreed to support the item and forward it to NCWM, recommending that it be a Voting item. At the NEWMA Annual Meeting, the S&T Committee heard comments in opposition to a two-minute time out and support to amend the proposal to a three-minute time out as specified in NCWM Publication 14. Consequently, NEWMA amended the time specified in the proposal for the device to de-authorize from two minutes to three minutes. The following amended proposal was forwarded to the NCWM along with the recommendation it be a Voting item:

S.X.X. Pay-At-Pump Retail Motor-Fuel Devices. – Once a device has been authorized, it must de-authorize within ~~two~~ three minutes if not activated. Re-authorization of the device must be performed before any product can be dispensed. If the time limit to de-authorize the device is programmable, it shall not accept an entry greater than ~~two~~ three minutes.
[Nonretroactive as of January 1, 2017]

At its fall 2015 Annual Meeting, the SWMA forwarded this item to NCWM, recommending that it be a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

330-3 V N.4.5. Verification of Linearization Factors

(This item was Adopted.)

Source:

Minnesota Weights and Measures Division (2014)

Purpose:

To update NIST Handbook 44 to reflect the technological changes in registers for liquid measuring devices and to alert weights and measures officials to the fact that error in start-up and shut-down delivery quantities can introduce linear errors in the calibration at normal flow rates; these errors increase the further the delivered quantity deviates from the prover size used at calibration.

Item Under Consideration:

Amend NIST Handbook 44 Liquid Measuring Devices Code by adding the following:

N.4.5. Verification of Linearization Factors. – All enabled linearization factors shall be verified. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis at the discretion of the official with statutory authority.

(Added 2016)

UR.4. Maintenance Requirements.

UR.4.1. Use of Adjustments. – Whenever a device is adjusted, all enabled linearization factors shall be verified to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis.

(Added 2016)

Background/Discussion:

Wholesale metering systems are used to deliver product at many different flow rates. Many of these systems are equipped with features that allow different calibration factors to be programmed at those flow rates. Companies commonly set accuracy goals of $\pm 0.05\%$ at normal and “fallback” delivery rates; however, they are often reluctant to spend time entering different calibration factors for the initial (“start-up”) and ending (“shut-down”) portions of the delivery. Spending time calibrating the metering system at normal and fallback delivery rates to such a high degree of accuracy is wasted if the error introduced into the measurement by the start-up and shut-down quantities is unknown. An additional concern is that an unscrupulous operator could use the error introduced by the start-up and shut-down portions of the delivery (if known) to adjust calibration at the normal delivery rate such that the overall error of a typical delivery is predominantly in the user’s favor. Officials should be aware that when delivered quantities are greater than the prover used at calibration, start-up and shutdown errors have a counter-intuitive effect. Underregistration errors (which are normally in the consumers’ favor) in the start-up and shut-down portions of the delivery may actually create shortages in the total delivery if calibration of the normal rate is adjusted to compensate for that underregistration. While these errors should be well within tolerance if the start-up and shut-down errors are in tolerance, an official who is trying to determine predominance of error should be aware of this effect and know how to determine the expected error in a typical delivery. Operators need to understand the importance of knowing and accounting for the effects of start-up and shut-down errors. Officials need to be aware of the potential for misusing that knowledge. Terminals and refineries want to maximize the accuracy of their liquid measuring devices by optimizing the calibration factors at typical delivery rates.

This proposal is not intended to have any effect on locations which do not use electronic calibration factors to optimize accuracy at every delivery rate. Even at locations which do use multiple calibration factors, no action is required unless the official notices that the error for the start-up and shut-down rates is predominantly in one direction. If the start-up and shut-down errors are predominantly in one direction, the official then needs to determine the size of a typical transaction and the likely predominance of the error. Device owners can easily ensure that they have no

problems with this requirement by making sure that their devices are in tolerance at slow flow start-up and shut-down rates and that errors are not predominantly in one direction.

See the 2014 and 2015 S&T Committee's Annual Report regarding this item to review previous language and positions to add paragraphs N.4.2.5. Initial Verification and UR. 2.5.1. Initial Verification Proving Reports to NIST Handbook 44 Liquid Measuring Devices Code.

2016 NCWM Interim Meeting:

Agenda Item 330-3 was amended immediately prior to the 2016 NCWM Interim Meeting as a result of a Multipoint-Calibration Work Group (MPCWG) meeting held on Sunday morning, prior to the start of that meeting. The new wording eliminates the conditions when a linearization factor would need to be verified because it was agreed that such details are better suited for inclusion in training material, a NIST EPO, or other document used as a resource in understanding the different factors necessitating verification.

The new wording ensures that all factors in a meter are verified each time any meter factor is changed. Verification of a factor may take the form of a physical test at the specified flow-rate or may be an evaluation of the factor using mathematical empirical analysis to ensure that the factor is reasonable for the affected flow rate. In all cases, a physical test must be performed at one or more specified flow rates.

During the Committee's 2016 Interim Meeting open hearings, clarification was requested from the floor on how to apply factors when multiple products are involved. Ms. Julie Quinn (Minnesota), Chairperson of the MPCWG, clarified that the intent is that all factors for all products, including grades of product within a family, are to be verified anytime a change is made. However, this verification may simply be a comparison of factors used between product grades to ensure they remain consistent.

Ms. Tina Butcher (NIST, OWM) asked that be given a chance to further study the new language in the proposal. OWM would also like to see a clarification of the term "empirical analysis" and proposed that the current wording leaves too much open to interpretation. Ms. Julie Quinn agreed with the need to clarify what is meant by "empirical analysis."

Representatives from Liquid Controls and Flint Hill Resources supported the item as presented.

Based on comment received, the Committee agreed to amend the proposal as requested by the MPCWG and to present the item as shown in Item Under Consideration for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting open hearings, the Committee agreed to group together Agenda Items 330-3 and 331-4 and take comments on these items simultaneously. Ms. Julie Quinn (Minnesota), submitter of the item and Chairperson of the MPCWG, provided the Committee with a document titled, "Draft Guidance on Empirical Analysis" and stated that the document gives clarification on what is meant by "empirical analysis." It allows the weights and measures official to exercise discretion for analysis. A copy of the document has been inserted into Appendix C of this report. She also stated that the MPCWG supports the item for Vote.

Ms. Tina Butcher (NIST, OWM), in referencing previous comments offered by OWM, noted that OWM believes it is essential that physical testing be included as part of any analysis and that the changes made to the proposed language by the Committee at the 2016 Interim Meeting clarifies this point and improves the proposal. She stated that OWM acknowledges that to be able to completely verify the performance of a meter with multi-point calibration, separate tests must be performed with each product to be metered and at all flow rates and every calibration factor that has been programmed into the system for those products. This makes obvious the need to perform many tests on a single meter in order to take into account the different factors, and combinations thereof, affecting performance. The proposed "Note" and accompanying "User Requirement" in the proposal provides guidance on when verification of linearization factors needs to be done.

Ms. Butcher also stated that NIST, OWM appreciates the continued work of the group that developed this issue to create accompanying guidelines for conducting empirical analysis. She encouraged members of the NCWM to study

the guidelines and provide input to the group, with the goal of finalizing the guidance prior to the adoption and publication of the proposed language. She reported that OWM had shared the latest draft of the guidelines provided by that group with fluid metrology experts at NIST and would provide any input obtained. She also recommended that the guidelines be shared with the Measuring Sector at its 2016 meeting with a request for comments. After the group obtains and incorporates input from interested parties, perhaps the information could be made available as an appendix to pertinent NIST EPOs and/or training materials if the group is amenable. As a final comment, she noted that OWM questions whether distinctions need to be made in the guidance document with regard to guidance for service personnel versus regulatory officials.

Mr. Ross Anderson (New York, Retired) stated that the language, “at the discretion of the official with statutory authority” should be removed from the UR.4.1. section of Item 330-3 and the UR.3.1. section of Item 331-4. He noted that both are User Requirements and it would be service personnel who typically make the adjustments and perform the verifications specified in these proposed paragraphs. For this reason, the verbiage “at the discretion of the official with statutory authority” is inappropriate for this particular section of the handbook.

Ms. Kristin Macey (California), Ms. Tina Butcher (NIST, OWM) and Mr. Dmitri Karimov (MMA) support the items with the removal of “at the discretion of the official with statutory authority” from the User Requirement paragraphs of each item.

During its work session members of the Committee acknowledged hearing support for the removal of the words, “at the discretion of the official with statutory authority” from the language proposed in paragraph UR.4.1. of Agenda Item 330-3 and paragraph UR.3.1. of Agenda Item 331-4 and the Committee agreed to eliminate these words from each of these two paragraphs and to present both proposals for a vote. The following represents the changes that were agreed to by the Committee:

Amend proposed new paragraph UR.4.1. Use of Adjustments of the proposal in Agenda Item 330-3 as follows:

UR.4.1. Use of Adjustments. – Whenever a device is adjusted, all enabled linearization factors shall be verified to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis. ~~at the discretion of the official with statutory authority.~~

Amend proposed new paragraph UR.3.1. Use of Adjustments of the proposal in Agenda Item 331-4 as follows:

UR.3.1. Use of Adjustments. – Whenever a device is adjusted, all enabled linearization factors shall be verified to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis. ~~at the discretion of the official with statutory authority.~~

Regional Association Comments:

The WWMA reported at its 2015 fall Annual Meeting that Mr. Tina Butcher, NIST OWM, submitted minor revisions to the proposal on behalf of the submitter. The WWMA believes that this proposal has been developed enough and recommended that it be an Informational item as follows:

N.4.2.5. Initial Verification. – A wholesale liquid measuring device shall be tested at all flow rates and with all products for which a calibration factor has been electronically programmed prior to placing it into commercial service for the first time or after being repaired or replaced.

A wholesale liquid measuring device not equipped with means to electronically program its flow rates and calibration factors shall be tested at a low and high flow rate with all products delivered prior to placing it into commercial service for the first time or after being repaired or replaced.

Example: A meter is electronically programmed to deliver regular and premium gasoline at a startup/shutdown flow rate of 150 gpm, a normal operating flow rate of 650 gpm, and a fall-back rate of 450 gpm. The meter is to be tested with regular gasoline at 150 gpm, 450 gpm and 650 gpm; and with premium gasoline at 150 gpm, 450 gpm and 650 gpm.

The official with statutory authority has the discretion to determine the flow rates and products at which a meter will be tested on subsequent verifications.

UR.2.5.1. Initial Verification Proving Reports. – Initial verification proving reports for wholesale liquid measuring devices equipped with means to electronically program flow rates shall be attached to and sent with placed-in-service reports when the regulatory agency with statutory authority requires placed-in-service reports.

N.4.5. Verification of Linearization Factors. – All enabled linearization factors shall be verified:

- (a) **when a device is initially being put into commercial use;**
- (b) **when a device has been placed into service and is officially being tested for the first time;**
- (c) **when a device is being returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time after corrective service;**
- (d) **when a device is being officially tested for the first time after major reconditioning or overhaul;
or**
- (e) **at the discretion of the official with statutory authority.**

The verification of enabled linearization factors may be done through physical testing or empirical.

UR.4. Maintenance Requirements.

UR.4.1. Use of Adjustments. – Whenever devices are adjusted, all enabled linearization factors shall be verified through physical testing or empirical analysis to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value.

At its fall 2015 Interim Meeting, the CWMA received recommendations for grammatical changes. The CWMA reported it believes that this proposal will help ensure accuracy and allow for efficient testing of these devices. The CWMA modified the item and forwarded it to the NCWM as follows with the recommendation it be presented as a Voting item:

N.4.5. Verification of Linearization Factors. - All enabled linearization factors shall be verified:

- (a) **when a device is initially being put into commercial use;**
- (b) **when a device has been placed into service and is officially being tested for the first time;**
- (c) **when a device is being returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time after corrective service;**
- (d) **when a device is being officially tested for the first time after major reconditioning or overhaul;
or**

(e) at the discretion of the official with statutory authority.

The verification of enabled linearization factors maybe done through physical testing or empirical analysis.

UR.4. Maintenance Requirements.

UR.4.1. Use of Adjustments. – Whenever devices are adjusted, all enabled linearization factors shall be verified through physical testing or empirical analysis to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value.

At its spring 2016 meeting, the CWMA recommended the item be forwarded to NCWM as a Voting item, noting that the item is fully developed and comments received were in support of the item.

At its fall 2015 Interim Meeting, NEWMA reported it realizes that multi-point calibrations are not going away and need to be addressed; however, this item needs further work by the Committee to address concerns. NEWMA recommended that this item be an Information item. At its spring 2016 meeting, NEWMA agreed to forward the item to NCWM as a Voting item after indicating it received comments in support of the item.

The SWMA batched this item with Item 331-4 at its fall 2015 Interim Meeting and recommended this item remain as a Developing item.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

330-4 D Recognize the Use of Digital Density Meters

Source:

Missouri (2016)

Purpose:

Allow the use of digital density meters for inspections of meters for viscous fluids such as motor oils, diesel exhaust fluid (DEF) and antifreeze.

Item under Discussion:

Amend NIST Handbook 44, Liquid Measuring Devices Code as follows:

Develop provisions in various LMD Codes of NIST Handbook 44 that would recognize the use of digital density meters in lieu of volumetric provers, or the use of flasks and thermometers in the case of gravimetric testing) when testing meters used to dispense certain viscous fluids such as motor oil, DEF, antifreeze, syrups, etc.

“Digital density meters may be a solution for testing motor oil, DEF and anti-freeze meters.”

Background/Discussion:

Current test procedures are slow and awkward due to the need of using borosilicate glassware for package checking. Digital density meters are fast; use small samples size (2 ml); and have built-in thermometers.

When conducting volumetric testing of meters used for dispensing viscous fluids such as motor oil, DEF, antifreeze, syrups, etc., air becomes entrapped in the fluid and clings to the sides of the prover which adversely affect the results of the test. In order to conduct gravimetric tests, it is necessary to determine the density of the product. Digital density meters are fast and accurate in comparison with recognized gravimetric testing procedures using flasks and thermometers. There is no need to “wet down” volumetric flasks before each measurement. Most non-food products may be recovered without contamination. Only a small sample size (2 ml) of the product is needed for testing. Using

digital density meters equipped with built-in API density tables will not require the cooling of samples to 60 °F. There is no need for a partial immersion thermometer or volumetric flasks.

Well-established ASTM and other international standard test methods are available with precision statements.

2016 NCWM Interim Meeting:

Ms. Tina Butcher (NIST, OWM) and Mr. Ross Anderson (New York, Retired) both stated they supported the concept, but questioned whether the use of density meters needed to be addressed in NIST Handbook 44. They suggested a more appropriate place might be in an EPO or other similar document. Mr. Michael Keilty (Endress + Hauser Flowtec) recommended keeping the status of this item as Developing because the direction of the item was a little unclear. Mr. Dmitri Karimov (Liquid Controls) recommended this item be Withdrawn. Based on the comments received, the Committee agreed to assign the item a Developing status.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, Mr. Ron Hayes (Missouri) provided an update on the progress to develop this item and requested it remain in a Developing status to allow time to complete this work.

Ms. Tina Butcher OWM reiterated many of the comments provided by OWM at the 2016 NCWM Interim Meeting. She stated that OWM supports the concept of using digital density meters in testing of metering systems and looks forward to the further development of this item. An accurate determination of product density is essential when conducting gravimetric tests and having the facility to make this determination might encourage inspection and testing of meters that dispense products with characteristics (e.g., viscosity, corrosiveness, etc.) that may not lend themselves to testing with volumetric methods.

OWM recognizes that the item is still under development and suggests that other codes which currently reference gravimetric test procedures in NIST Handbook 44 be considered as a template. Since the “Notes” section of the LMD Code currently makes reference to test drafts in volumetric units, these paragraphs may need to be reviewed for possible revision. In addition, the Fundamental Considerations should be considered in defining the suitability criteria of any density meter used in testing. It may be that the NIST EPOs, training materials, or other guidance documents might be more appropriate place(s) to specify details regarding the selection and use of this equipment and to provide details on its specifications. An additional question to be considered is whether or not there needs to be additional criteria in laboratory metrology documents such as the NIST 105 Series handbooks or in the NIST Handbook 133 procedures for gravimetric testing.

Ms. Butcher also reported that OWM’s Laboratory Metrology Program had previously conducted some testing of portable density meters in 2006. The results from that testing showed that the units don’t work very well for liquids that are likely to produce air bubbles, (e.g., oils or any product with carbonation). At the time, OWM was considering their use in determining density for package checking and found that the accuracy is suspect with products that form bubbles. Further, measurements are inaccurate when there are bubbles present in the oscillating tube and such repeatability suffers when some samples have bubbles and others do not.

In consideration of the comments received, the Committee agreed to maintain the item’s Developing status.

Regional Association Comments:

At its spring 2016 Annual Meeting, the CWMA recommended this item be withdrawn based on a suggestion from the item’s submitter that the item would be more appropriately included in NIST Handbook 133.

NEWMA reported that it did not receive any comments on this item at its spring 2016 Annual Meeting and agreed forward it to the NCWM as a Developing item.

At its fall 2015 Annual Meeting, the SWMA heard comments in support of this item and forwarded it to NCWM, recommending it as a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

331 VEHICLE-TANK METERS

331-1 V S.1.1.5. Return to Zero, S.1.1.6. Initial Zero Indication – Electronic Devices (See Related Items 330-1 and 332-1)

(This item was Adopted.)

Source:

Maryland (2016)

Purpose:

Ensure that a VTM register starts on zero upon initial authorization by following the manufacturer's instructions.

Item Under Consideration:

Amend NIST Handbook 44, Vehicle Tank Meter Code as follows:

S.1.1.5. Return to Zero. – Primary indicating elements shall be readily returnable to a definite zero indication. Means shall be provided to prevent the return of primary indicating elements, and of primary recording elements if these are returnable to zero, beyond their correct zero position. **Primary indicating elements shall not be resettable to zero during a delivery.**

(Amended 2016)

Background/Discussion:

The language that is currently in the NIST Handbook 44, VTM, LPG and NH₃ codes allows for the operator to reset a register to zero if it advances beyond zero when initially activated. This would mean that it is the responsibility of the operator to ensure the device is reset to zero prior to every operation and could easily lead to facilitation of fraud. Technology is currently available that would eliminate this issue, as evidenced by similar language in the LMD Code, Mass Flow Meters Code and the Hydrogen Gas-Measuring Devices Tentative Code. Having the capability to always start on zero would also eliminate the need to print additional receipts in order to reset the device to zero.

Commercial measuring devices such as retail motor-fuel dispensers, vehicle-tank meters, and LPG liquid-measuring systems are required to be "wet-hose type" devices. This means that the system's discharge hose is intended to be full of liquid at all times during its operation. This, coupled with requirements that prevent the drainage of the discharge hose (anti-drain requirements), help ensure that the hose is not drained between deliveries and that the current customer is not paying for the amount of product required to fill the discharge hose.

Between deliveries, the pressure in a discharge hose can sometimes vary with changing conditions. For example, when temperatures increase, the product in the hose may expand; conversely, when temperatures decrease the product may contract. As a result of these often slight changes, when a system is initially activated in preparation for delivery, the discharge hose may go through an initial "pressurization" process in which the discharge hose is filled with liquid. The re-pressurization can sometimes result in an advancement of the indications prior to the delivery of any product, an event often referred to as "computer jump." In this situation, the customer has received no product, but the quantity and total sale indications may indicate that product has been delivered.

Current language in several of the NIST Handbook 44 measuring codes includes requirements for the device user/operator to return indicating and recording elements to zero immediately before a delivery begins. This helps to ensure that deliveries start with a zero indication. This also requires that, if the system advances or "computer jump" occurs during the initial activation of the system, the operator reset the indications to zero.

Initially, most of the measuring codes did not include any specifications requiring that a system be designed with provisions to help ensure a zero start without necessitating intervention by the operator. While the user requirements referenced above can help, experience is showing that a user requirement by itself is not always effective in ensuring that transactions consistently start on zero. In 2005, the NCWM recognized that, with increased unit prices, the computer jump that sometimes occurs with retail motor-fuel dispensers was resulting in the advancement of the total sale indications prior to the delivery of any fuel.

Systems that routinely experience computer jump facilitate transactions that do not start on zero prior to the delivery of product and, thus, facilitate fraud. If a driver has already inserted a ticket in a VTM or LPG VTM, it is questionable (and probably unlikely) that the operator will reset the indications to zero after the hose has pressurized (and the indications have advanced) and put another ticket into the device. A better solution would be the addition of a requirement similar to that in LMD Code paragraph S.1.6.1. Indication of Delivery which includes the following nonretroactive provision to include automatic means to help ensure the transaction starts on zero:

*For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero.
[Nonretroactive as of January 1, 2006]*

Although most systems include a provision to prevent the reset operation from occurring during a delivery, this is not specified in all codes. Consequently, the proposals include suggested language to add this provision to the LMD, VTM, and LPG & NH₃ codes.

Note that consideration may also need to be given to limiting the quantity that can be suppressed as is currently referenced in LMD Code paragraph S.1.6.1.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Items 330-1, 331-1, and 332-1 and comments were taken simultaneously since the Committee considered them companion items. See Item 330-1 for a summary of comments received and the specific actions taken by the Committee for each of these items.

The Committee agreed to amend each of the three items based on the comments received during its open hearings. The Committee also agreed to present each item for vote at the Annual Meeting. The changes agreed to by the Committee are reflected in the Item Under Consideration.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting open hearings, the Committee announced it was grouping Agenda Items 330-1, 331-1, and 332-1 together and taking comments on all simultaneously. See Agenda Item 330-1 for a summary of the comments heard and that actions taken by the Committee on these items.

Hearing no comments in opposition the Committee agreed to present Items 330-1, 331-1, and 332-1 for Vote; each without change as shown in Item Under Consideration.

Regional Association Comments:

At its spring 2016 Annual Meeting, the CWMA reported no comments were received on this item. The CWMA feels this item is fully developed and recommends it be a Voting item on the NCWM Agenda.

At its spring 2016 Annual Meeting, NEWMA received comments that the item would harmonize the LMD, VTM, and LPG/NH₃ codes with other measuring codes. NEWMA feels this item has been properly developed and will recommend it be a Voting item.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 330-1, 331-1 and 332-1, and all items were heard together. The SWMA believes the items have merit and forwarded the items to NCWM, recommending that they be Voting items.

331-2 V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 332-4, 334-1, 335-1, 337-1, 338-1 and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

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

Table S.2.2. Categories of Device and Methods of Sealing	
Categories of Device	Methods of Sealing
<p>Category 1: No remote configuration capability.</p>	<p>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</p>
<p>Category 2: Remote configuration capability, but access is controlled by physical hardware.</p> <p>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.</p>	<p>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.</p>
<p>Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</p> <p>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.</p>	<p>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.)</p>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) (**Amended 2016**)

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the

2015 NCWM Annual Meeting when language was added to recognize the additional use of an electronic format. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. Ms. Tina Butcher (OWM) commented that the changes proposed to the sealing requirements in each of these codes would harmonize the language to that which was adopted last year in the LMD Code. She also suggested consideration be given to making similar changes to the audit trail criteria for Category 3 devices in other NIST Handbook 44 codes.

Mr. Dmitri Karimov (Liquid Controls, LLC) supported assigning a Voting status to the item.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and consequently agreed to recommend each item for vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. Industry and regulatory officials, alike, voiced support for these items. It was stated that the proposed changes to the sealing requirements would harmonize the language to that which was adopted in 2015 for the LMD Codes, thereby, providing consistency across all measuring device codes in NIST Handbook 44. Hearing no comments in opposition, the Committee agreed to present these items for vote.

Regional Association Comments:

The CWMA reported, at its spring 2016 Annual Meeting, that it feels this item is fully developed and recommended it be a Voting item on the NCWM Agenda.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these items: 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

331-3 D S.3.7. Manifold Hose Flush System

Source:

New York (2016)

Purpose:

Recognize the use of hose flush systems in the NIST Handbook 44, Vehicle-Tank Meters (VTM) code.

Item under Consideration:

Amend NIST Handbook 44, Vehicle-Tank Meter Code as follows:

S.3.7. Manifold Hose Flush System. – A hose flush system to clear the hose of product may be installed in the manifold when multiple products are dispensed through a single meter and hose under the following conditions:

(a) the inlet valves for the system are conspicuously located above the bottom framework of the truck;

(b) the inlet valves for the system are not connected to any hose or piping (dust covers are permitted) when not in use;

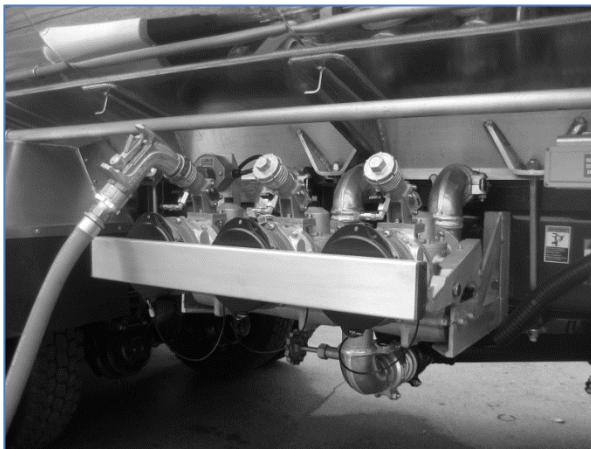
(c) the discharge hose remains of the wet hose type;

(d) the direction of flow for which the system may be set at any time is definitely and conspicuously indicated; and

(e) a recorded representation of each flush is maintained for inspection.

Background/Discussion:

Hose flush systems allow drivers to flush product where a truck is set-up to deliver multiple products through a single meter and hose. The system is particularly popular because it allows drivers to flush product without having to climb up on top of the truck, which is a common practice in the industry but can also be dangerous. These systems are considered a significant safety advancement; however, without safeguards in place it could also be used to facilitate fraud. These systems make returning product after weights and measures testing very easy. These systems are also very good for preventing contamination of product. Photographs of one such system are shown below.



Three-Compartment Manifold with Nozzle



Three-Compartment Manifold

These systems are being used country-wide and there is no uniformity in what is and what is not acceptable by weights and measures. Some states have developed their own policies for acceptance but this has led to problems when trucks have been moved from one state to another. Some states are considering prohibiting these systems citing facilitation of fraud; however, they are also concerned that such prohibition may lead to drivers being unnecessarily injured or even killed. Regulators want to do their jobs, but also want drivers to be able to do their jobs in the safest way possible.

2016 NCWM Interim Meeting:

The Committee heard comments on this item from Mr. Mike Sikula (New York), Mr. Hal Prince (Florida), Mr. Steve Giguere (Maine), Mr. John McGuire (New Jersey), Mr. Charlie Carroll (Massachusetts), Ms. Tina Butcher (OWM), Mr. Dmitri Karimov (Liquid Controls), and Mr. Dick Suiter (Richard Suiter Consulting). Mr. Sikula indicated that some newer trucks were designed with manifold hose flush systems that needed controls to prevent fraud, and he also pointed out that this was a nationwide issue not just a New York issue.

Ms. Butcher mentioned a need to provide additional safeguards; mark direction of flow on inlet and outlet valves; and add user requirements on when and how these systems should be used. Mr. Karimov advocated the addition of a second meter. Mr. Carroll said manifold flush systems should not be allowed.

There was general consensus in the comments heard that the hose flush back systems have arisen from a desire to minimize safety concerns with the delivery drivers having to climb up on top of trucks to flush hoses; however, these systems could enable fraud as fuel could be diverted after the meter and documentation of the flushing is typically not maintained. The Committee believes this item has merit and needs further development and is interested in hearing from other states and manufacturers on this issue.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee received an update on this item from its submitter, Mr. Mike Sikula (New York). Mr. Sikula reported that manifold hose flush systems continue to be an issue in New York and that work on this item is ongoing.

Ms. Tina Butcher (NIST, OWM) reiterated a number of the comments and recommendations which OWM had presented at the 2016 NCWM Interim Meeting and had shared with the submitter. The following is a shortened summary of the comments and recommendations she provided:

- There are undoubtedly safety and time advantages to being able to flush product from a hose using this system; there are also obvious concerns about the possibility of facilitation of fraud.
- It is presumably very easy to pump metered product back into the tank with this system and it is much less obvious and less difficult than climbing to the top of the truck with a charged hose and returning it through the hatches. Particularly in an environment where customers are often not present during the delivery, this creates serious concerns about its potential misuse and the ease with which that misuse can occur.
- If manifold hose flush systems are permitted, it is essential to have certain safeguards in place to help prevent misuse; yet still allow the operator to benefit from improved safety and ease of use offered by these systems.
- The system does not appear to violate the diversion of product requirements outlined in VTM Code paragraph S.3.1. Diversion of Measured Liquid since the manifold equipment isn't part of the discharge line or piping connected to the metering systems.
- The process of diverting already measured product through the use of the system would not be obvious to an untrained observer and is much more easily accomplished than having to climb to the top of a truck and flushing product back into one of the storage compartments.

The following key points and questions were also provided by OWM in written comments and recommendations to the Committee for it to consider in its assessment of this proposal:

- An argument in favor of such a system is that it provides a safer alternative for the operator to use than climbing to the top of the truck when flushing product back into the storage tank. Additionally, it may encourage proper flushing and help reduce operators taking shortcuts; this could prevent product contamination in a customer's tank and the potential safety hazards associated with such contamination. However, safeguards in the form of automatic features as well as user requirements would be essential to discourage misuse.
- The inlet valves for the system need to be clearly and permanently marked to indicate they are for use in "flushing" so that their purpose is clear to an observer.
- The meter and printer are presumably in operation during this procedure, which also means that, if the system were misused, the operation could take place at the beginning or end of a customer's delivery, thus diverting measured product. NIST, OWM previously read information on such a system that indicated there are safeguards to help prevent cross contamination of product. This suggests some degree of sophistication in the software, suggesting that it may be possible to incorporate other safeguards to help prevent misuse of the system. Consequently, OWM believes that displayed and recorded indications of quantity should be automatically inhibited whenever the flush system is in operation. Alternatively, or perhaps in addition, a requirement should be included to require clear indications that the indicated and recorded quantity and other associated information are not to be used for commercial purposes.
- An added measure of protection would be provided if, while in the "flush" mode, there is a clear indication that the device is not in normal operation.

- An accompanying user requirement clarifying that the flush system is not to be used during a commercial transaction would also help limit its use. The operator should have to reset the system following the flush procedure prior to beginning a commercial transaction. Is additional language needed to clarify this?
- OWM believes an associated user requirement needs to be included to restrict the use of such systems and to help ensure their proper use. A suggestion is provided at the end of OWM's comments on this item, but further refinement and input are needed.
- Is using the same meter to dispense products that are significantly different enough to create the need to routinely recirculate product, a suitable use of the equipment? Using different meters to avoid the contamination and safety issue altogether would eliminate the need for such a system. What is the cost of a second meter relative to the cost (and fraud risk) of this manifold system? Some have reported that the number of companies running different products (e.g., gas and home heating oil) through the same meter has diminished because of safety concerns, but we still hear about such scenarios when we conduct training schools.
- Are these systems installed on metering systems that are *not* equipped with the capability to measure different products with different accuracy settings (e.g., product codes with associated calibration factors)? If a meter (such as a mechanical meter with mechanical indicator) without such features is used for multiple different products, presumably there are no provisions to allow for different accuracy settings. A flush system might encourage this type of scenario and consideration might need to be given to limiting the system to only systems with multiple product/calibration factor capability.
- How will the owner/operator track metered product for use in tax reporting? Will the indications be suppressed to ensure that it is not recorded as delivered product? Or is a printed or electronic record provided of recirculated product or perhaps the totalizer readings could be used?
- Is there any control or interlock that would prevent flushing the hose into the manifold for the *same* product selected for delivery? For example, if the operator last delivered gasoline and has selected fuel oil for the current transaction, should the system prevent the operator from flushing the hose back into the same product type (for which there is presumably no need to flush the hose)? This might provide an added safeguard that would prevent someone from "recirculating" the same product rather than "flushing" a different type of product. At minimum, this should be a user requirement; it would be best if it could also be required in the flush system design.
- The visible view ports provide the operator with a means to visually observe when the product has flushed from the hose. Will this be a feature on all such systems? Is there any reason to require such viewing ports?
- In LMD Code paragraph S.3.1. Diversion of Measured Liquid, a provision was added to allow purging or draining, but only when the system is not in operation. In reviewing the history for the LMD Code paragraph, it appears that such provisions were not added to that paragraph in the VTM Code, but not necessarily because of greater concerns over fraud in the VTM applications. Instead, it was likely that the question just hadn't come up for those applications. The provision in the LMD Code provides an example in which weights and measures officials have allowed a feature or operation that is deemed necessary to normal operation (just as one could argue line purging to prevent cross contamination is necessary), but which could otherwise facilitate fraud. In other words, if the concern over fraud is great enough, then additional provisions may need to be added to the code or required via interpretation of G-S.2. to minimize the possibility through the use of a "necessary" feature before that feature is allowed. Thus, the addition of the proposed paragraph to the VTM Code would acknowledge the use of the feature, but provide additional safeguards for its proper use.
- An additional aspect of the LMD Code paragraph S.3.1. Diversion of Measured Liquid is that it includes requirements prohibiting diversion of measured product from the measuring chamber or its discharge line. However, outlets for purging or draining the system are permitted under limited, specific circumstances. In recognition of the importance of ensuring that product is not recirculated during a commercial transaction, a

provision was included in the LMD Code requirement that inhibits meter indications during the process of recirculating:

Effective automatic means shall be provided to prevent passage of liquid through any such outlet during normal operation of the measuring system and to inhibit meter indications (or advancement of indications) and recorded representations while the outlet is in operation.

OWM suggests that similar language be included in the proposed paragraph such that the indications and any recorded representations are inhibited during the recirculation process. Alternatively, but less desirable, would be that the displayed and printed quantity indications be unusable or clearly designated as such.

- The statement “inlet valves for the system are not connected to any hose or piping (dust covers are permitted) when not in use” might be better included as a user requirement.
- Should the requirement include provisions for a programmable limit on the quantity of fuel that can be flushed based on the volume of the hose for an individual metering system?
- The CWMA, SWMA, and WWMA have not yet reviewed this item; it will be beneficial to hear input from officials and industry in those regions to ensure that key technical issues and concerns have been addressed.

Based on these observations and comments, OWM recommends the following alternative version of the original proposal:

S.3.7. Manifold Hose Flush System. – A hose flush system that may be used for purging the measuring system. Such a system shall only be installed in the manifold when multiple products are dispensed through a single meter and hose, provided all of the following conditions are met:

- (a) The discharge hose remains of the wet hose type.**
- (b) The inlet valves for the system are conspicuously located above the bottom framework of the truck.**
- (c) The inlet valves for the system must be clearly marked to indicate they are used for “flushing” product.**
- (d) The flush system is not to be operational during a commercial transaction.**
- (e) ~~The inlet valves for the system are not connected to any hose or piping (dust covers are permitted) when not in use.~~**
- (e) The direction of product flow is clearly and automatically indicated during operation of the measuring and/or the flush systems.**
- (f) Effective automatic means shall be provided to prevent passage of liquid through any such flush system during normal operation of the measuring system and to inhibit meter indications (or advancement of indications) and recorded representations while the flush system is in operation.**
- (g) A clear indication is provided, both in the quantity indications and any associated recorded representations, stating that the device is in a “flushing mode” and “not for commercial use” when the flush system is in operation.**
- (h) A recorded representation of each flush is maintained for inspection.**

Additionally, NIST, OWM recommends the inclusion of a proposed new “User Requirement” to help ensure proper application and use of such flush systems. The following is offered for consideration:

UR.2.6. Manifold Hose Flush System Use. – A manifold flush system or similar system designed to assist in flushing product between deliveries is not to be used or operational during a commercial transaction. The inlet valves for the system are not to be connected to any hose or piping (dust covers are permitted) when not in use. When the flushing system is in operation, the discharge hose is only to be connected to the port for the product type being flushed from the discharge line. Following the flushing process, indications and recording elements must be reset to zero prior to beginning a commercial delivery. A manifold flush system is not to be used on a metering system that is not equipped with the capability to accept separate calibration factors for different product types.

(Added 20XX)

In consideration of the comments received, the Committee agreed to maintain the Developing status of the item to allow additional time for its further development.

Regional Association Comments:

At its spring 2016 Annual Meeting, the CWMA reported it feels this item has merit and the comments received were in support of it but it is in need of development. Consequently, the CWMA recommended it be a Developing item on the NCWM Agenda.

At its fall 2015 Interim Meeting, NEWMA commented that it may not be an overt bad practice of illegal bypass, but it is a good start for providing safety. NEWMA believes the item has merit and forwarded it to NCWM, recommending that it be a Developing item. At its spring 2016 Annual Meeting, the submitter requested to make this an Information item but NEWMA feels there is still work to be done by the submitter and recommended the item remain Developing.

331-4 V N.4.6. Verification of Linearization Factors.

(This item was Adopted.)

Source:

Minnesota Weights and Measures Division (2014)

Purpose:

To update NIST Handbook 44 to reflect the technological changes in registers for vehicle-tank meters and to alert weights and measures officials to the fact that error in start-up and shut-down delivery quantities can introduce linear errors in the calibration at normal flow rates which increase the further the delivered quantity deviates from the prover size used at calibration.

Item under Consideration:

Amend NIST Handbook 44, Vehicle Tank Meter Code by adding the following:

N.4.6. Verification of Linearization Factors. – All enabled linearization factors shall be verified. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis, at the discretion of the official with statutory authority.

(Added 2016)

UR.3. Maintenance Requirements.

UR.3.1. Use of Adjustments. – Whenever a device is adjusted, all enabled linearization factors shall be verified to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value. The verification of enabled linearization factors shall be done through physical testing, or a combination of physical testing and empirical analysis.

(Added 2016)

Background/Discussion:

Many terminals and refineries want to maximize the accuracy of their liquid-measuring devices by optimizing the calibration factors at typical delivery speeds and some bulk delivery companies are beginning to utilize the capabilities of electronic registers with multiple calibration factors to optimize their accuracy at flow rates that are customarily used. Just like registers on wholesale liquid measuring devices, these meters can be configured for a standard initial “start-up” and ending “shut-down” quantity delivered at a slower speed than is used for the remainder of the delivery. Service agents are expected to calibrate devices as close to zero as possible, but spending time calibrating normal delivery rates to a high degree of accuracy is wasted if the error introduced into the measurement by the start-up and shut-down quantities is unknown. On the other hand, an unscrupulous operator could also use the known error introduced by the start-up and shut-down errors to calibrate the normal delivery rates so that all the errors on typical deliveries work predominantly in the user’s favor. Officials should be aware that when delivered quantities are greater than the prover used at calibration, start-up and shut-down errors have a counter-intuitive effect. Underregistration, which normally operates in the consumers’ favor, may actually create shortages in the total delivery if calibration of the normal rate was adjusted to compensate for that underregistration. While these errors should be well within tolerance if the start-up and shut-down error are in tolerance, an official who is trying to determine predominance of error should be aware of this effect and know how to calculate the expected error in a typical delivery. Operators need to understand the importance of knowing and accounting for the effects of start-up and shut-down errors. Officials need to be aware of the potential for misusing that knowledge.

This proposal has no effect on locations which do not use electronic calibration factors to optimize accuracy at every delivery rate. Even at locations which do, no action is required unless the official notices that the error for the start-up and shut-down rates is predominantly in one direction. If the start-up and shut-down errors are predominantly in one direction, the official then needs to determine the size of a typical transaction and the likely predominance of the error. Device owners can easily ensure that they have no problems with this requirement by making sure that their devices are in tolerance at the slower start-up and shut-down flow rates and errors are not predominantly in one direction or the other.

See Appendix E, *How Slow Flow Errors Affect VTMs*, and the 2014 and 2015 S&T Committee’s Annual Report to review previous language and positions regarding this item.

2016 NCWM Interim Meeting:

Agenda Item 331-4 was amended immediately prior to the 2016 NCWM Interim Meeting as a result of a Multipoint-Calibration Work Group (MPCWG) meeting held on Sunday morning, prior to the start of the Interim Meeting. The new wording eliminates the conditions when a linearization factor would need to be verified because it was agreed that such details are better suited for inclusion in training material, a NIST EPO, or other document used as a resource in understanding the different factors necessitating verification.

The new wording ensures that all factors in a meter are verified each time any meter factor is changed. Verification of a factor may take the form of a physical test at the specified flow-rate or may be an evaluation of the factor using mathematical empirical analysis to ensure that the factor is reasonable for the affected flow rate. In all cases, a physical test must be performed at one or more specified flow rates.

During the open hearings, clarification was requested from the floor on how to apply factors when multiple products are involved. Ms. Julie Quinn (Minnesota), Chairperson of the MPCWG, clarified that the intent is that all factors for all products, including grades of product within a family, are to be verified anytime a change is made. However, this verification may simply be a comparison of factors used between product grades to ensure they remain consistent.

Ms. Tina Butcher (NIST, OWM) asked that OWM be given a chance to further study the new language in the proposal. OWM would also like to see a clarification of the term “empirical analysis” and proposed that the current wording leaves too much open to interpretation. Ms. Quinn agreed with the need to clarify what is meant by “empirical analysis.”

Representatives from Liquid Controls and Flint Hill Resources supported the item as presented.

Based on comments received, the Committee agreed to amend the proposal as requested by the MPCWG and to present the item as shown in Item Under Consideration for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting open hearings, the Committee agreed grouped together agenda Items 330-3 and 331-4 and took comments on these two items simultaneously. See Agenda Item 330-3 for a summary of the comments heard and the actions taken by the Committee on these items.

Regional Association Comments:

The WWMA reported at its 2015 fall Annual Meeting that Ms. Tina Butcher, NIST, OWM, submitted minor revisions to the proposal on behalf of the submitter. The WWMA believes that this proposal has been developed enough and recommended that it be an Information item as follows:

N.4.6. Initial Verification. – A vehicle tank meter shall be tested at all flow rates and with all products for which a calibration factor has been electronically programmed prior to placing it into commercial service for the first time or after being repaired or replaced.

A vehicle tank meter not equipped with means to electronically program its flow rates and calibration factors shall be tested at a low and high flow rate with all products delivered prior to placing it into commercial service for the first time or after being repaired or replaced.

Example: A vehicle tank meter is electronically programmed to deliver regular and premium gasoline at a startup/shutdown flow rate of 20 gpm, a normal operating flow rate of 100 gpm, and an intermediate rate of 65 gpm. The meter is to be tested with regular gasoline at 20 gpm, 65 gpm, and 100 gpm; and with premium gasoline at 20 gpm, 65 gpm and 100 gpm.

The official with statutory authority has the discretion to determine the flow rates and products at which a vehicle tank meter will be tested on subsequent verifications.

UR.1.5. Initial Verification Proving Reports. – Initial verification proving reports for vehicle tank meters equipped with means to electronically program flow rates shall be attached to and sent with placed-in-service reports when the regulatory agency with statutory authority requires placed-in-service reports.

N.4.6. Verification of Linearization Factors. – All enabled linearization factors shall be verified:

- (a) **when a device is initially being put into commercial use;**
- (b) **when a device has been placed into service and is officially being tested for the first time;**
- (c) **when a device is being returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time after corrective service;**
- (d) **when a device is being officially tested for the first time after major reconditioning or overhaul;
or**
- (e) **at the discretion of the official with statutory authority.**

The verification of enabled linearization factors may be done through physical testing or empirical.

UR.3. Maintenance Requirements.

UR.3.1. Use of Adjustments. – Whenever devices are adjusted, all enabled linearization factors shall be verified through physical testing or empirical analysis to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value.

At its fall meeting, the CWMA reported that it believes this proposal will help ensure accuracy and allow for efficient testing of these devices. The CWMA recommended that the item be modified as follows and that it be a Voting item:

N.4.5. Verification of Linearization Factors. – All enabled linearization factors shall be verified:

- (a) when a device is initially being put into commercial use;**
- (b) when a device has been placed into service and is officially being tested for the first time;**
- (c) when a device is being returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time after corrective service;**
- (d) when a device is being officially tested for the first time after major reconditioning or overhaul; or**
- (e) at the discretion of the official with statutory authority.**

The verification of enabled linearization factors may be done through physical testing or empirical analysis.

UR.4. Maintenance Requirements.

UR.4.1. Use of Adjustments. – Whenever devices are adjusted, all enabled linearization factors shall be verified through physical testing or empirical analysis to determine that the errors are in tolerance and any adjustments which are made, shall be made so as to bring performance errors as close as practicable to zero value.

At its spring 2016 Annual Meeting, the CWMA recommended the item be presented as a Voting item on the NCWM agenda noting it feels the item is fully developed.

NEWMA reported at its fall 2015 Interim Meeting that it realizes multi-point calibrations are not going away and need to be addressed; however, this item needs further work by the Committee to address concerns. NEWMA recommended that this item be an Information item. NEWMA heard comments in support of the item at its spring 2016 Annual Meeting and recommended it be a Voting item on the NCWM agenda.

The SWMA batched this item with Item 330-3 and heard them together at its fall 2015 Annual Meeting. It reported that it believes the item needs further development and recommended that it remain as a Developing item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

332 LPG AND ANHYDROUS AMMONIA LIQUID-MEASURING DEVICES

332-1 V S.1.4.2. Return to Zero, S.1.4.3. Initial Zero Indication – Electronic Devices. (See Related Items 3301 and 3311)

(This item was Adopted.)

Source:

Maryland (2016)

Purpose:

Ensure that a register starts on zero upon initial authorization by following the manufacturer's instructions.

Item under Consideration:

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

S.1.4.2. Return to Zero.

- (a) Primary indicating elements shall be readily returnable to a definite zero indication.
- (b) Primary recording elements on a stationary retail device shall be readily returnable to a definite zero indication if the device is equipped to record.
- (c) Means shall be provided to prevent the return of primary indicating elements and of primary recording elements if these are returnable to zero, beyond their correct zero position.

(d) Primary indicating elements shall not be resettable to zero during a delivery.

(Amended 1990 **and 2016**)

Background/Discussion:

The language that is currently in the NIST Handbook 44, VTM and LPG and NH₃ codes allows for the operator to reset a register to zero if it advances beyond zero when initially activated. This would mean that it is the responsibility of the operator to ensure the device is reset to zero prior to every operation and could easily lead to facilitation of fraud. Technology is currently available that would eliminate this issue, as evidenced by similar language in the LMD Code, Mass Flow Meters Code, and the Hydrogen Gas-Measuring Devices Tentative Code. Having the capability to always start on zero would also eliminate the need to print additional receipts in order to reset the device to zero.

Commercial measuring devices such as retail motor-fuel dispensers, vehicle-tank meters, and LPG liquid-measuring systems are required to be "wet-hose type" devices. This means that the system's discharge hose is intended to be full of liquid at all times during its operation. This, coupled with requirements that prevent the drainage of the discharge hose (anti-drain requirements), help ensure that the hose is not drained between deliveries and that the current customer is not paying for the amount of product required to fill the discharge hose.

Between deliveries, the pressure in a discharge hose can sometimes vary with changing conditions. For example, when temperatures increase, the product in the hose may expand; conversely, when temperatures decrease the product may contract. As a result of these often slight changes, when a system is initially activated in preparation for delivery, the discharge hose may go through an initial "pressurization" process in which the discharge hose is filled with liquid. The re-pressurization can sometimes result in an advancement of the indications prior to the delivery of any product, an event often referred to as "computer jump." In this situation, the customer has received no product, but the quantity and total sale indications may indicate that product has been delivered.

Current language in several of the NIST Handbook 44 measuring codes includes requirements for the device user/operator to return indicating and recording elements to zero immediately before a delivery begins. This helps to

ensure that deliveries start with a zero indication. This also requires that, if the system advances or “computer jump” occurs during the initial activation of the system that the operator reset the indications to zero.

Initially, most of the measuring codes did not include any specifications requiring that a system be designed with provisions to help ensure a zero start without necessitating intervention by the operator. While the user requirements referenced above can help, experience is showing that a user requirement by itself is not always effective in ensuring that transactions consistently start on zero. In 2005, the NCWM recognized that, with increased unit prices, the computer jump that sometimes occurs with retail motor-fuel dispensers was resulting in the advancement of the total sale indications prior to the delivery of any fuel.

Systems that routinely experience computer jump facilitate transactions that do not start on zero prior to the delivery of product and, thus, facilitate fraud. If a driver has already inserted a ticket in a VTM or LPG VTM, it is questionable (and probably unlikely) that the operator will reset the indications to zero after the hose has pressurized (and the indications have advanced) and put another ticket into the device. A better solution would be the addition of a requirement similar to that in LMD Code paragraph S.1.6.1. Indication of Delivery which includes the following nonretroactive provision to include automatic means to help ensure the transaction starts on zero:

For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero.

[Nonretroactive as of January 1, 2006]

Although most systems include a provision to prevent the reset operation from occurring during a delivery, this is not specified in all codes. Consequently, the proposals include suggested language to add this provision to the LMD, VTM, and LPG & NH₃ codes.

Note that consideration may also need to be given to limiting the quantity that can be suppressed as is currently referenced in LMD Code paragraph S.1.6.1.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Items 330-1, 331-1, and 332-1 and comments were taken simultaneously since the Committee considered them companion items. See Item 330-1 for a summary of comments received and the specific actions taken by the Committee for each of these items.

The Committee agreed to amend each of the three items based on the comments received during its open hearings. The Committee also agreed to present each item for vote at the Annual Meeting. The changes agreed to by the Committee are reflected in the Item Under Consideration.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting open hearings, the Committee announced it was grouping Agenda Items 330-1, 331-1, and 332-1 together and taking comments on all simultaneously. See Agenda Item 330-1 for a summary of the comments heard and the actions taken by the Committee on these items.

Hearing no comments in opposition the Committee agreed to present Items 330-1, 331-1, and 332-1 for Vote; each without change as shown in Item Under Consideration.

Regional Association Comments:

At its spring 2016 Annual Meeting, the CWMA reported there were no comments received on this item. The CWMA feels this item is fully developed and recommended it be a Voting item on the NCWM Agenda.

At its spring 2016 Annual Meeting, NEWMA received comments indicating that the item would harmonize the LMD, VTM, and LPG/NH₃ codes with other measuring codes. NEWMA recommended the item be a Voting item on the NCWM Agenda.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 330-1, 331-1 and 332-1 and all items were heard together. The SWMA believes the items have merit and forwarded the items to NCWM, recommending that they be Voting items.

332-2 V S.1.4.3. Provisions for Power Loss, S.1.5.1.1. Unit Price., S.1.5.1.2. Product Identity., S.1.6. For Retail Motor Vehicle Fuel Devices Only., S.1.7. For Wholesale Devices Only., UR.2.7. Unit Price and Product Identity., and UR.2.8. Computing Device.

(This item was Adopted.)

Source:

California Department of Food and Agriculture Division of Measurement Standards (2014)

Purpose:

Add similar Specifications and User Requirements for other retail motor-fuel devices to NIST Handbook 44 Section 3.32. Liquefied Petroleum Gas (LPG) and Anhydrous Liquid-Measuring Devices Code similar to those in Section 3.30. Liquid-Measuring Devices, Section 3.37. Mass flow Meters, and Section 3.39. Hydrogen-Gas Measuring Devices Tentative Code.

Item under Consideration:

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

S.1.4. For Retail Devices Only.

S.1.4.1. Indication of Delivery. – A retail device shall ~~be constructed to show~~ automatically **show on** its **face the** initial zero condition and the ~~amounts~~ **quantity** delivered up to the nominal capacity of the device. **However, the following requirements shall apply:**

For electronic devices manufactured prior to January 1, 2006, the first 0.03 L (or 0.009 gal) of a delivery and its associated total sales price need not be indicated.

For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero.

[Nonretroactive as of January 1, 2006]

(Amended 2016)

S.1.5. For Stationary Retail Devices Only.

S.1.5.1. Display of Unit Price and Product Identity. – ~~In a~~ **A** device of the computing type, ~~means~~ shall ~~be provided for~~ displaying on each face ~~of the device~~ the unit price at which the device is set to compute or to deliver ~~as the case may be~~, and there shall be conspicuously displayed on each side of the device the identity of the product that is being dispensed. ~~If a device is so designed as to dispense more than one grade, brand, blend, or mixture of product, the identity of the grade, brand, blend, or mixture being dispensed shall also be displayed on each face of the device.~~

Except for dispensers used exclusively for fleet sales and other price contract sales, all of the unit prices at which that product is offered for sale shall meet the following conditions:

- (1) For a system that applies a discount prior to the delivery, all unit prices shall be displayed or shall be capable of being displayed on the dispenser through a deliberate action of the purchaser prior to the delivery of the product. It is not necessary that all of the unit prices be simultaneously displayed prior to the delivery of the product.**

- (2) **For a system that offers post-delivery discounts on fuel sales, display of pre-delivery unit price information is exempt from (1) above, provided the system complies with S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided.**

Note: When a product is offered at more than one unit price, display of the unit price information may be through the deliberate action of the customer: 1) using controls on the device; 2) through the customer's use of personal or vehicle-mounted electronic equipment communicating with the system; or 3) verbal instructions by the customer.

[Nonretroactive as of January 1, 2017]

(Amended 2016)

~~S.1.5.3. — Recorded Representations, Point-of-Sale Systems. — Except for fleet sales and other price contract sales, a printed receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:~~

- ~~(a) the total volume of the delivery;~~
- ~~(b) the unit price;~~
- ~~(c) the total computed price; and~~
- ~~(d) the product identity by name, symbol, abbreviation, or code number.~~

~~(Added 2014)~~

S.1.5.3. Agreement Between Indications.

- (a) When a quantity value indicated or recorded by an auxiliary element is a derived or computed value based on data received from a device, the value may differ from the quantity value displayed on the dispenser, provided that the following conditions are met:

S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided. — Except for fleet sales and other price contract sales, a printed receipt providing the following information shall be available through a built-in or separate recording element that is part of the system for transactions involving a post-delivery discount:

- (a) the product identity by name, symbol, abbreviation, or code number;
- (b) transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount(s), including the:
 - (1) total volume of the delivery;
 - (2) unit price; and
 - (3) total computed price of the fuel sale.
- (c) an itemization of the post-delivery discounts to the unit price; and
- (d) the final total price of the fuel sale after all post-delivery discounts are applied.

(Added 2016)

S.1.5.6. Transaction Information, Power Loss. — In the event of a power loss, the information needed to complete any transaction in progress at the time of the power loss (such as the quantity and unit price,

or sales price) shall be determinable for at least 15 minutes at the device or other onsite device accessible to the customer.

[Nonretroactive as of January 1, 2017]

(Added 2016)

S.1.5.7. Totalizers for Retail Motor-Fuel Dispensers. – Retail motor-fuel dispensers shall be equipped with a nonresettable totalizer for the quantity delivered through the metering device.

[Nonretroactive as of January 1, 2017]

(Added 2016)

S.2. Design of Measuring Elements.

...

S.2.5. Zero-Set-Back Interlock for Stationary Retail Motor-Fuel Devices – A device shall be constructed so that:

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

[Nonretroactive as of January 1, 2017]

(Added 2016)

S.2.6. S.2.5. Thermometer Well. – For test purposes, means shall be provided to determine the temperature of the liquid either:

- (a) in the liquid chamber of the meter; or
- (b) in the meter inlet or discharge line and immediately adjacent to the meter.

(Amended 1987)

S.2.7.S.2.6. Automatic Temperature Compensation. – A device may be equipped with an adjustable automatic means for adjusting the indication and registration of the measured volume of product to the volume at 15 °C (60 °F).

S.2.7.1S.2.6.1. Provision for Deactivating. – On a device equipped with an automatic temperature-compensating mechanism that will indicate or record only in terms of liters or gallons adjusted to 15 °C (60 °F), provision shall be made to facilitate the deactivation of the automatic temperature-compensating mechanism so that the meter may indicate, and record if it is equipped to record, in terms of the uncompensated volume.

(Amended 1972)

~~S.2.7.2, S.2.6.2.~~ **Provision for Sealing.** – Provision shall be made for applying security seals in such a manner that an automatic temperature-compensating system cannot be disconnected and that no adjustment may be made to the system.

UR.2. Use Requirements.

...

UR.2.7. For Stationary Retail Computing Type Systems Only, Installed After January 1, 201X.

UR.2.7.1. Unit Price and Product Identity.

- (a) The following information shall be conspicuously displayed or posted on the face of a retail dispenser used in direct sale:
- (1) except for unit prices resulting from any post-delivery discount and dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), all of the unit prices at which the product is offered for sale; and
 - (2) in the case of a computing type device or money-operated type device, the unit price at which the dispenser is set to compute.

Provided that the dispenser complies with S.1.5.1. Display of Unit Price and Product Identity, it is not necessary that all the unit prices be simultaneously displayed or posted.

- (b) The following information shall be conspicuously displayed or posted on each side of a retail dispenser used in direct sale:
- (1) the identity of the product in descriptive commercial terms; and
 - (2) the identity of the grade, brand, blend, or mixture that a multi-product dispenser is set to deliver.

(Added 2016)

UR.2.7.2. Computing Device. – Any computing device used in an application where a product or grade is offered for sale at one or more unit prices shall be used only for sales for which the device computes and displays the sales price for the selected transaction.

The following exceptions apply:

- (a) Fleet sales and other price contract sales are exempt from this requirement.
- (b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement provided that:
 - (1) all purchases of fuel are accompanied by a printed receipt of the transaction containing the applicable price per unit of measure, the total quantity delivered, and the total price of the sale; and
 - (2) unless a dispenser complies with S.1.5.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.
- (c) A dispenser used in an application where a price per unit discount is offered following the

delivery is exempt from this requirement, provided the following conditions are satisfied:

- (1) **the unit price posted on the dispenser and the unit price at which the dispenser is set to compute shall be the highest unit price for any transaction;**
- (2) **all purchases of fuel are accompanied by a receipt recorded by the system for the transaction containing:**
 - (a) **the product identity by name, symbol, abbreviation, or code number;**
 - (b) **transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount including the:**
 1. **total volume of the delivery;**
 2. **unit price; and**
 3. **total computed price of the fuel sale prior to post-delivery discounts being applied.**
 - (c) **an itemization of the post-delivery discounts to the unit price; and**
 - (d) **the final total price of the fuel sale after all post-delivery discounts are applied.**

(Added 2016)

Background/Discussion:

The NCWM Publication 14 checklist for Liquefied-Petroleum Gas (LPG) Retail Motor Fuel Devices verifies compliance with specifications, such as: “Power Loss” (which requires a 15-minute power back up) and “Zero-Setback Interlocks.” However, these specifications are not located in Section 3.32. of NIST Handbook 44.

There are LPG devices with NTEP Certificates of Conformance (CCs) that meet current “power loss” and “zero-setback interlock” requirements. However, there are other LPG retail motor-fuel devices in the field that consist of an assembly of separable, compatible, and type evaluated LPG measuring and indicating elements, key/card lock systems that do not meet the power loss and interlock requirements because those requirements are not within the LPG Code and were not applied to the components during type evaluation. This creates unfair competition with holders of NTEP CCs for LPG retail dispensers.

There are newer LPG dispensers coming in to use, where measuring, indicating, and computing elements are assembled in retail motor fuel dispenser housings. These LPG devices serve as both propane bottle fillers and as retail motor fuel devices using separate hoses and nozzles on a dispenser. Many of these dispensers, while they do have a good safety history, are not assembled in compliance with safety standards such as UL 495 or 1238, or NFPA 50. Nor are they typically installed in accordance with NFPA 30A or NFPA 70.

Existing retail LPG dispensers can be adapted to fuel LPG-powered motor vehicles by adding a simple adaptor which attaches to the LPG nozzle on the dispenser’s hose. There are currently five active and two inactive NTEP Certificates of Conformance for LPG retail motor-fuel dispensers listed in the NCWM Database.

See the 2014 and 2015 S&T Committee’s Annual Report for additional background information and to review previous language and positions to amend the NIST Handbook 44 Liquefied Petroleum Gas and Anhydrous Liquid-Measuring Devices Code.

2016 NCWM Interim Meeting:

At the Committee’s 2016 NCWM Interim Meeting open hearings, Ms. Tina Butcher (NIST, OWM) reiterated the same concern that OWM had expressed at the 2015 NCWM Annual Meeting that the Item Under Consideration was *not* the latest version of the proposal and that the latest version needed to replace it. It was noted that the latest version of the proposal had been posted on NCWM’s website. An official from the State of California and another from

Alameda County, California, commented that they support the latest version of the proposal referenced by Ms. Butcher. Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, reported that the MMA also supports the latest version of the proposal.

Based on the comments received during the open hearings, the Committee agreed to replace the proposal appearing in the Item Under Consideration in 2016 NCWM Publication 15 with the latest version as shown in the Item Under Consideration in this report and present it for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee heard comments in support of the proposal from Ms. Tina Butcher (NIST, OWM). Ms. Butcher reported that the revised proposal had been submitted by NIST and the MAA with additional input having also been received from the 2015 WWMA Annual Meeting. Ms. Butcher stated that OWM believes the proposed amendments will help ensure that much-needed changes are made to the LPG and NH₃ Code to align it with the LMD Code. Mr. Dimitri Karimov (Liquid Controls), speaking on behalf of the MMA, also supported the proposal.

A regulatory official questioned the meaning of the word “face” in proposed sub-paragraph UR.2.7.1(a) and Ms. Butcher indicated that a clear definition for the word is included in NIST Handbook 44, Appendix D. However, that definition is currently intended only to apply to LMDs as indicated by the reference to Section 3.30. within the brackets shown immediately following the definition. Ms. Butcher then suggested someone might consider drafting a new proposal to add an additional reference to Section 3.32. to the bracketed area of the definition since, in her opinion, the definition could be applied to both device types.

The Committee, hearing no comments in opposition and only comments in support of the changes, agreed to present the item for Vote.

Regional Association Comments:

The WWMA, at its fall 2015 Annual Meeting, reported that the MMA and OWM submitted a proposal to replace the “Item under Consideration” in the S&T Committee’s 2015 Interim and Annual Report with this proposal. At their September 2015 Annual Meeting, the NTEP Measuring Sector reviewed this proposal and indicated its support of this version. The WWMA believes that the revised version of this proposal is fully developed and recommended that it be a Voting item. [Technical Advisor’s Note: This version appears in the “Item Under Consideration” in this report.]

The CWMA reported it believes this item will add consistency across similar devices types and recommended it be a Voting item at both its 2015 Interim and 2016 Annual Meetings.

NEWMA recommended, at both its fall 2015 Interim Meeting and spring 2016 Annual Meeting, the item be forwarded to the NCWM as a Voting item as it is complete and would harmonize the LMD, VTM, and LPG/NH₃ codes with other measuring codes.

The SWMA reported, at its fall 2015 meeting, that it believes the revised proposal by NIST is fully developed and recommended it be a Voting item on the NCWM agenda.

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

332-3 V S.2.1. Vapor Elimination

(This item was Adopted.)

Source:

NIST Office of Weights and Measures (2016)

Purpose:

- 1) To require that the vapor eliminator on LPG and Anhydrous Ammonia liquid-measuring devices be automatic in operation;
- 2) To edit the vapor eliminator requirements to ensure clarity and consistency with other measuring codes; and
- 3) To require that vapor elimination vent lines be made of a non-collapsible material.

Item under Consideration:

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

S.2.1. Vapor Elimination.

(a) A device shall be equipped with an effective ~~automatic vapor eliminator or other effective~~ means to prevent the passage of vapor through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 2016)

Background/Discussion:

The proposed changes to S.2.1. would clarify that the LPG or Anhydrous Ammonia liquid-measuring device's vapor eliminator must be automatic in operation and prevent both air and vapor from passing through the meter. Effective operation should not depend on operator intervention or action. Additionally, the proposed changes would require that the vent lines be made of material that resists the potential obstruction (e.g., bending or kinking) that may otherwise prevent the free-flow of air and vapor out of the metering system. Non-rigid vent lines would facilitate fraud and may lead to improper operation of the air/vapor elimination system. These modifications would more closely align the requirement with corresponding requirements in the Liquid-Measuring Devices, Vehicle-Tank Meters, Cryogenic Liquid-Measuring Devices, Milk Meters, and Mass Flow Meters Codes.

2016 NCWM Interim Meeting:

At its 2016 NCWM Interim Meeting open hearings, the Committee grouped Items 332-3 and 338-2 together and took comments simultaneously on these items. The Committee received numerous comments in support of these two proposals from enforcement officials and industry representatives alike, but with some suggested changes to the language in each. Dr. Matthew Curran (Florida) noted that the SWMA had suggested amending the two proposals at its 2015 fall Annual Meeting and he also indicated that he was interested in knowing other's opinions concerning those changes. Mr. Richard Suiter (Richard Suiter Consulting) stated that air will never get introduced into an LPG system and suggested the word "air" be removed from the proposed language. Ms. Tina Butcher (NIST, OWM) reported that OWM had submitted this item (and its companion, Item 338-2) to align requirements for vapor elimination with those requirements currently in other measuring device codes. The proposed language requires vapor elimination equipment to be automatic in operation and for vent lines to be constructed of rigid materials.

Ms. Butcher indicated that she agreed with Mr. Suiter's comment regarding "air." She noted that OWM also concurs with the suggestions of the SWMA and that OWM had initially recommended an alternative proposal provided by the SWMA as follows to replace the Item Under Consideration:

S.2.1. Vapor Elimination.

- (a) A device shall be equipped with an effective ~~automatic vapor or air eliminator or other effective~~ **automatic** means to prevent the passage of vapor ~~and air~~ through the meter.
- (b) Vent lines from the vapor ~~or air~~ eliminator shall be made of rigid corrosion-resistant metal tubing or other rigid material.

This alternative language would address both the CWMA's and Mr. Suiter's comments regarding the use of the term "air." Ms. Butcher further indicated that members of the MMA had reviewed the alternative proposal during their meeting the previous Sunday morning, and recommended replacing part (b) of the proposal with the following:

Vent lines from the vapor eliminator shall be made of metal tubing or other non-collapsible material.

This recommendation by the MMA was based on its members reporting that flexible stainless steel braided hose is an acceptable material to use for a vent line with these devices. Manufacturers of vehicle-mounted equipment, including Mr. Dmitri Karimov (Liquid Controls), pointed out that there is a move away from rigid materials such as metal tubing on vent lines because the vibration from the trucks in which these meters are commonly mounted tends to crack rigid lines. OWM supported the change being recommended by the MMA to the SWMA alternative proposal. A final OWM suggestion was that corresponding requirements in other measuring codes be similarly amended.

One enforcement official indicated that he would have a safety concern using corrugated stainless steel with LPG.

Based on the comments received during the open hearings, the Committee agreed to amend the proposal as shown in Item Under Consideration and present it for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee grouped together Items 332-3 and 338-2 and comments were taken simultaneously since the Committee considered them companion items. All comments received were in support of the items.

Ms. Tina Butcher (NIST, OWM) stated that OWM concurs with the modifications made to the original proposal by the Committee at the 2016 Interim Meeting. OWM believes that the new language will ensure the means provided for vapor elimination are automatic in operation; eliminates the reference to "air" and better addresses the need for the vent line to be constructed of material that prevents it from being intentionally or inadvertently compressed and/or closed off. Ms. Butcher indicated that OWM also suggests similar changes be proposed, where necessary, to corresponding requirements in other measuring codes and encouraged the Committee to consider including such items on its agenda in the 2016 - 2017 NCWM cycle in order to harmonize wording across all affected codes.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, reported that the MMA supports these items as written. Mr. Kurt Floren (Los Angeles County Agric. Comm/Weights and Measures) also voiced his support for the items, but recommended the "Purpose" section of the Committee's Final Report be changed for both items to reflect the change made to the proposals allowing vapor elimination vent lines be made from any non-collapsible material.

In consideration of the comments heard in support of the item, the Committee agreed to present the item for Vote.

Regional Committee Meetings:

The WWMA heard testimony at its 2015 Annual Meeting from Ms. Tina Butcher (NIST, OWM) that this proposal contains clean-up language to align this section with other codes in NIST Handbook 44. The WWMA S&T Committee agreed and during its Committee discussions noted that the requirement that the vent lines be constructed of rigid materials is important. The WWMA believes this item is fully developed and forwarded it to NCWM, recommending that it be a Voting item.

The CWMA, at its fall 2015 Interim Meeting supported the item and recommended it move forward as a Voting item, but also requested that the terminology be reviewed for technical reasons; specifically, the inclusion of the term “air.” At its spring 2016 Annual Meeting, the CWMA reported that it feels the item is fully developed and recommended it be forward to the NCWM as a Voting item.

At its fall 2015 Interim Meeting, NEWMA reported it believes the original language is appropriate since air should not be present in a pressurized system. NEWMA did not forward this item to NCWM at that time and recommended that it be withdrawn. However, at its spring 2016 Annual Meeting, NEWMA reported there were no comments received on the item and recommended it move forward as a Voting item.

The SWMA batched this item with Item 338-2 at its 2015 Annual Meeting and heard them together. The Committee recommends this new language based on comments received. The SWMA forwarded the items to NCWM and recommended that they be Voting items.

332-4 V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 334-1, 335-1, 337-1, 338-1 and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

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

Table S.2.2. Categories of Device and Methods of Sealing	
Categories of Device	Methods of Sealing
<i>Category 1: No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
<i>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.</i>	<i>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.</i>
<i>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.</i>	<i>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 <u>on demand</u> through the device or through another on-site device. <u>The information may also be available electronically.</u> 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.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) **(Amended 2016)**

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for Vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See Agenda

Item 331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these items: 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1 and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code. The SWMA forwarded these items to NCWM and recommended to the NCWM that they be Voting items.

332-5 D N.3. Test Drafts.

Source:

Endress + Hauser Flowtec AG USA (2015)

Purpose:

Allow transfer standard meters to be used to test and place into service dispensers and delivery system flow meters.

Item under Consideration:

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

N.3. Test Drafts.

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

(Amended 1982)

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

Background/Discussion:

The use of transfer standards is recognized in code Sections 3.34. Cryogenic Liquid-Measuring Devices Code and 3.38. Carbon Dioxide Liquid-Measuring Devices Code and 3.39. Hydrogen Gas-Measuring Devices – Tentative Code. Field evaluation of LPG meters and CNG dispensers and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using transfer meter standards are more efficient and safer. With CNG and LNG and LPG applications, the transfer standard meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of transfer standards eliminates return to storage issues and is easier and faster compared to the use of traditional field standards. The cost of using transfer standards and transporting them is much less than the cost of traditional field provers and standards. Recognition in NIST Handbook 44 will enable States to allow transfer standard meters to place systems into service and for field enforcement.

Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The State of Colorado uses a master meter to test propane delivery truck meters. The State of Nebraska has used a mass flow meter to test agricultural chemical meters.

In some applications, transfer standard meters are not more accurate than the meters used in the dispenser. For that reason, longer test drafts and possibly more tests need to be run.

The State of California is purported to have conducted a short study of master meters in the past. The conclusion did not lead to wide adoption of the practice. However, the State of California uses a mass flow meter as a master meter for carbon dioxide flowmeter enforcement.

Mass Flow Meters Code paragraph UR.3.8. Return of Product to Storage, Retail Compressed Natural Gas Dispensers requires that the natural gas which is delivered into the test container must be returned to storage. This is difficult and most often not complied with when the test vessel contents are released to atmosphere.

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

See the 2015 S&T Committee's Annual Report for additional background information and to review previous language and positions on this proposal.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped Items 332-5 and 337-3 together and comments were taken simultaneously on these two items.

Mr. Michael Keilty (Endress + Hauser Flowtec), the submitter, stated that he supported this item as a Voting item. Mr. Alan Walker (Florida) spoke in support of the item and recommended it move forward as a Voting item. Mr. Dmitri Karimov (Liquid Controls) recommended limiting the application of the proposal to retail CNG testing, which was echoed by Mr. Randy Moses (Wayne) stating he supported the concept for CNG testing. Mr. Mike Sikula (New York) supported the continued investigation of this item. Ms. Tina Butcher (NIST, OWM) stated that there is a USNWG subgroup presently working to establish uncertainties for select test methods. Currently, there are no representatives on the subcommittee to review factors that affect the uncertainties of measurements using master meters. OWM questions whether or not consideration needs to be given to providing a larger tolerance when conducting tests using a transfer standard as is done in the carbon dioxide and hydrogen codes. Testing would need to be conducted to demonstrate the magnitude of the additional tolerance. Ms. Butcher further stated that if the current proposal passed it doesn't mean that all jurisdictions would support it.

The Committee also received written comments from Mr. Henry Oppermann (Weights and Measures Consulting, LLC) on behalf of Seraphin Test Measure Company suggesting that additional test data is needed to be able to properly evaluate whether or not a calibrated transfer standard (e.g., a master meter) can be considered a suitable standard in testing devices that dispense such products.

During the Committee's work session, members of the Committee acknowledged that both written and some verbal comments received suggested the need for additional test data. It was also acknowledged that there was a lot of support for the proposal. Those supporting the proposal had indicated that using a transfer standard is much easier and faster than testing gravimetrically and eliminates the need to discharge product from a prover into the atmosphere, which is viewed by many as a safety concern. In discussing the item, it was noted that adding a requirement recognizing the use of transfer standards to the two codes wouldn't dictate the method of testing that a jurisdiction would have to use. The proposal only recognizes the use of transfer standards in testing and the decision on whether or not to use a particular method of testing would remain with each jurisdiction. Given these considerations, the Committee agreed to present both items for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee grouped Items 332-5 and 337-3 together and comments were taken simultaneously on these two items. The Committee received numerous comments from industry and regulators alike, predominantly in support of the proposals. The following is a list of many of the more significant comments that the Committee heard in support of the proposals:

- Using a transfer standard (e.g., a calibrated master meter) provides a much safer means of testing than testing gravimetrically because the product discharged during testing goes into a receiving tank and does not get discharged into the atmosphere.
- Using a transfer standard to test provides a faster and more efficient means of testing.
- Adding language to NIST Handbook 44, which recognizes the use of transfer standards in testing, provides the legal basis for using them.
- We have been using transfer standards very successfully in our state and have had no issues.
- NIST Handbook 44 Fundamental Considerations does not address the test method. Only the standard has to be accurate to within one-third of the tolerance to be applied to the device being tested. (*Technical Advisor's Note: This comment is in reference to the information contained in NIST Handbook 44, Appendix A. Fundamental Considerations paragraph 3.2. Tolerances for Standards*)
- We support the continued effort of developing alternative test standards for use in testing.

Mr. Marc Buttler (Emerson Process Management – Micro Motion) commented that he supports the adoption of both agenda items with one slight modification; replace the words “maximum discharge rate” with “maximum test rate” in proposed paragraph N.3.2. Mr. Michael Keilty (Endress + Hauser Flowtec AG USA) commented that he fully supports the change suggested by Mr. Buttler.

There were also some comments received suggesting the need for further development of the proposals. Ms. Tina Butcher (NIST, OWM) stated that OWM considers the development of alternative methods of testing commercial measuring systems an important issue because there are many applications in which using currently recognized test methods may not be feasible because of product characteristics, safety, cost, access to equipment, and other factors. Ms. Butcher reiterated many of the comments offered by OWM in previous NCWM Meetings as follows:

- Modifying NIST Handbook 44 as proposed does not ensure approval of any proposed test method. The decision on whether or not to accept a particular test method for use in testing commercial weighing and measuring equipment ultimately rests with the regulatory authority.

There is a need for those selecting an appropriate field standard (i.e., one that is suitable and can provide traceable measurements) to consider the various “essential elements of traceability” such as:

- the standard’s demonstrated reliability over time and its repeatability;
 - how well the standard duplicates actual use;
 - the existence of documentary standards;
 - the availability of equipment and facilities within a state laboratory to test the standard; and
 - whether training has been provided for the laboratory staff, field officials, and users of the equipment.
- It is important for field standards to meet the accuracy requirements specified in the Fundamental Considerations of NIST Handbook 44, Section 3.2. Tolerances for Standards. Those requirements specify that when a standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable tolerance.
 - Whether or not consideration needs to be given to providing a larger tolerance when conducting tests using a transfer standard as is done in the carbon dioxide and hydrogen codes. If so, testing would need to be conducted to demonstrate the magnitude of the additional tolerance.

- Because there is a potential for more than one type of alternative test method, the proposed language may unintentionally limit those methods from consideration. For example, the proposed language may not allow the use of a small volume prover. OWM believes more analysis is needed prior to recommending specific language for adoption.

Ms. Butcher noted that weights and measures officials and industry need a system that results in:

- manufacturers knowing the requirements for the design of the standard;
- systematic and appropriate collection of measurement data on proposed new standards; and
- states (regulatory authority) having access to the measurement data to determine whether or not a standard meets the guidelines in NIST Handbook 44, Fundamental Considerations and side-by-side testing to compare results with existing test methods.

Ms. Butcher provided an update on the ongoing work of the U.S. National Working Group on Alternative Test Methods (ATMs) and reported that the NTEP Measuring Sector is currently developing guidelines for use by type-evaluation laboratories when conducting evaluations using transfer standards such as master meters, small volume provers, etc. Information from this group may be useful in further developing this item.

Ms. Butcher also offered the following new OWM comments and recommendations regarding, in particular, the proposal to add paragraph N.3.1. to NIST Handbook 44, Section 3.37. Mass Flow Meters Code:

- Existing paragraph N.3. Test Drafts addresses the minimum test in terms of flow rate. That is, one test draft at the maximum flow rate of the installation and one test draft at the minimum flow rate.
 - It is not clear from the proposal if the intent is to strike the existing language in paragraph N.3. The proposal does not show the existing language in the paragraph (except for its title); yet, the language is not shown as being struck.
- Proposed new paragraph N.3.1. addresses the minimum test in terms of delivery amount. That is “at least the amount delivered by the device in one minute at its normal discharge rate.”
 - OWM notes that all parts of paragraph N.3.1. Minimum Test shown in Item Under Consideration are new and not just the underlined portion. The entire paragraph should be bold and underlined in the agenda.
- Proposed new paragraph N.3.1. is not consistent with the minimum test of a CNG RMFD being performed today in accordance with the NIST EPO. A test conducted at the MMQ typically takes far less than a minute to complete. Additionally, the test drafts performed at one-third, two-thirds, and three-thirds test tank capacity often are completed in less than a minute’s time.
- OWM believes more work is needed to further develop the minimum test requirements in the MFM Code.

In consideration of these points, OWM recommended the two items be changed to Information.

Mr. Henry Oppermann (Weights and Measures Consulting, LLC), speaking on behalf of Seraphin Test Measure, stated that he agreed with OWM’s comments and supported them. He disputed the claim made by an earlier speaker that the one-third error specified in NIST Handbook 44, Fundamental Considerations applies only to the test standard. Mr. Oppermann indicated that the one-third tolerance applies not only to the test standard but also the uncertainties created by using the standard. He stressed the need for regulators to be able to prove that their test results are valid and questioned how regulators would know which standards are acceptable if they didn’t have the proof to support their accuracy. He further noted that, in some cases, transfer standards are no more accurate than the meter being tested and that the proposals lack a specification associated with the performance of the standard. He recommended the items be downgraded to Information or Developing.

During the Committee's work session, members of the Committee agreed that the comments received during the open hearings were mostly in support of the two proposals. Mr. Harshman (NIST Technical Advisor) requested that members of the Committee, in consideration of the comments OWM had made during the open hearings, review proposed new paragraph N.3.1. in Agenda Item 337-3. Mr. Harshman explained that despite only the title being bold and underlined, the entire paragraph is new. The paragraph defines the minimum test of a mass flow meter and requires each test draft be comprised of at least the amount of product delivered by the device in one minute at its normal discharge rate. Mr. Harshman indicated that this proposed requirement cannot be met by someone wanting to apply the current test procedures in the NIST EPO for retail motor fuel devices used to dispense CNG. The NIST EPO was developed years ago by a work group comprised of subject matter experts, including manufacturers, users, regulatory officials, and others. The procedures in the EPO require a test at one-third, two-thirds, and three-thirds test tank capacity, as well as a test at the minimum measured quantity (MMQ), providing the MMQ is less than one-third test tank capacity. Mr. Harshman noted that it was his experience, in working with some states conducting these tests, that each of these tests typically takes less than a minute to complete and in some cases, far less than a minute. Some Committee members who are familiar with applying the procedures in the NIST EPO agreed that the testing typically takes less than a minute to complete.

The Committee concluded that proposed paragraph N.3.1. would conflict with existing paragraph N.3. Test Drafts, which specifies the minimum test shall be one test draft at the maximum flow rate of the installation and one test draft at the minimum flow rate. This caused the Committee to question whether the submitter had fully considered the impact that the two proposals would have on other existing requirements in the two Codes, which led to the Committee's majority decision to downgrade both items to Developing and return them to the submitter.

Regional Association Comments:

The WWMA S&T Committee did not receive comments on this item during open hearings of its 2015 Annual Meeting. During discussion on this item, WWMA S&T Committee members expressed their concern over the choice of requiring two minutes of flow. The WWMA sees possible merit in the proposal but believes that refinements and more test data are needed before further consideration can be given to this item and recommended that this item remain as a Developing item.

At its fall 2015 Interim Meeting, the CWMA reported it believes that the type of meter that could be considered appropriate for use as a transfer standard meter needs to be further defined. At its spring 2016 Annual Meeting, the CWMA reported it feels this item has merit and the comments received were in support of the use of transfer standards once the proper procedures have been developed to insure accuracy, traceability, and suitability. The CWMA recommended the status of the item be Developing at both meetings.

At its fall 2015 Interim Meeting, NEWMA stated that this item should be further developed by the submitter. Master meters are not going away but their accuracy needs to be verified. NEWMA recommended that this item be a Developing item. At its spring 2016 Annual meeting, NEWMA members could not support this item as Voting. There are too many uncertainties associated with the use of a master meter as a transfer standard for select test methods, including issues such as: the calibration of specific viscosities; no clear definition; and no traceability in the use of testing CNG, LNG, and LPG meters. NEWMA recommends the status of this item be changed to Information.

At its fall 2015 Annual Meeting, the SWMA batched this item with Item 337-3 and heard them together. The SWMA recommends that these items be Voting items.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

332-6 I N.4.2.3. For Wholesale Devices**Source:**

NIST Office of Weights and Measures (2016)

Purpose:

- 1) To specify the purpose of special tests conducted on Wholesale LPG and Anhydrous Ammonia Liquid-Measuring Devices;
- 2) To specify that the special tests are to be conducted at or slightly above the designated flow rates in the referenced paragraph; and
- 3) To specify that the special tests are not to be conducted below the device's marked minimum discharge rate.

Item under Consideration:

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

N.4.2.3. For Wholesale Devices. – A wholesale device shall be so tested at a minimum discharge rate of: “Special” tests shall be made to develop the operating characteristics of a measuring system and any special elements and accessories attached to or associated with the device. “Special” tests shall include a test at or slightly above the slower of the following rates:

- (a) 40 L (10 gal) per minute for a device with a rated maximum discharge less than 180 L (50 gal) per minute;
- (b) 20 % of the marked maximum discharge rate for a device with a rated maximum discharge of 180 L (50 gal) per minute or more; or
- (c) the minimum discharge rate marked on the device, ~~whichever is least.~~

In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

(Amended 1987 ~~and 20XX~~)

Background/Discussion:

In 2014, the Liquid-Measuring Devices (LMD) Code of NIST Handbook 44 was modified to clarify testing requirements for special tests of wholesale LMDs and to help to ensure that those tests were not conducted at flow rates less than the minimum flow rates marked by the manufacturers of the metering systems. The proposed changes outlined above would align the special test requirements for LPG and Anhydrous Ammonia Liquid-Measuring Devices with those adopted in 2014 in the LMD Code and provide consistency in testing procedures across similar measuring codes.

During training seminars for weights and measures officials and service personnel, NIST, OWM and other trainers instruct students to conduct special tests slightly above the marked minimum flow rate. While an official or service agent is not precluded from setting the flow rate exactly at the marked minimum flow rate, special care must be taken to ensure that the flow rate does not drop below the marked minimum during the course of the test. This can sometimes be difficult in field environments. Flow rates can vary slightly during the course of a test draft due to factors such as changes in system pressure and the number of other devices in use within the system. If the inspector or service agent sets the flow rate exactly at the marked minimum flow rate, such variations can result in the flow rate dropping below the marked minimum flow rate for portions of the test. This could potentially result in an unfair test to the metering system. Additionally, it is sometimes difficult to control the flow rate during the course of the entire test or to even set the flow rate at “exactly” the marked minimum rate. The proposed language would provide flexibility to the inspector or service agent to conduct a special test “at” or “near” the marked minimum and still consider such a test to be valid.

This proposal would provide consistency with 2015 NIST Handbook 44 Section 3.30. Liquid-Measuring Devices Code, Special Tests, paragraph N.4.2.4. Special Tests, Wholesale Devices.

2016 NCWM Interim Meeting:

At the Committee's 2016 NCWM Interim Meeting open hearings, Ms. Tina Butcher (OWM) noted that OWM had submitted this proposal to align requirements in the LPG and Anhydrous Ammonia Liquid-Measuring Devices Code with those adopted in the LMD Code in 2014. The proposed changes would help to avoid testing below the marked minimum flow rate and avoid challenges when running a "slow-flow test" at a rate other than the marked minimum.

Ms. Butcher further noted that the CWMA had suggested additional specificity for the term "slightly above." OWM agrees that this would be beneficial and supports such development. However, the proposed language is the same as that which was adopted by the NCWM in the LMD Code and is only intended to harmonize the two codes. She also noted that, prior to the 2014 adoption of the same term in the LMD Code, the NCWM S&T Committee heard similar comments and acknowledged that the phrase leaves room for interpretation. However, the Committee felt the term is adequate and provides for flexibility, and hearing no other opposition to the proposal, presented the item for a Vote with the phrase "slightly above." Lacking any specific suggestion, rather than delaying this proposal, OWM believes further definition of the term should be proposed as a separate issue that would also encompass the LMD Code.

Ms. Butcher also indicated that OWM proposes modifying the title of this item to include "Special Tests" so that it reads "N.4.2.3. Special Tests, For Wholesale Devices." Paragraph N.4.2.3. is part of a larger paragraph titled "N.4.2. Special Tests."

Mr. Michael Keilty (Endruss + Hauser Flowtec AG USA) commented that he supported the item.

Based on the comments received during the open hearings, the Committee agreed to present this item for Vote at the Annual Meeting.

2016 NCWM Annual Meeting

At the 2016 NCWM Annual Meeting, the Committee agreed to change the status of this item from Voting to Information based on a recommendation from Tina Butcher (NIST, OWM) and the MMA during open hearings. MMA believes the existing text in parts (a), (b), and (c) of paragraph N.4.2.4. For Wholesale Devices is redundant and, for that reason, the MMA prefers downgrading the item to allow additional time to develop the language.

Regional Association Comments:

The WWMA received testimony from Ms. Tina Butcher at its 2015 Annual Meeting, who indicated that the purpose of this proposal is to clarify that the special test should not be conducted exactly at the minimum rated flow rate as the flow rate may drop below the minimum flow rate during the test. The WWMA S&T agreed with her testimony. The WWMA forwarded the item to NCWM and recommended that it be a Voting item.

The CWMA believes that the term "slightly above" should be further defined in relation to part (c) of this proposal. The CWMA forwarded the item to NCWM and recommended that it be a Developing item at its fall 2015 Interim Meeting. At its 2016 Annual Meeting, the CWMA reported it believes the item is fully developed and recommended it be forwarded to the NCWM as a Voting item.

NEWMA stated, at its 2015 Interim Meeting that this item has merit but needs clarification of the language. NEWMA recommended that it be an Information item. At its 2016 Annual Meeting NEWMA reported it agrees the proposal will align requirements of the LPG and NH₃ Code with the LMD code and recommended the item move forward as a Voting item.

The SWMA forwarded this item to NCWM and recommended that it be a Voting item.

332-7 V UR.2.3. Vapor-Return Line

(This item was Adopted.)

Source:

NIST Office of Weights and Measures (2016)

Purpose:

Clarify conditions under which the use of an LPG vapor return line connected from a supplier's tank to a receiving container is or is not permitted.

Item under Consideration:

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

UR.2.3. Vapor-Return Line. – During any metered delivery of liquefied petroleum gas from a supplier's tank to a receiving container, ~~there shall be no a~~ vapor-return line from the receiving container to the supplier's tank **is prohibited except:**

- (a) in the case of any receiving container to which normal deliveries ~~can~~ **cannot** be made without the use of such vapor-return line; or
- (b) in the case of any ~~new~~ **top spray-fill** receiving container when the ambient temperature is ~~below at or above~~ **90 °F (32 °C)**.

(Amended 2016)

Background/Discussion:

The current language in NIST Handbook 44 paragraph UR.2.3. Vapor-Return Line continues to cause confusion and generates questions from inspectors, manufacturers, and measuring system users. The intent of the proposed modifications is to make this paragraph more direct and easier to understand. The proposed amendments to UR.2.3.(b) are intended to clarify the meaning of the term “new” in references to “receiving containers” in the existing language. Research of the original language revealed references to receiving containers (or tanks) that were designed with what was then considered “new” top “spray-fill” systems.

Discussion of requirements and considerations for the use of LPG vapor return lines can be traced back as early as the 1950 NCWM Conference Report and can be found specifically in the 1956, 1957, 1958, and 1964 Conference Reports.

As product flows into the receiving (customer's) tank during an LPG delivery, the liquid compresses the vapor in the customer's tank, increasing pressures and temperatures inside the tank. As the pressure increases, some of the vapor condenses into liquid and equilibrium is eventually restored. However, such increased pressure can make deliveries difficult or impossible. At one time, vapor return lines were used to help equalize the pressures. These lines would allow some vapor in the receiving tank to be pushed back into the seller's tank, thus reducing pressure in the receiving tank during the delivery. The problem with this practice is that this vapor belongs to the customer and the vapor is not measured and no compensation is made to the customer for it.

The “spray-fill” design allows relatively cool product to “spray” over the insides of the tank as a delivery is being made, cooling the vapor space and promoting condensation of existing vapor in the tank, and reducing pressure buildup. The advent of the “spray-fill” design virtually eliminated the need for a vapor-return line connected to the supplier's tank and the receiving container except in specific circumstances where other constraints may necessitate its use.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee received comments in support of the proposal from Mr. Clark Cooney (California). Mr. Cooney indicated that he had helped develop the proposal while working for NIST. His research into the history of term “new receiving container,” which appears currently in paragraph UR.2.3. Vapor Return Line, revealed that the term was intended to refer to a receiving container of new design that was first

introduced in the 1950s. This new design facilitated the cooling of product as it was received into the container, thereby, eliminating the need for a vapor-return line. This proposal is simply an attempt to make the language clearer.

Ms. Tina Butcher (NIST, OWM) reported that OWM routinely encounters questions about interpreting and applying the requirement as it is currently written. A vapor-return line allows vapor in the receiving tank to be displaced into the seller's tank. The line helps eliminate errors that can arise from the condensing of the vapor during testing; however, for a commercial transaction, that uncondensed product belongs to the customer. This proposal does not add anything new, but rather is an attempt to improve understanding of the requirement by changing the existing sentence structure and adding some additional clarification. The proposed language clarifies that the reference to the term "new" refers to a specific design of tank that was "new" when the language was first introduced many years ago.

Ms. Butcher noted that the words "at or above" should precede "90 °F (32 °C)" in (b) of the proposal. She also noted that the CWMA had suggested that additional detail is needed to define the conditions under which the use of a vapor-return line would be considered appropriate. OWM agrees that such detail would be beneficial, but suggests this be done as a separate effort rather than delaying the needed changes to the current paragraph. OWM also questions whether such guidelines might be best included in the NIST EPO.

Two regulatory officials from California commented that they too supported the proposal.

The Committee agrees with the justification to improve and clarify the current language in NIST Handbook 44 and that the words "at or above" need to be included as noted by OWM. Consequently, the Committee agreed to amend the proposal as shown in Item Under Consideration and present it for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearing, Ms. Tina Butcher (NIST, OWM) commented that OWM considers this proposal a "housekeeping" issue, which serves to provide additional clarification on what is meant by a "new" receiving container in bullet (b) of existing paragraph UR.2.3. Vapor-Return Line. Ms. Butcher stated that the reference to the term "new" refers to a specific design of tank that was "new" when the language was first introduced many years ago and which has created confusion regarding the interpretation of how the paragraph applies to specific systems. She further noted that the remaining changes proposed to the paragraph by OWM are simply intended to make the language easier to understand.

Mr. Dimitri Karimov (Liquid Controls), speaking on behalf of the MMA, stated that the MMA supports the changes proposed by OWM.

Hearing no comments in opposition and only comments in support of the changes proposed, the Committee agreed to present the item for Vote with no changes.

Regional Association Comments:

The WWMA received testimony from Ms. Tina Butcher at its 2015 Annual Meeting indicating this proposal doesn't change the requirement. It clarifies when a vapor return line is permitted. The WWMA S&T Committee agreed with her testimony. The WWMA forwarded the item to NCWM and recommended that it be a Voting item.

The CWMA reported, at its 2015 Interim Meeting, it believes this item needs more development, specifically defining under what conditions the use of a vapor return line would be allowed, to include but not be limited to, ambient temperature, tank pressure, and the condition of the delivery equipment. The CWMA forwarded this item to NCWM and recommended that it be a Developing item. However, at its spring 2016 Annual Meeting, the CWMA reported it believes the item is fully developed and recommended it move forward as a Voting item.

NEWMA indicated at its fall 2015 Interim Meeting that it does not think the purpose of this item is pertinent to NIST Handbook 44 and did not forward the item to NCWM, recommending that it be withdrawn. However, at its 2016 Annual Meeting, NEWMA indicated it believes the proposed changes will clarify the conditions for wholesale LPG and Anhydrous Ammonia LMD vapor return and recommended the item be forwarded to NCWM as a Voting item.

The SWMA forwarded this item to NCWM and recommended that it be a Voting item.

334 CRYOGENIC LIQUID-MEASURING DEVICES

334-1 V Table S.252. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 335-1, 337-1, 338-1, and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

Amend NIST Handbook 44, Cryogenic Liquid-Measuring Devices Code as follows:

<i>Table S.2.5. Categories of Device and Methods of Sealing</i>	
<i>Categories of Device</i>	<i>Methods of Sealing</i>
<i>Category 1: No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
<i>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.</i>	<i>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.</i>
<i>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.</i>	<i>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 <u>on demand</u> through the device or through another on-site device. <u>The information may also be available electronically.</u> 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.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) (**Amended 2016**)

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30 Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See Item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See agenda Item 331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

335 MILK METERS

335-1 V Table S.2.2. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 337-1, 338-1, and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

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

<i>Table S.2.3. Categories of Device and Methods of Sealing</i>	
<i>Categories of Device</i>	<i>Methods of Sealing</i>
<i>Category 1: No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
<i>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.</i>	<i>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.</i>
<i>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.</i>	<i>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 <u>on demand</u> through the device or through another on-site device. <u>The information may also be available electronically.</u> 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.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) (**Amended 2016**)

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See Item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for Vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See agenda Item 331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1 and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

337 MASS FLOW METERS

337-1 V Table S.3.5. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 335-1, 338-1, and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

Amend NIST Handbook 44, Mass Flow Meters Code as follows:

Table S.3.5. Categories of Device and Methods of Sealing	
Categories of Device	Methods of Sealing
Category 1: <i>No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
Category 2: <i>Remote configuration capability, but access is controlled by physical hardware.</i> <i>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.</i>	<i>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.</i>
Category 3: <i>Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</i> <i>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.</i>	<i>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.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 1995) (Amended 1995, 1998, 1999, ~~and~~ 2006, and 2016)

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See Item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for Vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together Agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See agenda

Item 331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

337-2 V Appendix D – Definitions: Diesel Liter Equivalent (DLE) and Diesel Gallon Equivalent (DGE) for Compressed Natural Gas and Liquefied Natural Gas; Definition of Gasoline Gallon Equivalent and Gasoline Liter Equivalent for Compressed Natural Gas; S.1.2. Compressed Natural Gas and Liquefied Natural Gas Dispensers; S.1.3.1.1. Compressed Natural Gas Used as an Engine Fuel; S.1.3.1.2. Liquefied Natural Gas Used as an Engine Fuel; S.5.2. Marking of Diesel and Gasoline Volume Equivalent Conversion Factor; Compressed Natural Gas, S.5.3. Marking of Diesel Volume Equivalent Conversion Factor; Liquefied Natural Gas, UR.3.1.1. Marking of Equivalent Conversion Factor for Compressed Natural Gas, UR.3.1.2. Marking of Equivalent Conversion Factor for Liquefied Natural Gas, and UR.3.8. Return of Product to Storage, Retail Compressed Natural Gas and Liquefied Natural Gas

(This item was Adopted.)

Source:

Clean Vehicle Education Foundation (2014)

Purpose:

Since natural gas is sold in the retail market place as compressed natural gas (CNG) and liquefied natural gas (LNG) as an alternative fuel to gasoline and diesel fuel, the proposed additions and edits to NIST Handbook 44 will provide definitions for volume units of CNG and LNG that are the approximate energy equivalents for diesel and/or gasoline gallons so that end users can readily compare cost and fuel economy. At present, only equivalents for gasoline are included in NIST Handbooks 44 and 130 for CNG as an engine fuel. The proposal also includes modifications to Appendix D relative to the sale of LNG and CNG.

Item Under Consideration:

Amend NIST Handbook 44 Appendix D to include the following new definition:

diesel gallon equivalent (DGE). – Diesel gallon equivalent (DGE) means 6.384 pounds of compressed natural gas or 6.059 pounds of liquefied natural gas. [3.37]

(Added 2016)

Amend NIST Handbook 44, Appendix D definitions as follows:

gasoline gallon equivalent (GGE). – Gasoline gallon equivalent (GGE) means 5.660 pounds of compressed natural gas. [3.37]

(Added 1994) (Amended 2016)

Delete the following NIST Handbook 44, Appendix D definition as shown:

~~**gasoline liter equivalent (GLE).**— **Gasoline liter equivalent (GLE) means 0.678 kilograms of natural gas.**
[3.37]
(Added 1994)~~

Amend NIST Handbook 44, Mass Flow Meters Code paragraphs S.1.2., S.1.3.1.1., S.5.2., and UR.3.8. and add new paragraphs S.1.3.1.2., S.5.3., UR.3.1.1., and UR.3.1.2. as follows:

S.1.2. Compressed Natural Gas and Liquefied Natural Gas Dispensers. – Except for fleet sales and other price contract sales, a compressed **or liquefied** natural gas dispenser used to refuel vehicles shall be of the computing type and shall indicate the quantity, the unit price, and the total price of each delivery. The dispenser shall display the mass measured for each transaction either continuously on an external or internal display accessible during the inspection and test of the dispenser, or display the quantity in mass units by using controls on the device.

(Added 1994) **(Amended 2016)**

S.1.3. Units.

S.1.3.1.1. Compressed Natural Gas Used as an Engine Fuel. – When compressed natural gas is dispensed as an engine fuel, the delivered quantity shall be indicated in **“gasoline liter equivalent (GLE) units” or “gasoline gallon equivalent (GGE) units” or diesel gallon equivalent units (DGE), or in mass.** (Also see Appendix D definitions.)

(Added 1994) **(Amended 2016)**

S.1.3.1.2. Liquefied Natural Gas Used as an Engine Fuel. – **When liquefied natural gas is dispensed as an engine fuel, the delivered quantity shall be indicated in diesel gallon equivalent units (DGE) or in mass. (Also see definitions.)**

(Added 2016)

S.5.2. Marking of Gasoline Volume Equivalent Conversion Factors for Compressed Natural Gas. – A device dispensing compressed natural gas shall have either the statement **“1 Gasoline Liter Equivalent (GLE) is Equal to 0.678 kg of Natural Gas” or “1 Gasoline Gallon Equivalent (GGE) is Equal means 5.660 lb of Compressed Natural Gas” or “1 Diesel Gallon Equivalent (DGE) means 6.384 lb of Compressed Natural Gas”** permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 1994) **(Amended 2016)**

S.5.3. Marking of Equivalent Conversion Factors for Liquefied Natural Gas. – **A device dispensing liquefied natural gas shall have the statement “1 Diesel Gallon Equivalent (DGE) means 6.059 lb of Liquefied Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.**

(Added 2016)

S.6. Printer. – When an assembly is equipped with means for printing the measured quantity, the following conditions apply:

- (a) the scale interval shall be the same as that of the indicator;
- (b) the value of the printed quantity shall be the same value as the indicated quantity;
- (c) **the printed quantity shall also include the mass value if mass is not the indicated quantity; [Nonretroactive as of January 1, 2021]**

(e d) a quantity for a delivery (other than an initial reference value) cannot be recorded until the measurement and delivery has been completed;

(d e) the printer is returned to zero when the resettable indicator is returned to zero; and

(e f) the printed values shall meet the requirements applicable to the indicated values.

(Amended 2016)

UR.3.1.1. Marking of Equivalent Conversion Factors for Compressed Natural Gas. – A device dispensing compressed natural gas shall have either the statement “1 Gasoline Gallon Equivalent (GGE) means 5.660 lb of Compressed Natural Gas” or “1 Diesel Gallon Equivalent (DGE) means 6.384 lb of Compressed Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 2016)

UR.3.1.2. Marking of Equivalent Conversion Factors for Liquefied Natural Gas. – A device dispensing liquefied natural gas shall have the statement “1 Diesel Gallon Equivalent (DGE) means 6.059 lb of Liquefied Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 2016)

UR.3.8. Return of Product to Storage, Retail Compressed and Liquefied Natural Gas Dispensers. – Provisions at the site shall be made for returning product to storage or disposing of the product in a safe and timely manner during or following testing operations. Such provisions may include return lines, or cylinders adequate in size and number to permit this procedure.

(Added 1998) **(Amended 2016)**

Background/Discussion:

A gasoline gallon equivalent (GGE) unit was defined by NCWM in 1994 to allow users of natural gas vehicles to readily compare costs and fuel economy of light-duty compressed natural gas vehicles with equivalent gasoline powered vehicles. More background on this work is available in the Reports of the 78th and 79th NCWM in NIST Special Publications 854 and 870 (see pages 322 and 327, respectively). Natural gas is sold as a vehicle fuel as either Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG). For medium and heavy duty natural gas vehicles in widespread use today, there is a need to officially define a unit allowing a comparison of cost and fuel economy with diesel powered vehicles. The submitter stated that the official definition of a DLE and a DGE will likely provide justification for California, Wisconsin, and many other states to permit retail sales of CNG for heavy-duty vehicles in these convenient units. The submitter has provided a mathematical justification for the specific quantity (mass) of compressed natural gas in a DLE and DGE, which is included in Appendix F.

See the Committee’s Final Reports from 2014 and 2015 to review previous language and positions to amend NIST Handbook 44, Mass Flow Meters Code to allow for the sale of natural gas used as an engine fuel by volume equivalent units of gasoline and diesel.

2016 NCWM Interim Meeting:

The Committee heard over a dozen comments on this item, many in support of the Item Under Consideration as written and some opposed. Many of the comments were similar to what had been heard by the Committee at prior meetings. Dr. Matthew Curran (Florida) raised concerns about the weights and measures community losing credibility if it can’t address this issue since exactly the same proposal was voted on and stalled in a tied vote at the last two NCWM annual meetings, and now states are beginning to use their own factors. The Internal Revenue Service was looking for the NCWM to address this issue last July, but since it again did not pass, they proceeded with their own values. The Southern Weights and Measures Association Voted on and put forth an alternate proposal (listed in NCWM Publication 15, page A-79) that added a requirement for mass to be displayed to the consumer simultaneously or in an alternating fashion with the gallon equivalent unit or via consumer controls on the dispenser to allow the consumer to choose to see the reading in either mass or volume equivalents. He further noted that the dispensers

already show readings in mass (only to the weights and measures official though) and volume equivalents so why not make them both visible to the consumer.

Mr. Randy Moses (Dresser Wayne), a CNG dispenser manufacturer, was opposed to the Florida proposal and said they were not likely going to dual displays, since this could be even more confusing to consumers. He also pointed out implications with point of sale systems. He supported the Item Under Consideration in NCWM Publication 15.

Mr. Ross Andersen (New York, retired) pointed out that an acceptable practice occurs when buyers and sellers agree on a method of sale, as is the case in the use of gallon equivalent units that have been accepted in the marketplace since 1994. Mr. Mike Sikula (New York) stated the State of New York supports the item.

Mr. Mahesh Albuquerque, (Colorado) supported the item as proposed. He mentioned that the State of Colorado had adopted method of sale regulations for retail natural gas in 2014 that were identical to the Item Under Consideration, and has been able to implement them effectively with no marketplace concerns. He urged the Conference to consider adopting the Item Under Consideration as presented in NCWM Publication 15. He did not support the alternative dual display proposal that was discussed at the SWMA.

Ms. Tina Butcher (NIST, OWM) raised technical concerns if commercial transactions were not in traceable units, which is in mass for CNG and LNG sales. The OWM also was concerned with the numerical values used in deriving the DGE and the DLE. She discussed the OWM comments included in NCWM Publication 15 and provided in OWM's technical analysis of the item for the Committee. She also noted that the SWMA proposal appears to provide a reasonable compromise, but encouraged the Committee to consider potential dispenser displays and ensure necessary requirements are included in the proposal that all information displayed to a customer would be clear and understandable.

Ms. Angela Godwin (Ventura County, California) opposed the item. She agreed with OWM's comments. Mr. Ron Hayes (Missouri) also opposed the item under consideration and supported the SWMA alternative proposal.

Mr. Jeff Clarke (NGV America) supported the Item Under Consideration and urged the Conference to move it forward. He mentioned several trade associations had also submitted letters of support to all regions. With regard to the alternate proposal discussed at the SWMA, he said it needed to be clear that the primary method of sale needs to be in equivalent units.

Ms. Paige Anderson (Sigma NACS) supported the item and stated her members had questions related to the SWMA's alternative proposal. Mr. Brett Barry (Clean Energy) supported the item as written.

After the open hearings, the S&T and L&R Committees met jointly to discuss all the CNG and LNG items on their respective agendas. In consideration of all of the comments heard, and at the suggestion of Mr. Ethan Bogren, the S&T Committee agreed to add a requirement to the Item Under Consideration that the mass value be included on the printed receipt, if not displayed on the dispenser. The Committee added a modification to paragraph S.6.(b) that would require printed receipts to include the equivalent mass value if mass is not the indicated quantity effective January 1, 2018.

2016 NCWM Annual Meeting:

The Committee heard numerous comments on this item, many in support of moving the Item Under Consideration forward as written or with some modification and some opposed. Some of the comments were similar to what had been heard by the Committee at prior meetings.

Mr. Jeff Clarke (NGV America) supported the item with a proposed modification. He stated that LNG is used in large trucks, and the DGE is more widely accepted nationally and accepted at the federal level for taxation purposes. Because of concerns related to POS capabilities, he suggested a change to the printed receipt that would include the conversion factor (instead of the mass value) and would allow a consumer to calculate the mass delivered. His suggested changes were included in his letter, which had been posted on the NCWM website. He urged adoption of this standard for consistency and requested the Conference to move it forward.

Mr. Randy Moses (Wayne), a CNG dispenser manufacturer, also raised concerns related to the printing GGE/DGE and mass units on receipt. He said to minimize consumer confusion the information displayed on the dispenser should be the same as what is on the printed receipt.

Ms. Tina Butcher (NIST, OWM) raised technical concerns if commercial transactions were not in traceable units, which is in mass for CNG and LNG sales. She also questioned the accuracy of the conversion factor.

Mr. Steve Harrington (Oregon) supported the proposal noting there needs to be consistency in the marketplace.

Dr. Matt Curran (Florida), speaking on behalf of FALS, expressed support for companion L&R Item 237-1.

Mr. Scott Simmons and Mr. Mahesh Albuquerque both of Colorado stated that Colorado had adopted the DGE for CNG and LNG in regulations back in 2014 and have had no consumer concerns since its adoption. Colorado recognizes the sale of CNG and LNG in mass or gallon equivalent units, and requires that the printed receipt include the same unit of sale as displayed on the dispenser.

Several other W&M officials including Ms. Julie Quinn (Minnesota), Mr. Joe Gomez (New Mexico), Mr. Mike Sikula (New York), Mr. Tim Chesser (Arkansas), Mr. Ethan Bogren (Westchester County, New York), and Dr. Curran also expressed support for the item and urged the Conference to move it forward as a Voting item. Dr. Curran further clarified the intent of his dual display proposal by stating that it basically shows the consumer the mass reading that weights and measures officials can already see now.

Mr. Ron Hayes (Missouri) and Ms. Angela Godwin (Ventura County, California) spoke in support of mass and the NIST proposal.

Several industry members, including Mr. Tim Columbus (Steptoe and Johnson, LLP), Mr. Mike Bailey (Bailey Enterprises, Inc.), Mr. Brett Barry (Clean Energy), Mr. Prentiss Searles (API), Mr. Russ Lewis (Marathon Petroleum Company), and Ms. Sherrie Merrow (NGV America) spoke in support of volume equivalents and Mr. Clarke's changes, and in moving the item forward.

The S&T Committee and L&R Committee met jointly during their work sessions to consider this item and companion L&R Items 232-8 and 237-1. There were quite a number of industry representatives, weights and measures officials, and others in attendance to witness, and, if requested by the committees, contribute to the discussions. In considering the comments from the open hearings, it was mentioned by a member of one of the committees that industry seemed somewhat opposed to providing the mass indication on the printed receipt. Members of the two committees then shared opinions on how best to proceed given industry's somewhat negative posture on this issue. There was general agreement that the current proposal represented a compromise of the two opposing sides with respect to the method of sale of natural gas. A committee member suggested, in an effort for the two committees to be able to present a proposal in which both sides of the MOS argument might agree, that additional time be granted for industry to comply with having to record the mass value on the printed receipt. Members of both committees liked the suggestion. Consequently, members of the S&T Committee agreed to change the formatting of paragraph S.6. Printer of the proposal that the portion of the paragraph requiring the mass value to be recorded be nonretroactive as of January 1, 2021. No additional changes were made to the proposal. The Committee then agreed to present the item, as shown in Item Under Consideration, for Vote.

Regional Association Comments:

The WWMA received testimony in support of this proposal from several regulators. One regulator gave testimony strongly opposing gallon equivalents. In addition, many stakeholders submitted written support for this item. One regulator noted that this issue needs to be addressed and resolved by the weights and measures community and should not be left up to other entities performing end-runs with state legislatures. The WWMA recommended that this be a Voting item.

The CWMA reported its members have been unable to come to a consensus as to whether the use of equivalency units is appropriate, but they believe that this proposal should be Voted on, on the basis of its merit. At both its 2015 Interim Meeting and 2016 Annual Meeting the CWMA recommended that this item be a Voting item.

NEWMA supported the item and recommended it be forwarded to NCWM as a Voting item at both its 2015 Interim Meeting and 2016 Annual Meeting.

At its fall 2015 Annual Meeting, the SWMA felt that a compromise version needed to be developed and forwarded because more votes for “mass” or “volume equivalents” would likely result in another failure to pass a method of sale and establish equivalencies for these products. Members of the SWMA S&T Committee also expressed concern that further delay could damage the future reputation of the Weights and Measures Community. Other agencies and states are now moving forward independently of the NCWM and, thus, lessening our relevance in the area of commerce one piece at a time. The SWMA believes that, while its recommended proposal may not completely satisfy all corners of this debate, it is the best overall compromise to date for all interested parties. The SWMA further noted that anyone opposing such a compromise version is more than welcome to provide an alternative. This proposal provides for the display of both “mass” and “volume equivalent” units and gives the dispenser manufacturers a future non-retroactive implementation date for installation so devices in service prior to the effective date would not have to be converted, only when replaced with new devices. The SWMA recommended the following compromise proposal as a Voting item:

Amend NIST Handbook 44, Appendix D to include the following new definition:

diesel gallon equivalent (DGE). – Diesel gallon equivalent (DGE) means 6.384 pounds of compressed natural gas or 6.059 pounds of liquefied natural gas. [3.37]

(Added 2016 2015)

Amend NIST Handbook 44, Appendix D definitions as follows:

gasoline gallon equivalent (GGE). – Gasoline gallon equivalent (GGE) means 5.660 pounds of **compressed** natural gas. [3.37]

(Added 1994) **(Amended 2016 2015)**

Delete the following NIST Handbook 44, Appendix D definition as shown:

~~**gasoline liter equivalent (GLE).**— Gasoline liter equivalent (GLE) means 0.678 kilograms of natural gas.[3.37]~~

~~**(Added 1994)**~~

Amend NIST Handbook 44, Mass Flow Meters Code paragraphs S.1.2., S.1.3.1.1., S.5.2., and UR.3.8. and add new paragraphs S.1.3.1.2., S.5.3., UR.3.1.1., and UR.3.1.2. as follows:

S.1.2. Compressed Natural Gas and Liquefied Natural Gas Dispensers. – Except for fleet sales and other price contract sales, a compressed **or liquefied** natural gas dispenser used to refuel vehicles shall be of the computing type and shall indicate the quantity, the unit price, and the total price of each delivery. The dispenser shall display the mass measured for each transaction either continuously on an external or internal display accessible during the inspection and test of the dispenser, or display the quantity in mass units by using controls on the device.

(Added 1994) **(Amended 2016 2015)**

S.1.3. Units.

S.1.3.1.1. Compressed Natural Gas Used as an Engine Fuel. – When compressed natural gas is dispensed as an engine fuel, the delivered quantity shall be indicated in ~~“gasoline liter equivalent (GLE) units” or “gasoline gallon equivalent (GGE) units”~~ **or diesel gallon equivalent units (DGE), and or in mass. Equivalent and mass units need not be displayed simultaneously, but may be displayed individually through customer activated controls.** (Also see Appendix D definitions.)

(Added 1994) **(Amended 2016 2015) (Nonretroactive as of January 1, 2020)**

S.1.3.1.2. Liquefied Natural Gas Used as an Engine Fuel. – When liquefied natural gas is dispensed as an engine fuel, the delivered quantity shall be indicated in diesel gallon equivalent units (DGE) and ~~or~~ in mass. Equivalent and mass units need not be displayed simultaneously, but may be displayed individually through customer activated controls. (Also see definitions.)

(Added 2016 ~~2015~~) (Nonretroactive as of January 1, 2020)

S.5.2. Marking of ~~Gasoline Volume~~ Equivalent Conversion Factors for Compressed Natural Gas. – A device dispensing compressed natural gas shall have either the statement “~~1 Gasoline Liter Equivalent (GLE) is Equal to 0.678 kg of Natural Gas~~” or “1 Gasoline Gallon Equivalent (GGE) is Equal means 5.660 lb of Compressed Natural Gas” or “1 Diesel Gallon Equivalent (DGE) means 6.384 lb of Compressed Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 1994) (Amended 2016 ~~2015~~)

S.5.3. Marking of Equivalent Conversion Factors for Liquefied Natural Gas. – A device dispensing liquefied natural gas shall have the statement “1 Diesel Gallon Equivalent (DGE) means 6.059 lb of Liquefied Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Amended 2016 ~~2015~~)

UR.3.1.1. Marking of Equivalent Conversion Factors for Compressed Natural Gas. – A device dispensing compressed natural gas shall have either the statement “1 Gasoline Gallon Equivalent (GGE) means 5.660 lb of Compressed Natural Gas” or “1 Diesel Gallon Equivalent (DGE) means 6.384 lb of Compressed Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 2016 ~~2015~~)

UR.3.1.2. Marking of Equivalent Conversion Factors for Liquefied Natural Gas. – A device dispensing liquefied natural gas shall have the statement “1 Diesel Gallon Equivalent (DGE) means 6.059 lb of Liquefied Natural Gas” permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

(Added 2016 ~~2015~~)

UR.3.8. Return of Product to Storage, Retail Compressed and Liquefied Natural Gas Dispensers. – Provisions at the site shall be made for returning product to storage or disposing of the product in a safe and timely manner during or following testing operations. Such provisions may include return lines, or cylinders adequate in size and number to permit this procedure.

(Added 1998) (Amended 2016 ~~2015~~)

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

337-3 D N.3. Test Drafts.

Source:

Endress + Hauser Flowtec AG USA (2015)

Purpose:

Allow transfer standard meters to be used to test and place into service dispensers and delivery system flow meters.

Item under Consideration:

Amend NIST Handbook 44, Mass Flow Meters Code as follows:

N.3. Test Drafts.

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

(Amended 1982 ~~and 20XX~~)

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

(Added 20XX)

Background/Discussion:

The use of transfer standards is recognized in code Sections 3.34. Cryogenic Liquid-Measuring Devices Code and 3.38. Carbon Dioxide Liquid-Measuring Devices Code, and 3.39. Hydrogen Gas-Measuring Devices – Tentative Code. Field evaluation of LPG meters and CNG dispensers and LNG dispensers is very difficult using volumetric and gravimetric field standards and methods. The tolerances for these applications are such that using transfer meter standards are more efficient and safer. With CNG and LNG and LPG applications, the transfer standard meters are placed in-line with the delivery system as it is used to fill tanks and vehicles. The use of transfer standards eliminates return to storage issues and is easier and faster compared to the use of traditional field standards. The cost of using transfer standards and transporting them is much less than the cost of traditional field provers and standards. Recognition in NIST Handbook 44 will enable states to allow transfer standard meters to place systems into service and for field enforcement.

Volumetric field provers and gravimetric field proving are susceptible to environmental influences. The State of Colorado uses a master meter to test propane delivery truck meters. The State of Nebraska has used a mass flow meter to test agricultural chemical meters.

In some applications, transfer standard meters are not more accurate than the meters used in the dispenser. For that reason, longer test drafts and possibly more tests need to be run.

The State of California is purported to have conducted a short study of master meters in the past. The conclusion did not lead to wide adoption of the practice; however, the State of California uses a mass flow meter as a master meter for carbon dioxide flowmeter enforcement.

Mass Flow Meters Code paragraph U.R.3.8. Return of Product to Storage, Retail Compressed Natural Gas Dispensers requires that the natural gas which is delivered into the test container must be returned to storage. This is difficult and most often not complied with when the test vessel contents are released to atmosphere.

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

See the 2015 S&T Committee's Annual Report (in NIST SP 1210) for additional background information and to review previous language and positions on this proposal.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped Items 332-5 and 337-3 together and comments were taken simultaneously on these two items. See Item 332-5 for a summary of the comments received during the Committee's open hearings and the Committee's discussions and considerations concerning these two items. Based on the comments received during the open hearings, the Committee agreed to present both items for Vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee grouped Items 332-5 and 337-3 together and comments were taken simultaneously on these two items. See Agenda Item 332-5 for a summary of comments heard on these two

items. In consideration of the comments received, the Committee, by Vote of its majority members, agreed to downgrade the status of these two items to Developing and return them to the submitter.

Regional Association Comments:

The WWMA did not receive any comments on this item its 2015 Annual Meeting. The WWMA sees possible merit in the proposal, but believes that refinements and more test data are needed before further consideration can be given to this item and recommended that this item remain as a Developing item.

At its fall 2015 Interim Meeting, the CWMA reported it believes the type of meter that could be considered appropriate for use as a transfer standard meter needs to be further defined. At its spring 2016 Annual Meeting, the CWMA reported it feels this item has merit and the comments received were in support of the use of transfer standards once the proper procedures have been developed to insure accuracy, traceability, and suitability. The CWMA recommended the status of the item be Developing at both meetings.

At its fall 2015 Interim Meeting, NEWMA recommended that this item remain as a Developing item. At its 2016 Annual Meeting, NEWMA recommended an Information status be assigned to this item and reported it feels there is not enough data to support the item at this time.

At its fall 2015 Annual Meeting, the SWMA batched this item with Item 332-5 and heard them together. The SWMA recommends that these items be Voting items.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

338 CARBON DIOXIDE LIQUID-MEASURING DEVICES

338-1 V Table S.2.5. Categories of Sealing and Methods of Sealing (See Related Items 331-2, 332-4, 334-1, 335-1, 337-1, and 339-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item under Consideration:

Amend NIST Handbook 44, Carbon Dioxide Liquid-Measuring Devices Code as follows:

<i>Table S.2.5. Categories of Device and Methods of Sealing</i>	
<i>Categories of Device</i>	<i>Methods of Sealing</i>
<i>Category 1: No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
<i>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.</i>	<i>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.</i>
<i>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.</i>	<i>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 <u>on demand</u> through the device or through another on-site device. <u>The information may also be available electronically.</u> 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.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) (**Amended 2016**)

Background/Discussion:

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search than the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See Item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for Vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See agenda Item

331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to the NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1 and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

338-2 V S.3.1. Vapor Elimination

(This item was Adopted.)

Source:

NIST Office of Weights and Measures (2016)

Purpose:

1. To require that the vapor eliminator on carbon dioxide liquid-measuring devices be automatic in operation;
2. To edit the vapor eliminator requirements to ensure clarity and consistency with other measuring codes; and
3. To require that vapor elimination vent lines be made of a non-collapsible material.

Item under Consideration:

Amend NIST Handbook 44, Carbon Dioxide Liquid-Measuring Devices Code as follows:

S.2.1. Vapor Elimination.

(a) A measuring system device shall be equipped with an effective automatic vapor eliminator or other effective means to prevent the measurement passage of vapor ~~that will cause errors in excess of the applicable tolerances~~ through the meter.

(b) Vent lines from the vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 2016)

Background/Discussion:

The proposed changes to S.2.1. would clarify that the carbon dioxide liquid-measuring device's vapor eliminator must be automatic in operation and prevent both air and vapor from passing through the meter. Effective operation should not depend on operator intervention or action. Additionally, the proposed changes would require that the vent lines be made of material that resists the potential obstruction (e.g., bending or kinking) that may otherwise prevent the free-flow of air and vapor out of the metering system. Non-rigid vent lines would facilitate fraud and may lead to improper operation of the air/vapor elimination system. These modifications would more closely align the requirements with corresponding requirements in the Liquid-Measuring Devices, Vehicle-Tank Meters, Cryogenic Liquid-Measuring Devices, Milk Meters, and Mass Flow Meters Codes.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting open hearings, the Committee grouped Items 332-3 and 338-2 together and took comments simultaneously on these items. See Item 332-2 for a summary of the comments received during the open

hearings on these two items. Based on the comments received during the open hearings, the Committee agreed to amend the proposal as shown in Item Under Consideration and present it for Vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee grouped together Items 332-3 and 338-2 and comments were taken simultaneously since the Committee considered them companion items. See Item 332-2 for a summary of the comments received and the actions taken by the Committee on these two items.

Regional Association Comments:

The WWMA's S&T Committee did not receive comments on this item during the open hearings of the WWMA's 2015 Annual Meeting. During Committee discussions, the WWMA S&T Committee agreed that this proposal contains clean-up language to align this section with other codes in NIST Handbook 44. The Committee also noted, as it did during its discussions on Item 332-3, that the requirement that the vent lines be constructed of rigid materials is important. The WWMA believes this item is fully developed and forwarded it to NCWM, recommending that it be a Voting item.

At its fall 2015 Interim Meeting, the CWMA requested that the terminology be reviewed for technical reasons specifically the inclusion of the term "air." The CWMA forwarded the item to NCWM and recommended that it be a Voting item at both its 2015 Interim Meeting and 2016 Annual Meeting.

NEWMA commented, at its 2015 Interim Meeting, that the original language in NIST Handbook 44 is appropriate since air should not be present in a pressurized system. NEWMA recommended this item be Withdrawn. However, at its 2016 Annual Meeting, NEWMA recommended the item be forwarded to the NCWM as a Voting item.

At its fall 2015 Annual Meeting, the SWMA batched this item with Item 332-3 and head them together. The SWMA recommends this new language based on comments received. The SWMA forwarded the items to NCWM and recommended that they be Voting items.

339 HYDROGEN GAS-METERING DEVICES

339-1 V Table S.3.3. Categories of Sealing and Methods of Sealing (See Related Items 3312, 3324, 3341, 3351, 337-1, and 338-1)

(This item was Adopted.)

Source:

Gilbarco, Inc. (2016)

Purpose:

Allow a Category 3 event logger to have an electronic means to transfer the event logger information.

Item Under Consideration:

Amend NIST Handbook 44, Hydrogen Gas-Measuring Devices Code as follows:

Table S.3.3. Categories of Device and Methods of Sealing	
Categories of Device	Methods of Sealing
Category 1: <i>No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
Category 2: <i>Remote configuration capability, but access is controlled by physical hardware.</i> <i>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.</i>	<i>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.</i>
Category 3: <i>Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</i> <i>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.</i>	<i>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.)</i>

(Amended 2016)**Background/Discussion:**

This amendment and similar proposals to amend other codes in Section 3 of NIST Handbook 44 would provide the same requirements for Category 3 event loggers as was adopted for the 3.30. Liquid Measuring Devices Code at the 2015 NCWM Annual Meeting. Event logger information in an electronic format is easier to sort and search the traditional paper format.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and comments were taken simultaneously on these items since they are considered companion items. See Item 331-2 for a summary of the comments received by the Committee on these items.

The Committee agreed that these proposals would harmonize the language for sealing Category 3 devices in each of these metering codes and, consequently, agreed to recommend each item for Vote.

2016 NCWM Annual Meeting:

At the Committee's 2016 NCWM Annual Meeting open hearings, the Committee grouped together agenda Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and took comments simultaneously on these items. See agenda Item 331-2 for a summary of the comments received on these items during the Committee's open hearings and the resulting actions taken by the Committee on these items.

Regional Association Comments:

The CWMA reported, at its spring 2016 meeting, that no comments were heard on this item and recommended it be forwarded to the NCWM as a Voting item.

NEWMA agrees that these proposals would harmonize the language for sealing Category 3 devices in the codes addressed by each of these Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1. At both its 2015 and 2016 Annual Meetings, NEWMA recommended these be forwarded to the NCWM as Voting items.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 331-2, 332-4, 334-1, 335-1, 337-1, 338-1, and 339-1 and all items were heard together. The SWMA agrees with adding this language and harmonizing it with the LMD Code and recommended to the NCWM that they be Voting items.

339-2 V Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas-Measuring Devices.

(This item was Adopted.)

Source:

California (2016)

Purpose:

Temporarily broaden tolerances to reflect the actual capability of the devices.

Item under Consideration:

Amend NIST Handbook 44, Hydrogen Gas-Measuring Devices Code as follows:

Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas-Measuring Devices			
Accuracy Class	Application or Commodity Being Measured	Acceptance Tolerance	Maintenance Tolerance
<u>2.0</u> <u>7.0</u>	Hydrogen gas as a vehicle fuel	<u>1.5 %</u> <u>5.0 %</u>	<u>2.0 %</u> <u>7.0 %</u>

(Amended 2016)

Background/Discussion:

The NIST Handbook 44 accuracy tolerances (1.5 % acceptance tolerance and 2.0 % maintenance tolerance) are currently not achievable by manufacturers of hydrogen dispensers.

Between 2009 and 2013, several manufacturers applied to the California Type Evaluation Program (CTEP) for approval of their hydrogen dispensers but none were able to successfully pass type evaluation with the existing NIST Handbook 44 tolerances. To overcome this, California promulgated regulations in 2014 to temporarily relax the accuracy tolerances found in NIST Handbook 44. Since that time, there have been three manufacturers who have successfully completed type evaluation of their hydrogen gas-measuring devices under the new regulations. Unless the accuracy tolerances of Section 3.39. are temporarily widened, other states will face the same dilemma experienced by California, and NTEP will not be able to issue Provisional Certificates allowing the commercial use of these devices.

A statement in the 2012 U.S. Department of Energy's Request for Information regarding hydrogen gas-measuring devices summarizes the current dilemma quite well:

In order to enable the commercialization of hydrogen, fueling equipment that meets measurement standards must be available to sell hydrogen fuel to the public by weight or volume. Based on available information, no commercially available devices are capable of meeting the National Institute of Standards and

Technology's (NIST's) NIST Handbook 44 measurement accuracy requirements for hydrogen while being used under fueling conditions....

It is recognized that error-free, perfect performance of mechanical equipment is unattainable. Accuracy tolerances are established to fix the legal range of accuracy within which equipment will be officially approved for commercial use. Tolerance values should be sufficiently small so that no serious injury to either the buyer or seller occurs. Consumers (and hydrogen fueling station owners) will be impacted by the proposed amendments, which would temporarily relax the accuracy tolerances from $\pm 2\%$ to $\pm 10\%$.

However, it is important to balance consumer protection with the equipment currently available for use. In order to commercialize FCEV and allow the legal sale of hydrogen in the United States, it is necessary to set accuracy tolerances that can be achieved at this time. There is only one Coriolis mass flow meter make and model available for purchase today by manufacturers wishing to build a commercial hydrogen gas-measuring device. When hydrogen fuel cell vehicles gain consumer acceptance and a profitable business model exists for equipment manufacturers, it is anticipated that companies will expend the research and development dollars to develop more accurate meters.

Sunset dates (2018 for installation of Accuracy Class 10.0 devices and 2020 for installation of Accuracy Classes 3.0 and 5.0 devices) are included to make clear that these relaxed tolerances are temporary. As technology advances and more accurate devices can be built, hydrogen gas-measuring devices will move into a more accurate or "better" accuracy class. Sunset dates also obligate the NCWM or the NIST-led USNWG for the Commercial Development of Hydrogen Measurement Standards to conduct a review of the accuracy tolerances as more data becomes available.

Hydrogen dispensers being tested today by the California Division of Measurement Standards are able to meet the expanded tolerances. Most, but not all, manufacturers have equipment that can achieve at least Accuracy Class 5.0. A summary of California's test data will be made available by January 2016 at the NCWM Interim Meeting.

In most states within the United States, the transportation sector is the biggest contributor to air pollutants, including greenhouse gas emissions. To improve air quality, states like California are attempting to facilitate the commercialization of Zero Emission Vehicles (ZEV), which include hydrogen-powered fuel cell vehicles (FCEV). However, the commercialization of hydrogen fueling stations is one of the biggest critical barriers preventing the widespread market penetration of hydrogen-fueled vehicles, and the current NIST Handbook 44 tolerances for hydrogen dispensers are too restrictive.

The inability of manufacturers to comply with current NIST Handbook 44 tolerances is partly due to potential hydrogen embrittlement of the tanks, a safety concern since the service pressures at which hydrogen is dispensed are very high (35 mPA and 70 mPA, or 5000 psi and 10 000 psi, respectively).

The Governors of eight states (California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island and Vermont) signed a Memorandum of Understanding in 2013 to put 3.3 million zero-emission vehicles on roads by 2025; 15 % of new vehicle sales. Car manufacturers are launching hydrogen-powered FCEV vehicles in California today, with statements that their next steps are to establish an East Coast Hydrogen Highway in states surrounding the New York and Boston regions, specifically, New York, New Jersey, Massachusetts, Connecticut, and Rhode Island.

2016 NCWM Interim Meeting:

During the Committee's 2016 NCWM Interim Meeting open hearings, Mr. Kevin Schnepf (California) provided an explanation of the basis for the submission of this item and recommended it move forward with a Voting status. Further, he requested that NIST reconvene the USNWG for hydrogen measurement standards to assign tolerances to the different classes.

Ms. Tina Butcher (NIST, OWM) stated NIST OWM supports expanding the tolerances if current equipment is unable to comply, but doesn't believe multiple tolerances for the same device are appropriate. If multiple tolerances are provided, there would be no incentive for companies to strive to improve accuracy of their equipment. Additionally, four different sets of tolerances for the same application would tend to create unfair competition amongst equipment manufacturers and the refueling station businesses.

Ms. Butcher noted that multiple tolerances frustrate value comparison. She asked everyone to consider two dispensers located at competing businesses; the first having a 10 % accuracy classification and set to compute at a lower unit price and the second dispenser, which has an accuracy classification of 5 % and set to compute at a higher unit price. How is a customer to determine which offers the better value? Ms. Butcher indicated that it is unnecessary to offer larger tolerances than the smallest tolerance that can be reasonably achieved. It isn't advisable to collect data and set tolerances based on the lowest common denominator, but rather, consider what most equipment can reasonably achieve. Ms. Butcher suggested that if equipment cannot meet the current 2 % maintenance/1.5 % acceptance tolerance, why not propose a single tolerance structure that can be met, (e.g., 5 % maintenance/3 % acceptance) providing it is agreed that such tolerances won't cause serious injury?

Ms. Butcher further noted that the proposal refers to the dates provided in footnote 1 and footnote 2 as "sunset" dates. OWM views these as phase-in dates; not sunset dates. There are no phase-out dates provided in the proposal. A 10.0 Accuracy Class device installed today could still be in use 25 years (or more) provided it continues to comply with NIST Handbook 44.

Ms. Kristin Macey (California) commented that she would appreciate the opportunity to share with everyone the data collected by California. She further indicated that the data is from "real world" testing and that she knew of no other meters in existence, other than those that had been tested in California.

Mr. Mike Sikula (New York), Mr. Mahesh Albuquerque (Colorado), Mr. Dwight Zuck (Air Liquide Advanced Technology), Mr. Ron Hasemeyer (Alameda County, California), and Mr. Charlie Myers (U.S. Department of Energy) supported the proposal.

Mr. Michael Keilty (Endress + Hauser Flowtec) recommended this remain a Developing item as he was concerned that the larger tolerances proposed are not appropriate for commercial metering, but rather intended for equipment used in a monitoring application. He felt the proposal would allow sub-standard systems to enter the market as opposed to requiring these systems to be updated. Mr. Kevin Schnepf (California) followed up by adding that the California test data was acquired from recently installed devices, as opposed to older devices, and that all of the meters tested use mass-flow meter technology. Mr. Dmitri Karimov (Liquid Controls) expressed concern over multiple tolerances for a single device and asked if this was deemed appropriate for these devices, why not for others as well?

In response to several comments regarding multiple tolerances for a single device, Mr. Mahesh Albuquerque (S&T Chair) suggested adding only the 10.0 accuracy class for use until January 1, 2020, after which all hydrogen measuring devices would need to comply with the requirements of the existing 2.0 accuracy class. This would give industry time to design equipment to meet the requirements of the 2.0 accuracy class. Mr. Kevin Schnepf (California), Mr. Charlie Myers (U.S. Department of Energy), and Mr. Dwight Zuck (Air Liquide Advanced Technology) recommended a 10 % tolerance if one had to be chosen.

During its work session, the Committee elected to amend the proposal to include the 10.0 accuracy class with 5 % and 10 % acceptance and maintenance tolerances, respectively with a sunset date of January 1, 2020, after which all hydrogen measuring devices would need to comply with the requirements of the 2.0 accuracy class. Further, the Committee also elected to delete footnote 1 and edit and renumber footnote 2 as footnote 1. The Committee agreed to present the item for Vote at the Annual Meeting. The changes agreed to by the Committee are reflected in the Item Under Consideration.

2016 NCWM Annual Meeting:

During the open hearings, Ms. Kristin Macey (California) spoke in favor of amending the accuracy classes and tolerances in the tentative code. She indicated data collected by California shows that existing devices in the marketplace cannot meet the tolerances in the current tentative code, supporting the necessity for changes to Table T.2 to broaden the tolerances. California has collected data for acceptance tolerance, but not maintenance tolerance. In response to comments to downgrade the item to Information until additional data was available, Ms. Macey recommended the Committee strike out accuracy class 2.0 and move the item forward. She also indicated that she was not opposed to a single accuracy class with 5 % and 7 % acceptance and maintenance tolerances, respectively.

Ms. Tina Butcher (NIST, OWM) expressed concern with the 10 % tolerance; saying that OWM believes it is too large. She supported eliminating the tighter tolerance of 1.5 % and 2.0%, and suggested that dispensers seem to be able to

meet 4 % or 5 %. She was in favor of a single accuracy class (though not at a level of 10 %) and said that multiple tolerances frustrate consumers and do not promote industry competition. She also noted that “phase in” or “sunset” dates might allow the perpetuation of equipment in the marketplace with multiple tolerance levels. Ms. Butcher also was not sure whether NTEP would evaluate devices under a tentative code. She recommended changing the status of the item to Informational to allow time to gather more data.

Mr. Michael Keilty (Endress + Hauser Flowtec) reported that he had participated in the Hydrogen Work Group teleconference and stated that the number of devices tested thus far is only 15, which is a small number. He said the real data showed tolerances more like 4 % on acceptance and 6 % on maintenance. He agreed with Ms. Butcher’s comments that multiple tolerances are confusing. He, too, recommended the status of the item be changed to Informational.

Mr. Mike Sikula (New York) encouraged changes be made to recognize larger tolerances.

Mr. Dmitri Karimov (Liquid Controls), speaking on behalf of the MMA, recommended the status of the item be changed to Informational and commented that having two tolerances for the same application is confusing.

Mr. Mahesh Albuquerque (Colorado) stated that Colorado recently adopted rules for hydrogen measurement and he supports the proposed changes to the tentative code. He didn’t believe the two tolerances with the associated sunset date was a problem.

Mr. Jim Truex (NTEP) provided clarification that NTEP does not make decisions as to whether to evaluate a device; it has to come from NIST Handbook 44. NTEP will issue a provisional certificate if stated in a tentative code.

During its work session, the Committee agreed to amend the proposal as shown in Item Under Consideration based on comments received during the open hearings.

Regional Association Comments:

At its 2016 Annual Meeting, the CWMA indicated, based on the fact that this item includes an expiration date of January 1, 2020, it recommends this as a Voting item to allow further data gathering and further development of infrastructure related to Hydrogen fuel and to allow meters to be developed that are capable of greater accuracy.

NEWMA commented, at its 2015 Interim Meeting, that tolerances must allow for the current inaccuracies due to high changing pressures and varying temperatures in order to prevent holding back the advancement of technology. NEWMA forwarded the item to the NCWM, recommending it as a Voting item. At its 2016 Annual Meeting, NEWMA commented the Hydrogen Gas-Measuring Devices Code is a tentative code and these changes are appropriate while additional test data is being collected.

The SWMA S&T Committee commented that it understands and appreciates the intent of the proposal, but there were several concerns elevated during the open hearings and, thus, the item needs further development. The SWMA encourages NIST to work with the submitter to develop this item. The SWMA forwarded the item to the NCWM and recommended that it be a Developing item.

354 TAXIMETERS

354-1 V S.1.2. Advancement of Indicating Elements.

(This item was Adopted.)

Source:

NIST USNWG on Taximeters (2015)

Purpose:

To recognize that: (1) when the use of flat rates or negotiated rates are permitted as passenger charges, the entry of a flat rate or negotiated rate must result in that charge being displayed on the primary indicating element and, if applicable, through the recording element; and (2) at the time a transaction has been completed, there shall be no further advancement of indicated customer charges.

Item under Consideration:

Amend NIST Handbook 44, Taximeter Code as follows:

A.2. Exceptions. – This code does not apply to:

(a) Odometers ~~odometers~~ on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Devices that only display a flat rate or negotiated rate.

(Amended 1977 **and 2016**)

S.1.2. Advancement of Indicating Elements. – Except when a taximeter is being cleared, the primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or by the time mechanism.

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]

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**)

Background/Discussion:

This amended proposal is a follow-up to a proposal that was submitted for consideration during the previous cycle (2014 - 2015) of regional weights and measures association meetings. That proposal was subsequently listed on the 2015 NCWM Annual Meeting agenda as a Voting item; however, during that meeting it was requested that the status be changed to Informational to allow for further development by the USNWG on Taximeters. The S&T Committee honored that request, and the status was changed to Informational. This item has been revised by the USNWG and is now being re-submitted with a recommendation from the work group that it be considered as a Voting item.

The use of non-incrementing (fixed amount) customer charges resulting from the application of a flat or negotiated rate in some jurisdictions is not addressed in NIST Handbook 44 Taximeters Code requirements. Where the use of this type of charge is permitted, those customer charges will normally be displayed on the primary indicating element in the display area reserved for “fare.” The customer charge based on these particular types of rates do not align with the definition found in NIST Handbook 44, Appendix D for “fare” because the charge is not based on distance traveled or time elapsed. Some confusion over the interpretation of the existing requirement has been reported to the USNWG on Taximeters due to the use of flat rates and the resulting passenger charges being displayed by the taximeter in a display area reserved for “fare.” The charge to the passenger resulting from the use of a flat or negotiated rate, when

entered, will cause the indicating element to change from zero or a no-charge to the amount that is associated with the flat or negotiated rate. This change from no charge to the value of the flat/negotiated rate has been interpreted by some as an advancement of the indicating elements. To account for this change in the displayed amount, the amendments shown above are being proposed by the USNWG on Taximeters.

Additionally, it was reported to the USNWG on Taximeters that during the type evaluation of a particular taximeter system, an advancement of the indicating element was observed after the passenger charges had been totaled and a receipt was printed. The members of the USNWG on Taximeters have determined that the indication of passenger charges should not continue to advance after the completion of a transaction and before the taximeter has been cleared of that transaction's data. Because there is no current requirement that addresses this advancement of indications after the completion of a transaction, the proposed amendment as shown is being recommended by the USNWG.

A number of jurisdictions are reportedly allowing the use of flat (fixed) rates to assess passenger charges for frequently traveled routes such as those trips between hotel/business districts and nearby airports. Some jurisdictions are also permitting the use of a negotiated rate that results in a passenger being charged by an amount that has been agreed upon by the passenger and driver. While these types of charges are not a product of calculations made by a commercial measuring device, taxicab owners/operators benefit from having those charges processed through a taximeter for documentation of vehicle use, revenue verification, invoicing, etc. In those cases, the flat/negotiated charges are to be entered into the taximeter and displayed by that commercial measuring device. For that reason, the USNWG believes that it is appropriate to recognize this practice and to regulate how those passenger charges appear and are displayed on the device. The requirement to have those fixed amounts displayed on the primary indicator and through the recording element will provide the passenger with a visual display of the charges assessed.

See the Committee's 2015 Annual Report for additional background information and to review previous language and positions to amend NIST Handbook 44, Taximeters Code.

2016 NCWM Interim Meeting:

At the its 2016 NCWM Interim Meeting open hearings, the Committee agreed to group together agenda Items 354-1, 354-2, 354-3, and 354-4 and take comments simultaneously on these items.

Mr. Ross Andersen (New York, retired) indicated that with respect to Item 354-1, he supported adding the "Note," but recommended deleting the proposed sentence, "No advancement of fare, extras, or other ... issued." He stated that if an operator prints a receipt, it must cause the transaction to clear.

Mr. John Barton (OWM/NIST Technical Advisor to the USNWG on Taximeters) reported that Item 354-1 is a carry-over item from the 2015 NCWM Annual Meeting during which the item's status was downgraded from Voting to Informational to allow the WG an opportunity to further revise the proposal to address concerns regarding the use of the terms "fare" and "flat rate" in the proposal.

Mr. Barton noted that the use of "flat rates" is permitted by some jurisdictions as the non-incrementing fares charged in specific instances where a flat rate would be used instead of a fare that does increment based on time elapsed and/or distance traveled. A "flat rate" does not meet the definition of "fare" in NIST Handbook 44, Appendix D, which specifies that "fare" is a charge based on time and/or distance measurement and is automatically calculated by the taximeter rather than manually entered. While a flat rate charge is not considered a fare, when used in a jurisdiction that permits it, the flat rate amount is most often displayed by a taximeter in the area designated "fare." If not for the display of a customer charge in the form of a flat rate on the indicating element (taximeter), the use of flat rates might not be considered a weights and measures concern. However, since flat rate charges are presented to the customer via taximeter, they become an integral element of a commercial transaction involving a measuring device.

When a trip/transaction is initiated that will be based upon a flat rate, the appropriate control is used to input a passenger charge based on the flat rate. This may include use of a keypad on the taximeter or a button that has been programmed to offer a selection representing a particular flat rate. When this input is made, the display on the taximeter changes from a zero fare to the monetary amount associated with that particular flat rate. Some may view this change as an advancement of indications. The USNWG, in its revision of the proposal, added a new "Note" to paragraph S.1.2. Advancement of Indicating Elements, which is intended to address this scenario.

The USNWG on Taximeters also agreed to recommend an additional change to paragraph S.1.2. Advancement of Indicating Elements in Item 354-1 based on a report to that group by one of its members. It was reported that an NTEP evaluator was able to restart the advancement of passenger charges on a taximeter system following the generation of a printed receipt without having to first clear the transaction. In considering this issue, the USNWG agreed that the generation of a passenger receipt by a taximeter system should result in the system concluding that transaction and that any subsequent transaction should not begin until the taximeter has been cleared. The USNWG agreed to propose adding a new sentence to the paragraph clarifying that no advancement of charges is permitted beyond the conclusion of a transaction (which may include a receipt being issued).

Mr. Barton provided a handout of the proposal to the Committee (as revised by the USNWG on Taximeters) and noted that the USNWG is recommending it as a Voting item in 2016 along with the other three items in this group.

Dr. Matthew Curran (Florida) asked Mr. Barton if the USNWG had considered the changes proposed by the SWMA at its 2015 Annual Meeting. Mr. Barton indicated that the USNWG had not convened since the SWMA meeting and, therefore, members had not yet had the opportunity to consider those changes.

Ms. Jo Rausen (New York City Taxi and Limousine Commission) indicated that she supported all of the taximeter items.

During its work session, the Committee discussed the need to amend the Application Section of the Taximeters Code to make clear that the code is not intended to apply to entities that only charge a flat rate or negotiated rate (e.g., some hotel shuttles, etc.) as was proposed by the SWMA during its 2015 Annual Meeting for agenda Items 354-1 and 354-4. One member of the Committee indicated that the changes proposed in Items 354-1 and 354-4 could lead some officials to believe that a shuttle van, for example, would be required to have a taximeter installed even if all charges to customers were by a flat or negotiated rate. It was for this reason that the SWMA had recommended paragraph A.2. Exceptions be amended to include entities that only charge a flat or negotiated rate and the amended paragraph then added to the proposals under these two agenda items. Although some Committee members didn't believe it was necessary to amend the Application Section to include such an exception, everyone agreed there would be no harm in doing so since such a change would only make the application of the code clearer. Thus, the Committee agreed to amend the proposals in agenda Items 354-1 and 354-4 to include paragraph A.2. of the Code with the suggested changes proposed by the SWMA included as shown in Item Under Consideration for these two agenda items. The Committee also agreed to revise the proposal under agenda Item 354-1 as recommended by the USNWG and as shown in the Item Under Consideration and agreed to present all four items for Vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee grouped together agenda Items 354-1 through 354-4 and comments were taken for all four items simultaneously. Mr. John Barton (NIST, OWM), chairman of the USNWG on taximeters, spoke first and indicated that the USNWG on taximeters supports all four items (agenda Items 354-1 through 354-4).

Mr. Barton stated that the USNWG does not see the need to add an exemption to the Application Section of the Taximeters Code as proposed in agenda Items 354-1 and 354-4 and voiced concern regarding use of the word "rate" in the proposed exemption language.

A representative from Florida noted that the exemption language referenced by Mr. Barton was in fact necessary to clarify the code did not apply to services in which customers are charged solely by flat fee or a fixed negotiated fee. Concern was expressed that without this clarification those businesses may inadvertently be brought into this regulation. Further, the representative stated that since the USNWG clarified the intent was not to bring these businesses into this regulation, it would only be prudent to clarify that intent and avoid unintended consequences down the road. The representative also noted that he had no objection to changing the wording in the exemption proposed.

With respect to the "Note" proposed for addition in paragraph S.1.2. of agenda Item 354-1, Mr. Barton stated that the proposed addition of an explanatory "note" clarifies that the input of a fixed, non-incrementing fare may be considered as an advancement of indications by some, but when flat or negotiated rates are used, the initial charge entered is not permitted to advance further. He recommended that this paragraph delete the designation of "note" and be reformatted simply as a supporting paragraph in the requirement.

Mr. Barton also stated that he interpreted the intent of the addition of the second paragraph in Item 354-1 to prohibit the advancement of customer charges following the conclusion of a transaction and until that transaction has been cleared from the taximeter. The rationale for this proposed change was provided by an NTEP evaluator who reported to the USNWG on an experience that occurred during a type evaluation of a taximeter system. During that evaluation, the accrual of indicated charges was momentarily stopped by the evaluator and a receipt containing the totalized charges was issued. Following the printing of the receipt, the evaluator was able to continue to add to the totalized customer charges by advancing the taximeter register without clearing the previous transaction. Mr. Barton recommended adding the statement “after payment is settled” within the parentheses in the second paragraph of the proposal to help convey that the transaction has indeed been concluded. Further, Mr. Barton stated he considers a transaction to be ended once the actions described in the second paragraph of the proposal have been performed. Provided that these actions have been performed, it should not be necessary to activate any further controls on a device to bring the current transaction to an end. Advancement of the indicating elements would then be permitted to occur following the taximeter being cleared as is stated in the proposal. Mr. Barton stated that he believed that taximeters not equipped with a recording element should not be affected by the proposed changes considering that only taximeters manufactured and placed into service on or after to January 1, 2016, are required to be equipped with a recording element. Considering that only taximeters manufactured and placed into service as of January 1, 2016, are required to be equipped with a recording element (in accordance with paragraph S.1.1.1. Recording Elements in NIST, Handbook 44, Section 5.54.), he recommended this portion/paragraph of the proposal should be made nonretroactive and enforceable as of January 1, 2017.

Mr. Ross Andersen (New York, Retired) stated that he agreed with the representative from Florida’s comments concerning the exemption proposed in agenda Items 354-1 and 354-4. Mr. Andersen, speaking to agenda Item 354-1, asked the question “How does the taximeter know when the button was pushed the last time (to total the transaction)?” He noted that that the printed ticket has to be available as soon as the taxi was hired so, “How does it know this?” Mr. Andersen added that when using a credit card swiping device, “How does the taxi meter know if a credit card has been swiped?” He concluded by stating that he believed a new sentence should be added reading, “A taximeter transaction shall begin when the taximeter is hired and shall end when the taximeter is cleared. Advancement of the fare indication, or entry of extras or other charges, shall only occur when the taximeter is hired. A taximeter shall be cleared by a specific action by the operator, such as activating a manual control, issuing a receipt, or completing the processing of payment through the taximeter using credit cards, debit cards, etc., which may or may not include issuing a receipt.”

In response to Mr. Andersen’s questions, Mr. Barton stated that he believed the language being proposed clarified when the transaction had been concluded so the question had been addressed. Mr. Andersen followed up by stating that the receipt is not actually issued until someone presses the ‘print’ button and concluded by noting that ‘available’ is not the same as “issued.” Mr. Barton concluded by stating that all agenda items in the group are related requirements for the Taximeter Code and that the USNWG on Taximeters recommended these items be considered as Voting items in a single Vote.

Regarding Item 354-2, Mr. Barton stated that he understands that the use of more than one rate in the calculation of a single fare is an established industry practice that is and has been permitted in some jurisdictions. NIST, OWM believes that to mitigate the possible fraudulent use of this capability and to contribute to the transparency of a transaction where this may occur, the proposed change is appropriate. He further stated that he believed by limiting the ability to change the rate in use to only after the completion of an interval or money drop within a trip, the calculation of the resulting fare is more easily verified. If the rate was permitted to change in the middle of an interval, the calculation of that portion of the fare for the interval where multiple rates would be used would be significantly more complex. Mr. Barton concluded by stating, as with the Item 354-1, he recommends that the statement proposed to be added should not appear as a “note” but instead appear as a stand-alone paragraph in the requirement.

Regarding Item 354-3, Mr. Barton acknowledged the reports from the USNWG regarding the lack of any sources declaring a need for a requirement addressing this type of mechanism. He stated he is unaware of any evidence that would indicate a need for retaining this requirement. The requirement and associated definition pertaining to a lever arm and flag does not appear to be relevant to the technologies currently used in taximeters.

Regarding Item 354-4, Mr. Barton stated he understands that when a “negotiated rate” is applied as a passenger charge, this will also result in a non-incrementing monetary amount for this charge. Mr. Barton recommended the proposed definition for “negotiated rate” be revised as follows to more closely mirror the proposed definition for “flat rate:”

negotiated rate. – a rate selection that when applied results in a fixed (non-incrementing) amount for passenger charges based on a value that has been agreed upon by the operator and passenger. The amount set by a negotiated rate does not increment. [5.54]

(Added 201X)

In consideration of the comments received on this agenda item (agenda Item 354-1), the Committee agreed to complete the following three changes to the proposal:

1. Amend the language in proposed sub-paragraph A.2.(b) to state that it applies to devices rather than entities;
2. Amend the second sentence of paragraph S.1.2. from “retroactive” to “non-retroactive and specify an effective date of January 1, 2017;”
3. Strike the “Note” designation appearing in advance of the last sentence of paragraph S.1.2.

The Committee then agreed to present the item, as shown in the Item Under Consideration, for Vote.

Regional Association Comments:

The WWMA S&T Committee did not receive comments on this item during its open hearings at the 2015 WWMA Annual Meeting. The WWMA believes that this item is fully developed and recommends that it be a Voting item.

The CWMA reported during its 2015 Interim Meeting that it would like the submitter to consider clarifying whether a receipt must be issued once the transaction is completed. The CWMA recommended that it be a Voting item at both its 2015 Interim and 2016 Annual Meetings.

NEWMA indicated at its 2015 Interim Meeting, the note in the proposed language should be removed. The remainder of the item has merit, and NEWMA recommends that it be a Voting item. At its 2016 Annual Meeting, NEWMA questioned how the proposed language, “At the conclusion...cleared.” would apply to taximeters that are not equipped with ticket printers and that consideration be given to making this portion of the proposal a user requirement since it is the user that ultimately clears the transaction and not the design of the device. NEWMA reported it feels the language being proposed significantly changes that which was originally proposed and that the intent of these changes is not clear. Given the comments received on this item, NEWMA recommended the status of this item be changed from Voting to Information.

The SWMA grouped this item in a batch consisting of Items 354-1, 354-2, 354-3, and 354-4 and all items were heard together. The SWMA had concerns the proposed language would include entities that only charge a flat rate or negotiated rate, but thinks changes to Section A.2. would make it clear such entities are not subject to the requirements of this code. The SWMA proposed the following changes to Section A.2. and recommended that these items be Voting items:

A.2. Exceptions. – This code does not apply to:

(a) Odometers ~~odometers~~ on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Entities that only charge a flat rate or negotiated rate.

(Amended 1977 **and 201X**)

Additional letters, presentations, and data may have been part of the Committee’s consideration. To review the supporting documentation, please refer to the “Report of the 100th National Conference on Weights and Measures” (SP1210, 2015).

354-2 V S.2. Basis of Fare Calculations

(This item was Adopted.)

Source:

U.S. National Working Group on Taximeters (2016)

Purpose:

To provide a clear statement that more than one rate may be used to calculate a single fare; this proposal would add language to the existing S.2. Basis of Fare Calculations. The proposed changes also specify the only time during the sequence of fare calculations at which a change in the rate applied would be permitted to occur.

Item under Consideration:

Amend NIST Handbook 44, Taximeters Code as follows:

S.2. Basis of Fare Calculations. – A taximeter 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 taximeter 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**)

Background/Discussion:

In some jurisdictions, it is a permitted practice to apply more than one rate in the calculation of passenger fare during a single trip. While there is no language in the Taximeters Code preventing this at this time, there is no language that would expressly permit this practice. Because it has been reported by some regulatory officials that there is a question about whether the use of multiple rates for the calculation of a single fare should be permitted, the additional language suggested in this proposal will explicitly state that this practice is permissible. It is also necessary to ensure that any change in the rate applied in the calculation of a single fare be as clearly observable to the passenger as possible. Therefore, it is important that no change to the rate being applied to calculate a fare would occur in the middle of a “money drop” or interval. If that were to occur, the monetary value of that particular interval during the trip would involve a complex series of calculations that would be very difficult to analyze. This is believed to be a potential cause for confusion and misunderstanding by the average passenger or operator.

2016 NCWM Interim Meeting:

At its 2016 NCWM Interim Meeting open hearings, the Committee agreed to group together agenda Items 354-1, 354-2, 354-3, and 354-4 and take comments simultaneously on these items. See agenda Item 354-1 for a summary of the comments received and the actions taken by the Committee on these four items.

2016 NCWM Annual Meeting:

At its 2016 NCWM Annual Meeting open hearings, the Committee grouped Items 354-1 through 354-4 together and took comments on all four items simultaneously. See Item 354-1 for a summary of the comments that the Committee received on these four items. In consideration of the comments received on this particular agenda item, the Committee agreed to delete the “Note” designation from the proposal as follows and present the item, as shown in Item Under Consideration, for Vote:

Note: A taximeter 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.

Regional Association Comments:

The WWMA did not receive comments on this item during the open hearings of the 2015 WWMA Annual Meeting. During its Committee discussions, the WWMA S&T Committee noted that there is a need for verification of time of day, as rate changes may be associated with specific hours of the day. The WWMA forwarded the item to the NCWM and recommended that it be a Developing item.

At its 2015 Interim Meeting, the CWMA reported it believes this item needs further development; specifically, whether the way the fare can be calculated can change throughout the period of travel and if that is clear to the customer. The CWMA forwarded the item to the NCWM and recommended that it be a Developing item. At its 2016 Annual Meeting, NEWMA reported it believes the item is fully developed and recommended it be forwarded as a Voting item.

NEWMA requested, at its 2015 Interim Meeting, assurance that the wording of this item conveys the correct meaning of verification of fare calculations before it be granted Information or Voting status. NEWMA forwarded it to the NCWM and recommended it be a Developing item. NEWMA grouped agenda Items 354-2, 354-3, and 354-4 together at its 2016 Annual Meeting and reported it feels these items are developed and ready for a Vote.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 354-1, 354-2, 354-3, and 354-4 and all items were heard together. The SWMA forwarded this item to NCWM and recommended that it be a Voting item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

354-3 V S.3.2. Flag

(This item was Adopted.)

Source:

U.S. National Working Group on Taximeters (2016)

Purpose:

Eliminate unnecessary and archaic language from the NIST Handbook 44, Taximeters Code.

Item Under Consideration:

Delete NIST Handbook 44, Taximeters Code paragraph S.3.2. Flag and the definition of the word "Flag" in Appendix D of NIST Handbook 44 as follows:

NIST Handbook 44, Taximeters Code paragraph S.3.2. Flag:

~~S.3.2. Flag.— If the control for the operating condition is a lever arm and flag, the flag shall be at its highest position when the taximeter is cleared, and in this position the whole of the flag shall be above the level of the taximeter housing.~~

NIST Handbook 44, Appendix D, definition:

~~flag.— A plate at the end of the lever arm or similar part by which the operating condition of a taximeter is controlled and indicated. [5.54]~~

Background/Discussion:

The language describing the operation of taximeters in this existing paragraph refers to specific mechanisms in older, obsolete models of taximeters such as a "flag" and "lever arm." Based on information gathered through the USNWG, personal accounts, and the fact that there are no NTEP Certificates of Conformance found (active or inactive) for

mechanical-type taximeters, the USNWG has surmised that the taxi industry relies exclusively on electronic-type meters today and that there is no need for a requirement that specifically addresses these mechanical-based meters that are no longer being used in commercial service.

The reference to the mechanical components in S.3.2. has no relevance to the electronic meters currently used and, therefore, it is believed this requirement is no longer needed for the examination of today's taximeters.

The formation of the USNWG on Taximeters was performed through an exhaustive process where any and all stakeholders were identified. All efforts were made to establish contact with those stakeholders. Those identified included device manufacturers, regulatory officials, subject matter experts, and trade associations. Agendas and meeting summaries that included details concerning this proposal were made available to all stakeholders. Throughout the three years of deliberations of the USNWG, there has been no reported use of mechanical-type taximeters. To this date, there has been no information provided to the USNWG that would indicate the existence of in-service mechanical-based taximeters.

2016 NCWM Interim Meeting:

At its 2016 NCWM Interim Meeting open hearings, the Committee agreed to group together agenda Items 354-1, 354-2, 354-3, and 354-4 and take comments simultaneously on these items. See agenda Item 354-1 for a summary of the comments received and the actions taken by the Committee on these four items.

2016 NCWM Annual Meeting:

At its 2016 NCWM Annual Meeting open hearings, the Committee grouped agenda Items 354-1 through 354-4 together and took comments on all four items simultaneously. See Item 354-1 for a summary of the comments the Committee received on these four items. In consideration of the comments received on this particular agenda item, the Committee agreed to present the item for Vote with no changes.

Regional Association Comments:

During the open hearings at its 2015 Annual Meeting, the WWMA did not receive comments on this item. The WWMA S&T Committee agrees with the recommendation from the USNWG on Taximeters and noted that "flag" is still defined in Appendix D and recommends striking that definition when S.3.2. is removed from NIST Handbook 44. The WWMA forwarded the item to the NCWM and recommended that it be a Voting item with the following additional amendment to NIST Handbook 44 Appendix D, Definitions:

~~**flag.—A plate at the end of the lever arm or similar part by which the operating condition of a taximeter is controlled and indicated. [5.54]**~~

The CWMA agrees with the submitter that this Section is outdated and can be removed along with the definition of "flag" in Appendix D. The CWMA forwarded the item to NCWM and recommended that it be a Voting item at both its 2015 Interim and 2016 Annual Meetings.

At its 2015 Interim Meeting, NEWMA commented that this item has merit and forwarded it to the NCWM, recommending it as a Voting item. NEWMA grouped agenda Items 354-2, 354-3, and 354-4 together at its 2016 Annual Meeting and reported it feels these items are developed and ready for a Vote.

At its fall 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 354-1, 354-2, 354-3, and 354-4 and all items were heard together. The SWMA forwarded this item to the NCWM and recommended that it be a Voting item and that the definition for "flag" be removed from NIST Handbook 44, Appendix D as shown above in the WWMA report.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

354-4 V Appendix D - Definitions: Flat Rate and Negotiated Rate

(This item was Adopted.)

Source:

U.S. National Working Group on Taximeters (2016)

Purpose:

Provide definitions for two terms introduced in a proposed amendment to S.1.2. Advancement of Indicating Elements in the NIST Handbook 44, Taximeters Code.

Item under Consideration:

Amend NIST Handbook 44, Taximeters Code paragraph A.2. Exceptions and add new definitions for “flat rate” and “negotiated rate” to NIST Handbook 44, Appendix D - Definitions as follows:

Amend NIST Handbook 44, Taximeters Code paragraph A.2. Exceptions as follows:

A.2. Exceptions. – This code does not apply to:

(a) Odometers ~~odometers~~ on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Devices that only display a flat rate or negotiated rate.

(Amended 1977 **and 2016**)

Add the following definitions to NIST Handbook 44, Appendix D:

flat rate. – a rate selection that when applied results in the indication of a fixed (non-incrementing) amount for passenger charges. This rate shall be included on the statement of established rates that is required to be posted in the vehicle. [5.54]

(Added 2016)

negotiated rate. – a rate selection that when applied results in a fixed (non-incrementing) amount for passenger charges and is based on a value that has been agreed upon by the operator and passenger. [5.54]

(Added 2016)

Background/Discussion:

While not appearing in the current edition of NIST Handbook 44, the terms “flat rate” and “negotiated rate” are used in another proposal to amend the existing requirement S.1.2. Advancement of Indicating Elements. The proposal to amend S.1.2. is also being submitted to the four regional weights and measures associations for consideration and includes the use of the two terms that are defined under this proposal. Both terms have specific meaning when used in the context of NIST Handbook 44, Taximeters Code and, therefore, it is believed to be beneficial to provide the definition for both terms in NIST Handbook 44, Appendix D to provide a clear understanding of the terms and the requirement that they would be used in.

2016 NCWM Interim Meeting:

At its 2016 NCWM Interim Meeting open hearings, the Committee agreed to group together agenda Items 354-1, 354-2, 354-3, and 354-4 and take comments simultaneously on these items. See agenda Item 354-1 for a summary of the comments received and the actions taken by the Committee on these four items.

2016 NCWM Annual Meeting:

At its 2016 NCWM Annual Meeting open hearings, the Committee grouped agenda Items 354-1 through 354-4 together and took comments on all four items simultaneously. See Item 354-1 for a summary of the comments that the Committee received on these four items. In consideration of the comments received on this particular agenda item, the Committee agreed to make the following two changes to the proposal:

1. Amend the language in proposed sub-paragraph A.2.(b) to state that it applies to devices rather than entities.
2. Amend the proposed definition of “negotiated rate” so that it more closely mirrors the definition of “flat rate.”

The Committee then agreed to present the item, as shown in Item Under Consideration, for Vote.

Regional Association Comments:

The WWMA did not receive comments on this item during the open hearings of the 2015 WWMA Annual Meeting. The WWMA S&T Committee agrees with the recommendation from the USNWG on Taximeters. The WWMA forwarded the item to the NCWM and recommended that it be a Voting item.

The CWMA recognizes the need for the definitions and believes this item is sufficiently developed. The CWMA forwarded the item to the NCWM and recommended that it be a Voting item at both its 2015 Interim Meeting and 2016 Annual Meeting.

NEWMA found merit in the item but recommended that it be amended as shown below. NEWMA forwarded it to the NCWM, recommending the amended version be designated a Voting item.

flat rate. – a rate selection that when applied results in the indication of a fixed (non-incrementing) amount for passenger charges. This rate shall be included on the statement of established rates that is required to be posted in the vehicle The amount set by a flat rate does not increment.

(Added 201X)

negotiated rate. – a rate selection that when applied results in passenger charges based on a value that has been agreed upon by the operator and passenger. The amount set by a negotiated rate does not increment.

(Added 201X)

NEWMA grouped agenda Items 354-2, 354-3, and 354-4 together at its 2016 Annual Meeting and reported it feels these items are developed and ready for a Vote.

At its 2015 Annual Meeting, the SWMA grouped this item in a batch consisting of Items 354-1, 354-2, 354-3, and 354-4 and all items were heard together. The Committee had concerns the proposed language would include entities that only charge a flat rate or negotiated rate, but thinks changes to Section A.2. would make it clear such entities are not subject to the requirements of this code. The SWMA proposed the following changes to Section A.2. and recommended that these items be Voting items:

A.2. Exceptions. – This code does not apply to:

(a) Odometers ~~odometers~~ on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

(b) Entities that only charge a flat rate or negotiated rate.

(Amended 1977 **and 201X**)

354-5 D USNWG on Taximeters – Taximeter Code Revisions and Global Positioning System-Based Systems for Time and Distance Measurement

Note: This item was originally titled “Item 360-5, S.5. Provision for Security Seals” in the Committee’s 2013 Interim Agenda. At the 2013 NCWM Interim Meeting, the Committee combined that item with “Item 354-1. Global Positioning Systems for Taximeters” and “Item 360-6. Global Positioning Systems for Taximeters” to create this new, consolidated item to address the development of recommendations on multiple topics related to taximeters and GPS-based time and distance measuring systems.

Source:

NIST USNWG on Taximeters

Purpose:

Develop recommendations for modifying the existing Taximeters Code to reflect current technology (including requirements for sealing, display requirements, and other features) and to examine GPS-based time and distance measuring systems to determine how to best address these measuring systems in NIST Handbook 44 to ensure accuracy and transparency for passengers and businesses.

Item under Consideration:

This item is under development. Comments and inquiries may be directed to Mr. John Barton (NIST OWM) at (301) 975-4002 or john.barton@nist.gov.

The USNWG is considering proposals to modify the sealing requirements in the Taximeters Code to reflect more advanced sealing methods (see 2012 NCWM Final S&T Report); to amend the Taximeters Code to specifically recognize GPS-based time and distance measuring systems; and to amend other sections of the Taximeters Code to reflect current technology and business practices while ensuring accuracy and transparency for customers and a level playing field for transportation service companies.

Background/Discussion:

The Committee has received multiple proposals over the past several years related to updating the current NIST Handbook 44, Taximeters Code to reflect current technology as well as a request to establish criteria for GPS-based time and distance measuring systems. In April 2012, NIST OWM established a U.S. National Working Group to work on these issues. The USNWG has met multiple times since it was established. For details of those meetings as well as the current proposals being developed by the USNWG, please contact Mr. Barton as noted in the “Item Under Consideration” above.

Additional background information and updates on the progress associated with this item can be found in the Committee’s 2015 (see NIST SP 1210 [2015]) and earlier final reports.

2016 NCWM Interim Meeting:

At the Committee’s 2016 NCWM Interim Meeting open hearings, Mr. John Barton (OWM, NIST Technical Advisor to the USNWG on Taximeters) reported that the USNWG on Taximeters recommended that agenda Item 354-5 and 354-6 be consolidated into a single agenda item. The purpose of the item is to update NIST Handbook 44 requirements to reflect current technology and to address GPS based systems. Ms. Kristin Macey (California) stated that she objected to the consolidation. The Committee agreed to maintain the two as separate items on its agenda and maintain the Developing status of both.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, Mr. John Barton, Chair of the USNWG on Taximeters, stated a meeting of the USNWG on Taximeters was held just prior to the 2016 NCWM Annual Meeting at which time it reviewed the Transportation Network Systems (TNS) Draft Code as well as associated changes. The USNWG plans to draft and submit proposals to amend the TNS Draft Code for consideration by the four regional weights and measures associations at the fall 2016.

Regional Associations Meetings:

The WWMA did not receive comments on this item during open hearings at its fall 2015 Annual Meeting. The WWMA agrees with the USNWG on Taximeters that this item remain Developing. The WWMA encourages the USNWG on Taximeters to give consideration to other applications involving services, including those covered by the Odometers Code such as towing, ambulances, deliveries, etc.

The CWMA believes this item has merit, but needs further development. It recommended that this item be forwarded to the NCWM as a Developing item during both its 2015 Interim Meeting and 2016 Annual Meeting.

NEWMA agreed with a suggestion from a member of the USNWG on Taximeters during the 2015 NEWMA Interim Meeting that this item remain as a Developing item. At its 2016 Annual Meeting, NEWMA reported it feels the USNWG on Taximeters is very close to modifying the Taximeters Code to reflect current technology to suit the GPS-based systems and recommended to the NCWM that it remain a Developing item.

At its fall 2015 Annual Meeting, the SWMA encouraged the USNWG on Taximeters to continue to develop the GPS specifications and tolerances and recommended that this item remain as a Developing item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

354-6 W Transportation Network Systems – Draft Code

(This item was Withdrawn.)

Source:

California Department of Food and Agriculture, Division of Measurement Standards (2016)

Purpose:

Create an Information item to engage the weights and measures community in a discussion to create a code section within NIST Handbook 44 for transportation measuring devices that determine fares using GPS to calculate time and distance.

Item under Consideration:

Amend the NIST Handbook 44, Taximeters Code as follows:

- Rename Section 5.54. Taximeters to Transportation Measuring Devices;
- Within Section 5.54., create Section 5.54.(a) for Taximeters and Section 5.54.(b) for Transportation Network Systems;
- Move current requirements in Section 5.54. Taximeters to Section 5.54(a). Taximeters; and
- Add draft requirements for Transportation Network Systems to new Section 5.54.(b) as follows:

Transportation Network Systems – Tentative Code

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

(Tentative Code Added 20XX)

A. Application

A.1. General. – This code applies to systems that utilize Global Positioning System (GPS) software and associated equipment or other comparable software-based system to determine distance and time, separately or simultaneously, to calculate a rate or rates and indicate the charge for hire of a vehicle or other mode of transport.

A.2. Exceptions. – This code does not apply to taximeters that use distance measurement transducer or odometers on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

A.3. Additional Code Requirements. – In addition to the requirements of this code, Transportation Network Systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements.

S.1.1. General. – A system shall be equipped with a primary indicating element and may be equipped with a recording element.

S.1.1.1. Recording Elements. – A receipt providing information as required in S.1.9. Recorded Representations shall be available from the system or other means through an integral or separate recording element for all transactions conducted.

S.1.2. Identification. – The system shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) **the name, initials, or trademark of the manufacturer or distributor;**
- (b) **the current software version or revision identifier shall be:**
 - (a) **prefaced by words or an abbreviation that clearly identifies the number as the required version or revision.**
 - i. **Abbreviations for the word “Version” shall, as a minimum, begin with the letter “V” and may be followed by the word “Number”;**
 - ii. **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.);**
 - (b) **directly linked to the software itself.**
- (c) **a California Type Evaluation Program (CTEP) Certificate of Approval (COA) number or a corresponding COA Addendum Number. The COA Number or a corresponding COA Addendum Number shall be prefaced by the terms “CTEP COA,” “COA,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).**
- (d) **If the system is it designed such that it consists of more than one part, the part dedicated to the metrologically significant software shall be clearly identified.**

S.1.3. Location of Marking Information. – The required information in S.1.2. Identification. shall be:

- (a) **continuously displayed; or**
- (b) **accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, “Help,” “System Identification,” “Weights and Measures Identification,” or “Identification.”**

Note: Clear instructions for accessing the location of the information required in S.1.2. Identification. shall be listed on the CTEP COA, including information necessary to identify that the software is the same type that was evaluated.

S.1.4. Advancement of Indicating Elements. – Except when a system is being reset, the primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or the time mechanism.

S.1.5. Visibility of Indications. – The indication of fare shall be available at the beginning of the transaction. All fares shall be available whenever the vehicle is hired and in operation. All indications of passenger interest shall be displayed to the passenger, either in the vehicle from a distance of 1.2 m (4 ft) under any condition of normal operation, or on a device operated by the passenger. If the display is not on continuously, it shall be accumulated continuously so that real-time measurement is displayed during activation, no more than every 60 seconds.
(Nonretroactive as of 20XX)

S.1.5.1. Minimum Height of Figures, Words, and Symbols. – If the indications are displayed in the vehicle, 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.

S.1.5.2. Lighting of Indications. – If the indications are displayed in the vehicle, integral lighting shall be provided to illuminate the fare and extras.

S.1.5.3. Supplemental Indications. – If a supplementary indicating element is installed in a vehicle to provide information regarding the service to the passenger, it 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.

S.1.5.3.1. Fare and extras charges – The indication of fare and extras charges on the indicating element shall agree with similar indications displayed on all other indicating elements in the system.

S.1.6. Actuation of Fare-Indicating System. – A system shall be designed to calculate fares upon the basis of a combination of distance traveled and time elapsed.

S.1.7. Operating Condition.

S.1.7.1. 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.1.7.2. 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.

S.1.7.2.1. Nonuse of Extras. – If and when system extras are prohibited by a 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.1.8. Protection of Indications. – All indications of fare and extras shall be protected from unauthorized alteration or manipulation.

S.1.9. Recorded Representation. – A receipt issued from a system, whether through an integral or separate recording element, shall include the following:

(a) date;

- (b) unique vehicle identification number, or other identifying information as specified by the statutory authority;
- (c) start and end time of trip, and total time of trip, maximum increment of one second;
- (d) distance traveled, maximum increment of 0.01 kilometer or 0.01 mile;
- (e) the associated fare in \$ at each rate;
- (f) additional charges where permitted such as extras; and
- (g) total fare in \$ (total charge).

S.2. Basis of Fare Calculations. – A system may calculate fares upon the basis of:

- (a) distance traveled;
- (b) time elapsed; or
- (c) a combination of distance traveled and time elapsed.

S.3. Interference. – For systems that determine distance and time separately there shall be no interference between the time and the distance portions of the mechanism device at any speed of operation.

S.4. Provision for Sealing.

S.4.1. System Security. – A system shall be designed with provisions to ensure that no change can be made that detrimentally affects its metrological integrity.

S.4.2. Changelog. – The system shall provide a changelog, with the information available electronically to the weights and measures official. The changelog shall include a chronological record of all changes affecting the metrological integrity of the system.

S.4.3. Software Authenticity. – Technical means shall be employed to guarantee the authenticity of the loaded software, to ensure that it originates from the owner of the type approval certificate.

S.5. Provisions for Power Loss.

S.5.1. Transaction Information. – In the event of a power loss, the system shall be capable of determining the information needed to complete any transaction in progress at the time of the power loss.

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of a system shall be conducted utilizing a distance test or a transfer standard test where applicable.

- (a) Specific Distance Test. – The test consists of operating the conveyance over a precisely measured course at least one mile in length.
- (b) Transfer Standard Test. – When comparing a system with a calibrated transfer standard, the distance shall be equal to at least the distance traveled on the specific distance test.

N.1.2. Test Procedures. – Not less than two test runs shall be conducted for a distance test and shall be at a speed approximating the average speed traveled by the vehicle in normal service.

N.1.3. Test Conditions. – Tests shall be conducted under conditions that are usual and customary with respect to the location and use of the device.

N.2. Time Test. – A system equipped with a timing device shall be tested during the specific distance and transfer standard tests.

N.3. Isolation Test. – If a system is designed to calculate fares for time and distance separately, tests for time and distance shall be conducted independently.

N.4. Software Tests. – The system software shall be loaded onto a smartphone and tested for authenticity and version number.

T. Tolerances

T.1. Tolerance Values.

T.1.1. Distance Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) on Overregistration: 1 %; and

(b) on Underregistration: 4 %

T.1.2. Time Tests. – Maintenance and acceptance tolerances shall be as follows:

(a) on Overregistration: 5 seconds per test; and

(b) on Underregistration: 5 seconds per test.

Background/Discussion:

Transportation Network Companies (TNCs) (e.g., Uber, Lyft, and possibly others) have developed software applications for use with a mobile device, which enables their drivers to provide transportation services for hire to customers who also have TNC applications downloaded on their mobile device. The software has significant metrological importance and is essential to these commercial transactions. Fares are determined based on a GPS calculating distance and time.

There are unique operating characteristics of these software-based systems that distinguish them from traditional mechanical and electronic taximeters. For this reason, a separate code section is appropriate.

Weights and measures jurisdictions throughout the United States are coming under increasing pressure to demonstrate equal application of weights and measures laws to companies offering alternative transportation services to the traditional taxicab business model.

Taximeter manufacturers may soon decide to use GPS technology to calculate time and distance in an effort to be more like the TNC business model, which has gained widespread public acceptance.

In the United States, Uber operates in 43 states and Washington, D.C., and Lyft operates in 27 states and Washington, D.C. Both these and other similar companies are growing and expanding their market share.

2016 NCWM Interim Meeting:

At the Committee's 2016 NCWM Interim Meeting open hearings, a number officials and industry representatives alike supported the continued development of this item. Representatives from Lyft, Inc. and Uber Technologies, Inc. further recommended the item remain under California direction.

Mr. Doug Musick (Kansas) commented that he, too, supported maintaining the Developing status of the item. He recommended that the scope be broadened to include agricultural applications noting that GPS-based technology is huge for measuring area in crop applications. He suggested that all possible uses of the technology be considered and evaluated.

In consideration of the comments received, the Committee agreed to recommend maintaining the Developing status of this item.

2016 NCWM Annual Meeting:

During the Committee's open hearings at the 2016 NCWM Annual Meeting, Ms. Kristin Macey (California), submitter of the item, made a recommendation to merge this item with Item 354-5 and let the USNWG on Taximeters develop the draft code. She added that the code being proposed by this agenda item is "California specific" and concluded by stating that California may come back with another proposal depending on the direction and progress of the USNWG, but would prefer that a single proposal come forward. The Committee agreed to Withdraw this item based on Ms. Macey's recommendation to merge the item together with Item 354-5.

Regional Association Comments:

During its fall 2015 Annual Meeting open hearings, the WWMA did not receive comments on this item. The WWMA S&T Committee agrees with the submitter that this item should be accepted by the NCWM as a tentative code. The WWMA S&T Committee recommends that the USNWG on Taximeters look at this tentative code as they continue their work. Consideration may be given to other applications involving charges for services as found in the Odometers Code. The WWMA forwarded the item to NCWM and recommended it as a Voting item with some changes as shown here:

Transportation Network Systems – Tentative Code

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

(Tentative Code Added 20XX)

A. Application

A.1. General. – This code applies to systems that utilize Global Positioning System (GPS), software and associated equipment or other comparable software-based system to determine distance and time, separately or simultaneously, to calculate a rate or rates and indicate the charge for hire of a vehicle or other mode of transport.

A.2. Exceptions. – This code does not apply to taximeters that use distance measurement transducer or odometers on vehicles that are rented on a distance basis (for which see Section 5.53. Code for Odometers).

A.3. Additional Code Requirements. – In addition to the requirements of this code, Transportation Network Systems shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements.

S.1.1. General. – A system shall be equipped with a primary indicating element and may be equipped with a recording element.

S.1.1.1. Recording Elements. – A receipt providing information as required in S.1.9. Recorded Representations shall be available from the system or other means through an integral or separate recording element for all transactions conducted.

S.1.2. Identification. – The system shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;**
- (b) the current software version or revision identifier shall be:**
 - (1) 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”;**
 - (3) 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.).**
- (c) directly linked to the software itself;**
- (d) a California Type Evaluation Program (CTEP) Certificate of Approval (COA) number or a corresponding COA Addendum Number. The COA Number or a corresponding COA Addendum Number shall be prefaced by the terms “CTEP COA,” “COA,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.); and**
- (e) if the system is it designed such that it consists of more than one part, the part dedicated to the metrologically significant software shall be clearly identified.**

S.1.3. Location of Marking Information. – The required information in S.1.2. Identification. shall be:

- (a) continuously displayed; or**
- (b) accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, “Help,” “System Identification,” “Weights and Measures Identification,” or “Identification.”**

Note: Clear instructions for accessing the location of the information required in S.1.2. Identification. shall be listed on the CTEP COA, including information necessary to identify that the software is the same type that was evaluated.

S.1.4. Advancement of Indicating Elements. – Except when a system is being reset, the primary indicating and recording elements shall be susceptible of advancement only by the movement of the vehicle or the time mechanism.

S.1.5. Visibility of Indications. – The indication of fare shall be available at the beginning of the transaction. All fares shall be available whenever the vehicle is hired and in operation. All indications of passenger interest shall be displayed to the passenger, either in the vehicle from a distance of 1.2 m (4 ft) under any condition of normal operation, or on a device operated by the passenger. If the display is not on continuously, it shall be accumulated continuously so that real-time measurement is displayed during activation, no more than every 60 seconds.

[Nonretroactive as of 20XX]

S.1.5.1. Minimum Height of Figures, Words, and Symbols. – If the indications are displayed in the vehicle, 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.

S.1.5.2. Lighting of Indications. – If the indications are displayed in the vehicle, integral lighting shall be provided to illuminate the fare and extras.

S.1.5.3. Supplemental Indications. – If a supplementary indicating element is installed in a vehicle to provide information regarding the service to the passenger, it 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.

S.1.5.3.1. Fare and extras charges – The indication of fare and extras charges on the indicating element shall agree with similar indications displayed on all other indicating elements in the system.

S.1.6. Actuation of Fare-Indicating System. – A system shall be designed to calculate fares upon the basis of a combination of distance traveled and time elapsed.

S.1.7. Operating Condition.

S.1.7.1. 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.1.7.2. 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.

S.1.7.2.1. Nonuse of Extras. – If and when system extras are prohibited by a 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.1.8. Protection of Indications. – All indications of fare and extras shall be protected from unauthorized alteration or manipulation.

S.1.9. Recorded Representation. – A receipt issued from a system, whether through an integral or separate recording element, shall include the following:

- (a) date;**
- (b) unique vehicle identification number, or other identifying information as specified by the statutory authority;**
- (c) start and end time of trip, and total time of trip, maximum increment of one second;**
- (d) distance traveled, maximum increment of 0.01 kilometer or 0.01 mile;**
- (e) the associated fare in \$ at each rate;**
- (f) additional charges where permitted such as extras; and**

(g) total fare in \$ (total charge).

S.2. Basis of Fare Calculations. – A system may calculate fares upon the basis of:

(a) distance traveled;

(b) time elapsed; or

(c) a combination of distance traveled and time elapsed.

S.3. Interference. – For systems that determine distance and time separately there shall be no interference between the time and the distance portions of the mechanism device at any speed of operation.

S.4. Provision for Sealing.

S.4.1. System Security. – A system shall be designed with provisions to ensure that no change can be made that detrimentally affects its metrological integrity.

S.4.2. Changelog. – The system shall provide a changelog, with the information available electronically to the weights and measures official. The changelog shall include a chronological record of all changes affecting the metrological integrity of the system.

S.4.3. Software Authenticity. – Technical means shall be employed to guarantee the authenticity of the loaded software, to ensure that it originates from the owner of the type approval certificate.

S.5. Provisions for Power Loss.

S.5.1. Transaction Information. – In the event of a power loss, the system shall be capable of determining the information needed to complete any transaction in progress at the time of the power loss.

N. Notes

N.1. Distance Tests.

N.1.1. Test Methods. – To determine compliance with distance tolerances, a distance test of a system shall be conducted utilizing a distance test or a transfer standard test where applicable.

(a) Specific Distance Test. – The test consists of operating the conveyance over a precisely measured course at least one mile in length.

(b) Transfer Standard Test. – When comparing a system with a calibrated transfer standard, the distance shall be equal to at least the distance traveled on the specific distance test.

N.1.2. Test Procedures. – Not less than two test runs shall be conducted for a distance test and shall be at a speed approximating the average speed traveled by the vehicle in normal service.

N.1.3. Test Conditions. – Tests shall be conducted under conditions that are usual and customary with respect to the location and use of the device.

N.2. Time Test. – A system equipped with a timing device shall be tested during the specific distance and transfer standard tests.

N.3. Isolation Test. – If a system is designed to calculate fares for time and distance separately, tests for time and distance shall be conducted independently.

N.4. Software Tests. – The system software shall be loaded onto a smartphone and tested for authenticity and version number.

T. Tolerances

T.1. Tolerance Values.

T.1.1. Distance Tests. – Maintenance and acceptance tolerances shall be as follows:

- (a) On Overregistration: 1 %; and**
- (b) On Underregistration: 4 %.**

T.1.2. Time Tests. – Maintenance and acceptance tolerances shall be as follows:

- (a) On Overregistration: 5 seconds per test; and**
- (b) On Underregistration: 5 seconds per test.**

The CWMA agrees the portion of NIST Handbook 44 addressing personal transportation for hire needs revision to reflect the advancement in technology currently present in the industry and appreciates the efforts of the California Department of Food and Agriculture, Division of Measurement Standards to accomplish this. The CWMA forwarded the item to the NCWM and recommended that it be an Information item at the 2015 NCWM Interim Meeting. At its 2016 Annual Meeting, the CWMA agreed to support the Withdrawal of the item at the submitter's request.

NEWMA, at its 2015 Interim Meeting, forwarded the item to the NCWM with the recommendation it be a Developing item. At its 2016 Annual Meeting, NEWMA Withdrew the item on a recommendation made by the submitter of the item.

At its fall 2015 Annual Meeting, the SWMA forwarded this item to the NCWM, recommending that it be a Developing item and encouraged the submitter to continue developing the GPS specifications and tolerances.

358 MULTIPLE DIMENSION MEASURING DEVICES

358-1 V Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems, Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.1.a.

(This item was Adopted.)

Source:

NTEP Multiple Dimension Measuring Device Work Group (MDMD) (2016)

Purpose:

Create a new specification in the Multiple Dimension Measuring Devices Code to require that the measurement result of all axes being displayed, printed, or recorded are in the same unit of measure.

Item under Consideration:

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

S.1.5. Value of Dimension/Volume Division Units. – The value of a device division “d” expressed in a unit of dimension shall be presented in a decimal format. The value of “d” for each measurement axis shall be in the same unit of measure and with the value of the division expressed as:

...

(Amended 2016)

Background/Discussion:

All dimensions being measured and used in the calculation of the volume of the object being measured must be the same unit measure so as not to misrepresent the accuracy of the measurement.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee heard comments in support of this item as written from Mr. Russ Vires (SMA) and Ms. Fran Elson-Houston (Ohio Department of Agriculture).

Mr. Robert Kennington (Quantronix, Inc. and Chair of the Multiple Dimension Measuring Device Work Group) supported the item and recommended that the Committee move the item forward with a status of Voting at the 2016 NCWM Annual Meeting.

Ms. Tina Butcher (NIST, OWM) commented that it is reasonable to expect the value of the division “d” for each measurement axis (length, width, and height) of an MDMD to be in the same unit of measure (i.e., all in inches or all in centimeters, etc.). OWM recommends the Committee consider replacing the language in the proposal with the following to improve understanding:

S.1.5. Value of Dimension/Volume Division Units. – The value of a device division “d” expressed in a unit of dimension shall be presented in a decimal format. The value of “d” for each measurement axis shall be in the same unit of measure and with the value of the division expressed as:

...

In discussing this item, the Committee agreed that the language proposed by OWM would improve understanding of the paragraph and agreed to amend the language as shown in the Item Under Consideration. In consideration of the comments received in support of this item, the Committee also agreed to present the item for a Vote at the 2016 Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee heard comments in support of this item as written from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA; Mr. Robert Kennington (Quantronix, Inc.); speaking on behalf of and as Chair of the Multiple Dimension Measuring Device Work Group; and Ms. Fran Elson-Houston (Ohio).

Ms. Tina Butcher (NIST, OWM) reiterated the comments by provided by OWM at the 2016 NCWM Interim Meeting that it is reasonable to expect the value of the division “d” for each measurement axis (length, width, and height) of an MDMD to be in the same unit of measure (i.e., all in inches or all in centimeters, etc.).

In consideration of the comments received in support of this item, the Committee agreed to present the item for Vote.

Regional Association Comments:

At its 2015 Interim Meeting and 2016 Annual Meeting, NEWMA recommended the item be forwarded to the NCWM as a Voting item.

The CWMA, at both its 2015 Interim Meeting and 2016 Annual Meeting, reported it feels this item is fully developed; comments received were in support of the item. The CWMA recommended the item be forwarded to the NCWM as a Voting Item.

At its fall 2015 Annual meeting, the SWMA forwarded the item to NCWM and recommended that it be a Voting item.

358-2 V Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems, Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.1.a.

(This item was Adopted.)

Source:

NTEP Multiple Dimension Measuring Devices Work Group (MDMD) (2016)

Purpose:

Provide requirements pertaining to the use of multi-intervals on an MDMD.

Item under Consideration:

Amend NIST Handbook 44, Multiple Dimension Measuring Devices Code Table S.4.1.b. as follows:

Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring System				
	Multiple Dimension Measuring Equipment			
	Multiple Dimensions Measuring Device and Indicating Element in Same Housing	Indicating Element not Permanently Attached to Multiple Dimension Measuring Element	Multiple Dimension Measuring Element not Permanently Attached to the Indicating Element	Other Equipment (1)
To Be Marked With ↓				
Manufacturer's ID	X	X	X	X
Model Designation	X	X	X	X
Serial Number and Prefix	X	X	X	X (2)
Certificate of Conformance Number (8)	X	X	X	X (8)
Minimum and Maximum Dimensions for Each Axis (3)(9)	X	X	X	
Value of Measuring Division, d (for each axis and range) (9)	X	X	X	
Temperature Limits (4)(9)	X	X	X	
Minimum and Maximum Speed (5)(9)	X	X	X	
Special Application (6)(9)	X	X	X	
Limitation of Use (7)(9)	X	X	X	

(Amended 2016)

Table S.4.1.b. Multiple Dimension Measuring Systems Notes for Table S.4.a.	
1.	Necessary to the dimension and/or volume measuring system, but having no effect on the measuring value (e.g., auxiliary remote display, keyboard, etc.)
2.	Modules without "intelligence" on a modular system (e.g., printer, keyboard module, etc.) are not required to have serial numbers.
3.	The minimum and maximum dimensions and measuring division (using upper and lower case type) shall be marked. For example: <div style="margin-left: 40px;"> Length: min ___ max ___ d ___ Width: min ___ max ___ d ___ Height: min ___ max ___ d ___ </div>
4.	Required if the range is other than – 10 °C to 40 °C (14 °F to 104 °F)
5.	Multiple dimension measuring devices, which require that the object or device be moved relative to one another, shall be marked with the minimum and maximum speeds at which the device is capable of making measurements that are within the applicable tolerances.
6.	A device designed for a special application rather than general use shall be conspicuously marked with suitable words visible to the operator and the customer restricting its use to that application.
7.	Materials, shapes, structures, combination of object dimensions, speed, spacing, minimum protrusion size, or object orientations that are inappropriate for the device or those that are appropriate.
8.	Required only if a Certificate of Conformance has been issued for the equipment.
9.	<u>This marking information may be readily accessible via the display. Instructions for displaying the information shall be described in the NTEP CC.</u>

(Amended 2004, ~~and~~ 2008, and 2016)

Background/Discussion:

Devices are continually being developed and have less space to include all marking requirements in a legible and readable format. This proposal provides harmonization with existing OIML marking requirements stated in R 129 and the European Measuring Instruments Directive 2014/32/EU.

January 2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee heard comments in support of this item as written from Mr. Russ Vires (SMA), Mr. Scott Henry (Zebra Technologies), and Mr. Sprague Ackley (Honeywell).

Robert Kennington (Quantronix, Inc. and Chair of the Multiple Dimension Measuring Devices Work Group) supported the item and recommended that the Committee move the item forward with a status of Voting at the 2016 NCWM Annual Meeting.

Ms. Tina Butcher (NIST, OWM) commented that OWM understands the need for manufacturers of equipment with limited space in which to display all required marking information, to be able to provide at least some of that information using some alternative means. The information required to be marked on load cells is permitted to appear in an accompanying document for this same reason as noted in this proposal (see NIST Handbook 44, Scales Code Table S.6.3.a. footnote 11). A condition for allowing the information to appear on an accompanying document for a load cell is that the manufacturer’s name or trademark, the model designation, and identifying symbols for the model and serial number of the load cell appear on both the load cell and in the accompanying document. Since NIST Handbook 44 requires a serial number to be nonrepetitive, it is the serial number that positively links the required information appearing in an accompanying document to a particular load cell.

NIST, OWM notes that not all information required by Table S.4.1. would be allowed to appear in an accompanying document should the proposal be accepted. The manufacturer’s ID, model designation, serial number and prefix, and CC number would still be required to be marked on the device. It is only the information which footnote 9 references in the proposal that could appear in an accompanying document. OWM questions whether or not the configuration

parameters associated with some of the required marking information are changeable depending on the particular device application. For example, it is probable that the value of the measuring division can be changed on some devices (as is the case with the value of “d” on many electronic scales) with its set value based on customer need and the sizes of the boxes being measured. This being the case, an owner’s manual that includes a list of all the acceptable division values for which the equipment complies would not meet the marking requirement for the value of the measuring division because it is not specific to the device being inspected. That is, Table S.4.1. requires the value of the measuring division for each axis and range be marked on the device.

NIST, OWM is not opposed to allowing some of the required marking information to be included on an accompanying document, provided the information is specific to the device being inspected and the manufacturer’s ID, model designation, serial number and prefix, and CC appear on both the device and in the accompanying document.

In consideration of the comments received in support of this item, the Committee agreed to present the proposal as shown in Item Under Consideration for a Vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee heard comments in support of this item, as written, from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA and Mr. Robert Kennington (Quantronix, Inc.), speaking on behalf of and as Chair of the Multiple Dimension Measuring Device Work Group.

Ms. Tina Butcher (NIST, OWM) commented that the required marking information listed in Table S.4.1.a. and explained in the notes in Table S.4.1.b. of the MDMD Code not only includes make, model, and serial number, but also includes information that is critical to the proper and safe operation of the device. That is, much of this information also aids as a constant reminder to users of the limitations placed on that equipment by the manufacturer. Failure to adhere to those limitations could result in inaccurate measurements and possibly damage to the equipment. Additionally, weights and measures officials rely on this information to determine the conditions and extent of testing that’s needed, the tolerances to be applied, and that users of that equipment are operating it properly.

NIST, OWM feels this basic information needs to be displayed on the device, although OWM believes it may be appropriate to allow some of the information to be accessed through a menu on the device, providing everyone could agree on some uniform instructions for accessing the information and those instructions be specified in the MDMD Code. OWM recognizes that documents are easily misplaced and this information is too important for it not to be immediately available to both officials and users of the device. This basic identifying information needs to be made readily available to an inspector and user, and it shouldn’t be necessary to search for documents to locate it.

Mr. Scott Henry (Zebra Technologies) proposed removal of the references to an accompanying document in proposed note 9 of the proposal. He indicated that all the marking information identified in the table using the reference “9” could be made readily available from a display. Consequently, there is no need to allow for it to be included on an accompanying document. He then provided the Committee some handwritten changes to proposed (foot)note 9 for its consideration. Ms. Fran Elson-Houston (Ohio) commented that she would like to see Mr. Henry’s proposed changes to determine whether or not she could support them. She also indicated that she wanted to see the item move forward.

In discussing this item, the Committee considered whether the changes proposed by Mr. Henry would satisfy the concerns made evident by OWM. The Committee concluded that although they may not fully address all the concerns expressed by OWM, the changes offered were appropriate and would provide some flexibility for a manufacturer to comply with the marking requirements. Consequently, the Committee agreed to amend the new footnote proposed for addition to Table S.4.1.b. by eliminating the option that would allow the required marking information associated with footnote 9 to appear on an accompanying document, yet continuing to permit that information to be readily accessible via the display. The following changes to footnote 9 were agreed to by the Committee:

- 9. This marking information may be readily accessible via the provided by a display. Instructions for displaying the information shall be described in the NTEP CC. ~~or accompanying document. If an accompanying document is provided, the accompanying document shall include the manufacturers name and model designation.~~**

In consideration of the comments received in support of this item, the Committee then recommended the item be presented for a Vote as shown in the Item under Consideration.

Regional Association Comments:

The CWMA, at its 2016 Annual Meeting, reported it believes this item is fully developed and recommended it be a Voting item on the NCWM Agenda.

NEWMA recommended, at both its 2015 Interim and 2016 Annual Meetings, this item be Voting on the NCWM Agenda.

At its fall 2015 Annual Meeting, the SWMA forwarded the item to NCWM and recommended that it be a Voting item.

358-3 V S.2.2.1. Maximum Value of Tare for Multi-Interval (Variable Division Value) Devices. S.2.2.2. Net Values, Mathematical Agreement, Table 1: Examples of Acceptable Altering of Tare to Achieve Accurate Net Indication, Table 2: Examples of Acceptable Rounding of the Net Result (Following the Subtraction of Tare) to Achieve Accurate Net Indication, Table S.4.1.a., Marking Requirements for Multiple Dimension Measuring Systems, T.2.3. Multi-interval (Variable Division-Value) Devices., T.2.4. Mixed-interval Devices.

(This item was Adopted.)

Source:

NTEP Multiple Dimension Measuring Device Work Group (MDMD) (2016)

Purpose:

Provide requirements pertaining to the use of multi-intervals on an MDMD.

Item under Consideration:

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

Add new sub-paragraphs S.2.2.1. Maximum Value of Tare for Multi-Interval (Variable Division- Value) Devices and S.2.2.2. Net Values, Mathematical Agreement beneath existing paragraph S.2.2. Tare as follows:

S.2.2. Tare. – The tare function...

S.2.2.1. Maximum Value of Tare for Multi-Interval (Variable Division-Value) Devices. – A multi-interval device shall not accept any tare value greater than the maximum capacity of the lowest range of the axis for which the tare is being entered.

(Added 2016)

S.2.2.2. Net Values, Mathematical Agreement. – All net values resulting from a device subtracting a tare entry from a gross value indication shall be indicated and recorded, if so equipped, to the nearest division of the measuring range in which the net value occurs. In instances where the tare value entered on a multi-interval device is in a lower partial measuring range (or segment) than the gross indication, the system shall either alter the tare entered or round the net result after subtraction of the tare in order to achieve correct mathematical agreement.

The following example (of a multi-interval device having two partial measuring ranges for the “x” axis) and accompanying two tables are provided to further clarify the two acceptable methods a device can use to achieve mathematical agreement when tare has been entered in a lower partial measuring range than the gross indication:

Example multi-interval device having two partial measuring ranges for the “x” axis:

- **Partial measuring range 1: 0 – 100 inches by 0.2 inch**
- **Partial measuring range 2: 100 – 300 inches by 0.5 inch**

Table 1: Examples of Acceptable Altering of Tare to Achieve Accurate Net Indication

Gross Indication of Item Being Measured	Tare Entered	Value of Tare after Being Altered by the Device	Acceptable Net Indication
<u>154.5 inches</u>	<u>41.2 inches</u>	<u>41.0 inches</u>	<u>113.5 inches</u>
<u>154.5 inches</u>	<u>41.4 inches</u>	<u>41.5 inches</u>	<u>113.0 inches</u>

Table 2: Examples of Acceptable Rounding of the Net Result (Following the Subtraction of Tare) to Achieve Accurate Net Indication

Gross Indication of Item Being Measured	Tare Entered	Net Result Before Rounding (Gross Indication Minus Tare Entered)	Acceptable Net Indication Rounded to Nearest 0.5 inch
<u>154.5 inches</u>	<u>41.2 inches</u>	<u>113.3 inches</u>	<u>113.5 inches</u>
<u>154.5 inches</u>	<u>41.4 inches</u>	<u>113.1 inches</u>	<u>113.0 inches</u>

(Added 2016)

Amend Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Equipment as follows:

Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Systems				
To Be Marked With ↓	Multiple Dimension Measuring Equipment			
	Multiple Dimension Measuring Device and Indicating Element in Same Housing	Indicating Element not Permanently Attached to Multiple Dimension Measuring Element	Multiple Dimension Measuring Element not Permanently Attached to the Indicating Element	Other Equipment (1)
Manufacturer's ID	x	x	x	x
Model Designation	x	x	x	x
Serial Number and Prefix	x	x	x	x (2)
Certificate of Conformance Number (8)	x	x	x	x (8)
Minimum and Maximum Dimensions for Each Axis for <u>Each Range in Each Axis</u> (3)	x	x	x	
Value of Measuring Division, d (for each axis and range)	x	x	x	
Temperature Limits (4)	x	x	x	
Minimum and Maximum speed (5)	x	x	x	
Special Application (6)	x	x	x	
Limitation of Use (7)	x	x	x	

(Amended 2016)

*Amend paragraph T.2.3. Multi-Interval (Variable Division-Value) Devices and add a new paragraph T.2.4. **Mixed-interval Devices.** as follows:*

T.2.3. Multi-interval (Variable Division-Value) Devices. – ~~For multi-interval (variable division-value) devices,~~ **When there exists two or more partial measuring ranges (or segments) specified for any of the “dimensioning” axes (length (x), width (y), or height (z)) and the division values corresponding to those partial measuring ranges (or segments) within the same “dimensioning” axis differ,** the tolerance values ~~are~~ **shall be** based on the value of the ~~device~~ division of the range in use.

(Amended 2016)

T.2.4. Mixed-interval Devices. – **For devices that measure to a different division value in at least one dimensioning axes and all axes are single range, the tolerance values shall be based on the value of the division of the axis in use.**

(Added 2016)

Background/Discussion:

Members of the NTEP Multiple Dimension Measuring Device (MDMD) Work Group (WG) agreed during their May 2015 WG Meeting that the MDMD Code of NIST Handbook 44 does not contain any requirements pertaining to the use of multi-intervals on an MDMD. The WG notes that NIST Handbook 44, MDMD Code paragraph T.2.3., despite

its title (i.e., Multi-interval (Variable Division-Value) Devices) was never intended to apply to devices that measure using multi-intervals in two or more partial measuring ranges within the same axes. Instead, the paragraph applies to devices that measure to a different division value in at least one of the dimensioning axes in comparison to the other two. Multi-interval MDMDs intended for commercial application exist in today's marketplace. The purpose of this proposal is to amend NIST Handbook 44 so as to differentiate between these two different applications and add requirements to address the use of multi-intervals on MDMDs. There are currently no requirements in the MDMD Code of NIST Handbook 44 that apply to the use of multi-intervals on an MDMD, yet equipment with multi intervals currently exists in the marketplace and is intended for commercial use.

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee heard comments of support for this item as written from Mr. Russ Vires (SMA) and Ms. Fran Elson-Houston (Ohio Department of Agriculture).

Mr. Robert Kennington (Quantronix, Inc. and Chair of the Multiple Dimension Measuring Device Work Group) supported the item and recommended that the Committee move the item forward with a status of Voting at the 2016 NCWM Annual Meeting.

Ms. Tina Butcher (NIST, OWM) reported that this proposal was developed and submitted by the NCWM MDMD WG to make possible the improved harmonization of United States and Canadian type evaluation criteria. That is, the MDMD WG identified a number of gaps in NCWM Publication 14 when comparing United States and Canadian type evaluation criteria and before a recommendation can be made to the NTEP Committee to address these gaps, there needs to be some NIST Handbook 44 requirements in place, which allow for the changes. There are three main parts to this proposal. Each main part is intended to address a particular gap associated with the inspection of an MDMD equipped with multi-intervals as follows:

1. The maximum value of tare for multi-interval MDMDs;
2. How mathematical agreement is to be met when a tare is entered in a lower measuring range than the range in which the measurement will take place;
3. The application of tolerances to multi-interval and mixed interval MDMDs.

In developing the proposal to address mathematical agreement, the MDMD Work Group recognized the differences in the requirement in the Scales Code from that being proposed for the MDMD Code. That is, the Scales Code (paragraph S.1.2.1.) provides a means for mathematical agreement to be met without the need to round or alter any values by allowing the net weight indication to be expressed in a value other than 1, 2, or 5, or a decimal multiple or submultiple of 1, 2, or 5 when a tare is taken in a lower weighing range and subtracted from a gross weight in a higher weighing range. The proposal, on the other hand, offers no such provision and requires the net value be indicated and recorded, if so equipped, to the nearest division of the measuring range in which the net value occurs. Thus, in instances where a tare value is entered on a multi-interval device in a lower partial measuring range than the gross indication, the system must either alter the tare entered or round the net result after subtraction of the tare in order to achieve mathematical agreement in accordance with the proposal.

In its decision to deviate from drafting a proposal similar to the requirement in the Scales Code, the WG considered the following:

- The proposal (i.e., proposed paragraph S.2.2.2.) reflects what is considered acceptable by Canadian standards with respect to the net measurement result when tare is taken on a multi-interval MDMD.
- Tare is not a feature typically used on MDMDs by U.S. shipping companies.
- Scales Code paragraph S.1.2.1. does not prohibit the rounding of either the tare value or the net weight indication to achieve mathematical agreement on a multi-interval scale in instances where a tare value is entered in a lower weighing range than the gross weight indication. Instead, the word "may" is used rather than "shall" to describe how the subtraction of a value is to occur.

- Members of the WG acknowledged that very few, if any, multi-interval MDMDs are known to exist in the U.S. marketplace.

OWM believes the proposal as written is appropriate and would allow for the improved harmonization of United States and Canadian type-evaluation criteria.

In consideration of the comments received in support of this item, the Committee agreed to present this item for a Vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, the Committee heard comments in support of this item, as written, from Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA; Mr. Robert Kennington (Quantronix, Inc.), speaking on behalf of and as Chair of the Multiple Dimension Measuring Device Work Group; and Mr. Scott Henry (Zebra Technologies).

The Committee also heard support for this item from Ms. Tina Butcher (NIST, OWM), and Ms. Fran Elson-Houston (Ohio).

In consideration of the comments received in support of this item, the Committee recommended it be presented for Vote.

Regional Association Comments:

The WWMA, at its 2015 Annual Meeting, noted that the MDMD Work Group expressed support for this proposal as a Voting item. The WWMA has concerns about rounding rules applied in this proposal with respect to tare. It is possible for the tare to round to a smaller value or possibly no value as indicated in the example found in Table 1 when the device converts to a larger division size. The WWMA recommends that the device shall retain the correct tare value from the lower range when the device transitions to a higher range. The WWMA suggests that the submitter review the Scales Code 2.20., S.1.2.1. Digital Indicating Scales Units, for potential reference. The WWMA forwarded the item to the NCWM, recommending that it be a Developing item with modifications as follows:

S.2.2. Tare. – The tare function...

S.2.2.1. Maximum Value of Tare for Multi-Interval (Variable Division-Value) Devices. – A multi-interval device shall not accept any tare value greater than the maximum capacity of the lowest range of the axis for which the tare is being entered.

S.2.2.2. Net Values, Mathematical Agreement. – All net values resulting from a device subtracting a tare entry from a gross value indication shall be indicated and recorded, if so equipped, to the nearest division of the measuring range in which the net value occurs. In instances where the tare value entered on a multi-interval device is in a lower partial measuring range (or segment) than the gross indication, the system shall either alter the tare entered or round the net result after subtraction of the tare in order to achieve correct mathematical agreement.

The following example (of a multi-interval device having two partial measuring ranges for the “x” axis) and accompanying two tables are provided to further clarify the two acceptable methods a device can use to achieve mathematical agreement when tare has been entered in a lower partial measuring range than the gross indication:

Example multi-interval device having two partial measuring ranges for the “x” axis:

- **Partial measuring range 1: 0 – 100 inches by 0.2 inch**
- **Partial measuring range 2: 100 – 300 inches by 0.5 inch**

Table 1: Examples of Acceptable Altering of Tare to Achieve Accurate Net Indication

<u>Gross Indication of Item Being Measured</u>	<u>Tare Entered</u>	<u>Value of Tare after Being Altered by the Device</u>	<u>Acceptable Net Indication</u>
<u>154.5 inches</u>	<u>41.2 inches</u>	<u>41.0 inches</u>	<u>113.5 inches</u>
<u>154.5 inches</u>	<u>41.4 inches</u>	<u>41.5 inches</u>	<u>113.0 inches</u>

Table 2: Examples of Acceptable Rounding of the Net Result (Following the Subtraction of Tare) to Achieve Accurate Net Indication

<u>Gross Indication of Item Being Measured</u>	<u>Tare Entered</u>	<u>Net Result Before Rounding (Gross Indication Minus Tare Entered)</u>	<u>Acceptable Net Indication Rounded to Nearest 0.5 inch</u>
<u>154.5 inches</u>	<u>41.2 inches</u>	<u>113.3 inches</u>	<u>113.5 inches</u>
<u>154.5 inches</u>	<u>41.4 inches</u>	<u>113.1 inches</u>	<u>113.0 inches</u>

Amend Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring Equipment as follows:

Table S.4.1.a. Marking Requirements for Multiple Dimension Measuring System				
	Multiple Dimension Measuring Equipment			
	Multiple Dimensions Measuring Device and Indicating Element in Same Housing	Indicating Element not Permanently Attached to Multiple Dimension Measuring Element	Multiple Dimension Measuring Element not Permanently Attached to the Indicating Element	Other Equipment (1)
To Be Marked With ↓				
Manufacturer's ID	x	x	x	x
Model Designation	x	x	x	x
Serial Number and Prefix	x	x	x	x (2)
Certificate of Conformance Number (8)	x	x	x	x (8)
Minimum and Maximum Dimensions for Each Axis for Each Range in Each Axis (3)	x	x	x	
Value of Measuring Division, d (for each axis and range)	x	x	x	
Temperature Limits (4)	x	x	x	
Minimum & Maximum speed (5)	x	x	x	
Special Application (6)	x	x	x	
Limitation of Use (7)	x	x	x	

Amend paragraph T.2.3. Multi-Interval (Variable Division-Value) Devices and add a new paragraph T.2.4. Mixed-interval Devices. as follows:

T.2.3. Multi-interval (Variable Division-Value) Devices. – For multi-interval (variable division-value) devices, When there exists two or more partial measuring ranges (or segments) specified for any of the “dimensioning” axes (length (x), width (y), or height (z)) and the division values corresponding to those partial measuring ranges (or segments) within the same “dimensioning” axis differ, the tolerance values are shall be based on the value of the device division of the range in use.

T.2.4. Mixed-interval Devices. – For devices that measure to a different division value in at least one dimensioning axes and all axes are single range, the tolerance values shall be based on the value of the division of the axis in use.

At both its 2015 Interim Meeting and 2016 Annual Meeting, NEWMA recommended the item be presented as a Voting item on the NCWM agenda.

The SWMA, at its 2015 Annual Meeting, forwarded the item to NCWM and recommended that it be a Voting item.

The CWMA, at its 2015 Interim Meeting reported the item has merit and should remain Developing. At its 2016 Annual Meeting, the CWMA reported it feels the item is fully developed and the comments received were in support of the item. The CWMA recommended the item be Voting on the NCWM Agenda.

360 OTHER ITEMS

360-1 D Electric Watthour Meters Code under Development

Source:

NIST OWM (2016)

Purpose:

Create a Developing item for inclusion on the NCWM S&T Committee Agenda where progress of the USNWG can be reported as it develops legal metrology requirements for electric watthour meters and continues work to develop test procedures and test equipment standards, including the following.

1. Make the weights and measures community aware of work being done within the U.S. National Work Group on Electric Vehicle Fueling and Submetering to develop proposed requirements for electric watthour meters used in submeter applications in residences and businesses.
2. Encourage participation in this work by interested regulatory officials, manufacturers, and users of electric submeters.
3. Allow an opportunity for the USNWG to provide regular updates to the S&T Committee and the weights and measures community on the progress of this work.
4. Allow the USWNG to vet specific proposals as input is needed.

Item under Consideration:

This item is currently under development and there is not yet any specific proposal for consideration by the NCWM or the weights and measures community.

Background/Discussion:

In 2012, NIST, OWM formed the U.S. National Working Group on Electric Vehicle Fueling and Submetering to develop proposed requirements for commercial electricity-measuring devices (including those used in sub-metering electricity at residential and business locations and those used to measure and sell electricity dispensed as a vehicle

fuel) and to ensure that the prescribed methodologies and standards facilitate measurements that are traceable to the International System of Units (SI).

In 2013, the NCWM adopted changes recommended by the USN WG to the NIST Handbook 130 requirements for the Method of Sale of Commodities to specify the method of sale for electric vehicle refueling. At the 2015 NCWM Annual Meeting, the NCWM adopted NIST Handbook 44, Section 3.40. Electric Vehicle Refueling Systems developed by the USN WG.

This Developing item is included on the Committee's agenda (and a corresponding item is proposed for inclusion on the L&R Committee Agenda) to keep the weights and measures community apprised of USN WG current projects, including the following:

- The USN WG continues to develop recommended test procedures for inclusion in a new EPO 30 for Electric Vehicle Refueling Equipment along with proposed requirements for field test standards.
- The USN WG is continuing work to develop a proposed code for electricity-measuring devices used in sub-metering electricity at residential and business locations. This does not include metering systems under the jurisdiction of public utilities. The USN WG hopes to have a draft code for consideration by the community in the 2016 - 2107 NCWM cycle.

The inclusion of Developing items on both the L&R and S&T Committee agendas is intended to provide for a venue to allow the USN WG to update the weights and measures community on continued work to develop test procedures and test equipment standards. These items will also provide a forum for reporting on work to develop proposed method of sale requirements for electric watt-hour meters and a tentative device code for electric watt-hour meters in residential and business locations and serve as a placeholder for eventual submission of these proposals for consideration by NCWM. The USN WG welcomes input from the community on this work.

For additional information, contact USN WG Chairman Tina Butcher at tbutcher@nist.gov or (301) 975-2196 or Technical Advisor, Juana Williams at Juana.williams@nist.gov or (301) 975-3989

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee received an update on the progress of this item from Ms. Tina Butcher (NIST, OWM). Several officials voiced support for the continued development of the Electric Watt-hour Meters Code. In consideration of the comments received in support of the item, the Committee agreed to recommend the item continue in a Developing status.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, Ms. Tina Butcher (OWM) provided an update on the development of this item, which summarized the following written OWM comments and recommendations provided to the Committee during the meeting:

The USN WG on Electric Vehicle Fueling and Submetering last met on July 6, 2016. The following summarizes key activities and issues currently under development in the USN WG:

- **Restructuring of USN WG:**
Since its inception, the scope of the USN WG has included the development of proposed standards, test procedures, and other requirements for (1) electric vehicle fueling systems; and (2) electric watt-hour meters used as submeters (in applications falling under the jurisdiction of weights and measures jurisdictions). Following the adoption by the NCWM of the Tentative Code on Electric Vehicle Fueling Systems in July 2015, the USN WG recognized that individuals may have an interest in only one or the other topic, though some may have an interest in both areas. The USN WG is reviewing proposed modifications to its charter which will restructure the WG into one subgroup to address electric vehicle refueling and another subgroup to address electric watt-hour meters. This will allow the group to more efficiently address these two areas of work.

- **Test Equipment and Test Procedures for Electric Vehicle Fueling Systems:**
A Subcommittee, chaired by Mr. Ted Bohn, Argonne National Laboratory, continues to work on the development of recommended criteria for test equipment and test procedures. The Subcommittee last met in March 2016. Multiple field trials are planned to vet proposed test procedures. At least two companies have developed prototype field standards for use by weights and measures jurisdictions and service personnel for testing EVSE in the field.
- **Electric Watt Hour Meters:**
A draft NIST Handbook 44 code for electric watt-hour meters was circulated to the USNWG in November 2015. This draft was extracted from an original draft code drafted by NIST several years ago that included requirements for both electric watt-hour meters and electric vehicle refueling systems.

The USNWG plans to hold an in-person meeting late fall 2016 to continue work on the draft code. Both California Division of Measurement Standards and Ohio Weights and Measures have graciously offered to host this meeting.

In consideration of the ongoing work on this item, the Committee agreed to maintain its Developing status.

Regional Association Comments:

NEWMA and the SWMA, at their 2015 Annual Meetings, forwarded this item to NCWM, recommending it be a Developing item. NEWMA also recommended the item be Developing at its 2016 Annual Meeting in consideration of the ongoing work by the USNWG to develop the item.

The CWMA recommended, at its 2016 Annual Meeting, the item be Developing on the NCWM Agenda and indicated it feels the item has merit and comments received were in support of the item.

360-2 W Appendix A – Fundamental Considerations, 2.1. Acceptance and Maintenance Tolerances

(This item was Withdrawn.)

Source:

Ross Andersen, Retired (2016)

Purpose:

Amend Section 2.1 of Fundamental Considerations to make it more effectively explain the purpose and application of NIST, Handbook 44 tolerances.

Item under Consideration:

Amend NIST Handbook 44, Appendix A, Fundamental Considerations as follows:

~~**2.1. Acceptance and Maintenance Tolerances.**—The official tolerances prescribed by a weights and measures jurisdiction for commercial equipment are the limits of inaccuracy officially permissible within that jurisdiction. It is recognized that errorless value or performance of mechanical equipment is unattainable. Tolerances are established, therefore, to fix the range of inaccuracy within which equipment will be officially approved for commercial use. In the case of classes of equipment on which the magnitude of the errors of value or performance may be expected to change as a result of use, two sets of tolerances are established: acceptance tolerances and maintenance tolerances.~~

~~Acceptance tolerances are applied to new or newly reconditioned or adjusted equipment, and are smaller than (usually one half of) the maintenance tolerances. Maintenance tolerances thus provide an additional range of inaccuracy within which equipment will be approved on subsequent tests, permitting a limited amount of deterioration before the equipment will be officially rejected for inaccuracy and before reconditioning or adjustment will be required. In effect, there is assured a reasonable period of use for~~

~~equipment after it is placed in service before reconditioning will be officially required. The foregoing comments do not apply, of course, when only a single set of tolerance values is established, as is the case with equipment such as glass milk bottles and graduates, which maintain their original accuracy regardless of use, and measure containers, which are used only once.~~

2.1. Equipment Tolerances. – The official tolerances prescribed by a weights and measures jurisdiction for commercial equipment are the limits of inaccuracy officially permissible within that jurisdiction. These limits are set by means of tolerances which are codified to fix the range of inaccuracy within which equipment will be approved for commercial use when undergoing official tests. Alternatively, equipment that is performing outside these tolerance limits will be rejected and removed from service.

Regulatory decisions, to either approve or reject equipment, come with risks. Measurements are imperfect; meaning measurement without error is unattainable. All measurements involve rounding to the chosen increment of scale, all are subject to random variations, and all are affected by influences, disturbances, biases, and drift. This applies equally to the measurements being made by the commercial equipment, and to the official measurements made to verify that equipment. With these unavoidable uncertainties in the measurements, it is possible, and in fact likely, that compliant equipment will sometimes be rejected and non-compliant equipment will sometimes be approved. The regulatory approach used in this handbook recognizes the risks, attempts to limit the risks to reasonable levels, and, most importantly, balances the risks between buyer and seller. The approach has three primary concerns; accurate official standards, uniform test procedures, and limited equipment variability.

Accurate Official Standards – Each of the specific codes in the handbook prescribes the appropriate verification standards for official testing. The error in the verification standards is limited by a separate set of tolerances that are smaller than the tolerances applied to the equipment under test. These tolerances (see Part 3 of this Appendix) limit the biases imparted to the test directly from any error or bias inherent in the standards. However, these tolerances for the standards do not address the effects of influences, disturbances and drift on the standards when used in official testing.

Uniform Test Procedures – Each of the specific codes in this handbook prescribes uniform test procedures in the Notes section for various types of commercial equipment. These procedures evaluate equipment performance under varying operating conditions consistent with normal usage. The official performing the tests should ensure the procedures are followed meticulously so as to minimize the variability from these procedural sources. Although the procedures may be performed correctly, it is not possible to eliminate the effects of random variations, influences, disturbances, and biases from the procedures.

Limited Equipment Variability – Each of the specific codes in this handbook recognizes a reasonable amount of variability normally expected for each type of commercial equipment and the unique commodities or services measured. The equipment is subject to the effects of random variations, influences, disturbances, biases, and drift. In addition, the commodities and services are variables, as their properties affect how they are measured by the equipment.

Any official test result includes the variability from all three of the sources described above. When dealing with this variability, however, it is not practical to evaluate testing uncertainties for each inspector and each individual piece of equipment. The costs would be enormous to the regulatory agencies. Instead, the regulatory approach used in this Handbook is to view the process in terms of the tests on the entire population rather than on the single piece of equipment. In this context, the variability of the combined measurement is not a simple sum of the three parts, but rather a combination based on probabilities. We can express those probabilities using standard deviations (sd) for each of the terms. If we use S for standards, P for procedures and E for equipment, then we can express the total variation of the system using the formula below.

$$\text{Total Variability} = \sqrt{(\text{sd}^2\text{S} + \text{sd}^2\text{P} + \text{sd}^2\text{E})}$$

Essentially the prescribed tolerance limit is a formal cap to equipment variability including variation from all sources in the verification, (i.e., variability in the standards and in the performance of prescribed test procedures). (See General Code G-S.5.4.) If the variability of the standards and the test procedure are small relative to that of the equipment, their impact on the total variability can be shown to be relatively small. Thus, the equipment variability emerges as the primary source of the variation within the population. Measurement science confirms that measurement performance behaves normally, producing a population that has probabilities approximating a bell-shaped curve. It is critical to understand that the probabilities of false rejection and false acceptance are equal under this approach and the risks are equally distributed between buyers and sellers. The tolerance limits serve to identify individual pieces of equipment in the tails of the bell that should be rejected and then adjusted back to the middle of the population. Examples of the impacts of various levels of variability for the three components are shown in the table below.

<u>sd Equipment</u>	<u>sd Standards</u>	<u>sd Procedures</u>	<u>sd Total Variability</u>	<u>*Contribution of Equipment %</u>
<u>1</u>	<u>1/3</u>	<u>1/3</u>	<u>1.106</u>	<u>90</u>
<u>1</u>	<u>1/4</u>	<u>1/4</u>	<u>1.061</u>	<u>94</u>
<u>1</u>	<u>1/5</u>	<u>1/5</u>	<u>1.039</u>	<u>96</u>
<u>1</u>	<u>1/10</u>	<u>1/10</u>	<u>1.010</u>	<u>99</u>

Contribution of Equipment % is calculated as sd Equipment/sd Total Variability*100

The general rule for tolerance application pertains to equipment that is adjustable. It employs two levels of tolerances, acceptance tolerances and maintenance tolerances, where acceptance tolerance values are generally one-half the value of maintenance tolerances. These tolerances are applied based on a timeline. The timeline begins when the equipment is initially placed in service and ends when the equipment is either officially rejected, undergoes a major reconditioning or overhaul, or is decommissioned by the user.

A) Tolerances when placed in service: Equipment is tested when it is initially placed in service. Based on the test result(s), it is adjusted to bring performance error(s) as close as practicable to zero error. In addition, all errors must be within the acceptance tolerances. (See General Code Paragraphs GUR.4.3. and GT.1.) However, when making any adjustment it is not possible to know the impacts of the random variations, influences, disturbances, and biases on the measurements at that moment. By adjusting as close as practicable to zero error, there is a balanced risk of introducing bias in the equipment to either overregister or underregister (but still perform within the acceptance tolerance). Thus, over the entire population of equipment, the adjustments result in equipment performance that is bunched close to zero error and a population that is not skewed in favor of either buyer or seller.

B) Tolerances on official tests made within the first 30 days after placement in service: In the first 30 days after adjustment, acceptance tolerances are applied to any official tests of the equipment. Over a 30-day period after adjustment, the range of influences is expected to be small and there should be minimal drift in the equipment, thus the smaller acceptance tolerances are deemed appropriate.

C) Tolerances on official tests made 31 or more days after placement in service: For any official test after the first 30 days in service, maintenance tolerances are applied. This larger tolerance recognizes the effects of a full range of influences and allows for small amounts of drift before the equipment will be officially rejected and require readjustment, repair, or major reconditioning or overhaul. Provided performance is maintained within the maintenance tolerances, the equipment can remain in service indefinitely. However, any out-of-tolerance performance in an official test is grounds for rejection and this creates a new timeline starting again at placement in service.

The special rule for tolerance application pertains to devices that are not adjustable, like steel tapes, timing devices, glass graduates, and measure-containers. For these devices the specific code prescribes only a

single level of tolerances that are applied in all official tests of the equipment. These tolerances are applicable at all times the device is in service.

Background/Discussion:

The submitter provided the following statements:

Recent discussions within the Work Group on Multi-Point Calibrations have, I believe, exposed a significant weakness in this section of the Fundamental Considerations. Those discussions revealed that people may misunderstand what tolerances are for and why they are necessary. In particular, I would point to the following sentences from the first and second paragraphs of Section 2.1.:

In the case of classes of equipment on which the magnitude of the errors of value or performance may be expected to change as a result of use, two sets of tolerances are established: acceptance tolerances and maintenance tolerances. (emphasis added)

Maintenance tolerances, thus, provide an additional range of inaccuracy within which equipment will be approved on subsequent tests permitting a limited amount of deterioration before the equipment will be officially rejected for inaccuracy and before reconditioning or adjustment will be required. (emphasis added)

These passages seem to suggest that any change in performance in a commercial device performance between tests is due to deterioration, or to be more precise, instrumental drift. I strongly believe this section has reinforced some poor assumptions by failing to recognize that variability in test results are most often due to the impact of influences and other random factors. We easily recognize influences that change device performance over short time frames. Consider the impact of flow rate on many metering devices. We can imagine a single performance curve of delivery error vs. flow rate where the errors at minimum rated flow rate show underregistration (plus error) but are close to zero error at maximum delivery rate. This is why we test both at normal and low flow rates. With a limited timeframe, there is a tendency to think those results are representative of all possible test conditions.

However, if we collect data over an extended time period we see that changes in viscosity may not only offset the device performance curve but also change the shape of the flow rate curve. I have seen test results from Measurement Canada's volumetric lab on a positive displacement meter using the same product at temperatures of 0 °C, 15 °C and 30 °C. Their analysis clearly shows that performance changes reached 0.4 % at fast flow over a 30 °C range for diesel fuel. These changes were shown to correlate very closely with the observed change in viscosity due to temperature. For Petrosol over the same temperature range, the difference was about 0.34 %. I think this makes sense as the change in viscosity over temperature will be less for products with lower viscosity.

In 1986, the entire Scales Code was revised. A major part of that revision was the inclusion of tolerances for influence factors. We began to understand why some scales set to zero in the summer failed when tested in the winter and vice versa. These failures weren't being caused by instrumental drift, i.e., permanent changes in performance. It was just a case of the normal range of influences on the output of the load cells. The code changes required production of load cells that could maintain performance within acceptance tolerance over the temperature ranges a device should normally see. No one picked up that this section in Fundamental Considerations should have been changed when influence factor tolerances were added to the Scales Code, but not only for the Scales Code. It should have been changed for all codes since influences affect all measurements. This proposal seeks to correct that omission and give influences and other sources of variability due recognition in the explanation of how tolerances work in NIST Handbook 44.

There is another related issue, which requires us to understand the real purpose of G-S.5.4. Because the title of G-S.5.4. includes the term "repeatability" and we have tests for repeatability, people think this paragraph refers only to repeatability tests. Instead I suggest it refers to any and all tests. It can't reasonably be restricted to repeatability tests because the second sentence clearly covers performance under varying conditions. In a repeatability test, you are required to test under only one set of conditions.

If I ask you to point out where in the NIST Handbook 44 codes it specifically says that a device must perform within tolerance, where would you point? The tendency is to point either to the tolerance sections of either the General Code or the specific codes. However, those sections only declare what the tolerances values are when you are to apply the various types of tolerances. Nowhere in these sections can you find it clearly stated that the commercial device is required to conform to the tolerances. You can try to stretch it from the general meaning of the term tolerance, but I think that is unnecessary. The specific code requirement requiring performance within tolerances under all test conditions is G-S.5.4.! It is by extension that we expect the equipment to perform within tolerance under normal conditions of use.

There is another critical bit of text in G-S.5.4. that significantly affects our application of tolerances. It deals with the text: “repeated performance of steps or operations that are embraced in the testing procedure.” We have to understand why this text is there. My explanation is the text is necessary to specifically explain that the prescribed tolerances include all of the uncertainties associated with the test procedures and the standards used in the tests. It says clearly that you do not need to make any further allowances or corrections for uncertainties when performing the prescribed tests with suitable standards (see Fundamental Considerations Section 3).

This becomes clearer if we parse the sentence to its basic elements.

G-S.5.4. Repeatability of Indications. – A device shall be capable of repeating, within prescribed tolerances, its indications and recorded representations. This requirement shall be met irrespective of *condition A* and of *condition B*.

Note that because of the underlined and, both conditions A and B must be met simultaneously.

Condition A is – “repeated manipulation of any element of the device in a manner approximating normal usage (including displacement of the indicating elements to the full extent allowed by the construction of the device and repeated operation of a locking or relieving mechanism).”

Condition B is – “the repeated performance of steps or operations that are embraced in the testing procedure.”

Metrology has several ways of dealing with measurement uncertainty in the verification process, where uncertainties are well established. One method is to explicitly state the uncertainties, as is done for most calibration work. Another method is called guard banding. This method essentially reduces the applicable tolerance by the uncertainty of the test. Thus, if the prescribed equipment tolerance is ± 10 units and the test uncertainty is ± 2 units, then you pass only equipment with errors up to ± 8 units. In the case of field tests of commercial devices, guard banding may not be feasible because it requires rigorous evaluation of the test uncertainty. I don’t believe that many of us in the enforcement areas have the resources to fully evaluate those test uncertainties. It would require each and every inspector to be evaluated individually over a range of devices and varying test conditions. I would add that it is unreasonable to assert that this has ever been the accepted application of the tolerances in HB44. A third method is the Test Uncertainty Ratio. In this method you establish a limit to test uncertainty that is small relative to the performance limits, i.e. usually something like 4:1.

Handbook 44 is not using any of these methods because the measurement uncertainty of the verification of commercial equipment is not well established. Instead it is using a method that aims to control the population of devices using a broad probabilistic approach. What the revisions to this section do is attempt to clarify that performance changes in equipment that we observe in official tests can be caused by a variety of causes including influences on the equipment as well as variability in the test. These tend to be the dominant causes of variability and we will find that the instrumental drift that was the target of the original text is really a minor effect. The tolerances in HB44, both on the standards and on the equipment, recognize reasonable variations but provide black-and-white pass-fail decision criteria for the inspector when conducting official tests. The overall outcome is a population that fits a bell curve centered at zero error.

While the revised text is somewhat longer than the original, I believe it is necessary to discuss all of the important measurement variables in this section and explain how they are addressed in the regulatory approach of HB44. This fills a void that I believe exists in the original text.

2016 NCWM Interim Meeting:

Mr. Ross Anderson (New York, retired) provided an explanation on the system of tolerances and explained the rationale for the current regulatory framework.

Ms. Tina Butcher (NIST, OWM) and Mr. Michael Keilty (Endress + Hauser Flowtec AG USA) suggested that the proposal may be better used in training material instead of NIST Handbook 44.

The Committee agreed that the content of the proposal could be incorporated into future training material rather than into NIST Handbook 44 and decided to withdraw this item in consideration of the comments and suggestions provided.

Regional Association Meetings:

At its 2015 Annual Meeting, the WWMA received comment from one regulator that this item may call into question the integrity of the tolerance specifications found in NIST Handbook 44 and may have other unintended consequences. The WWMA believes that elements of this proposal may have merit, but does not believe that NIST Handbook 44 is the appropriate place for this level of detail. It may unnecessarily complicate the fundamental understanding of acceptance and maintenance tolerances. The WWMA did not forward this item to NCWM and recommends that it be Withdrawn.

The CWMA reported at its 2015 Interim Meeting, it would like to have more clarification as to the need to revise this part of NIST Handbook 44. The CWMA forwarded it to the NCWM and recommended that it be a Developing item.

NEWMA, at its 2015 Interim Meeting, stated that this item is developed and forwarded it to NCWM, recommending it be an Information item:

At its 2015 Annual Meeting, the SWMA reported it doesn't believe this item is necessary and current language is sufficient. The SWMA did not forward this item to NCWM and recommends that it be Withdrawn.

360-3 I Appendix D – Definitions: Batching System (See Related Item 320-1)

Source:

Richard Suiter Consulting (2016)

Purpose:

Add a definition to NIST Handbook 44, Appendix D for batching systems.

Item under Consideration:

Amend NIST Handbook 44, Appendix D, Definitions as follows:

batching system. – One in which materials are measured in pre-determined quantities by weight and/or liquid measure. [2.20]

Background/Discussion:

Even though there are numerous batching systems in the marketplace and several batching systems, both manual and automated, have an NTEP CC, there is no definition in NIST Handbook 44 to differentiate this system from other types of weighing and measuring systems. Weights and measures officials seeing a system for the first time, particularly if automated, may have difficulty in determining what section of the Scales Code to apply. This definition will assist those officials in making that determination. The SMA Handbook of Terms and Definitions Fourth Edition 1981 includes a definition for batching systems; however, for some reason that definition has never been added to NIST Handbook 44. The definition for batching scales also has never been added even though Paragraph S.1.2. Value of Scale Division Units, makes an exception for “batching scales and weighing systems.”

2016 NCWM Interim Meeting:

At the 2016 NCWM Interim Meeting, the Committee agreed to group Item 320-1 and 360-3 together and receive comments simultaneously on these two items. See Item 320-1 for a summary of the comments received and Committee considerations regarding these two items.

The Committee agreed to amend the proposed definition of “batching system” by deleting the word “raw” as was done by the WWMA S&T Committee at its 2015 Annual Meeting and proposed by the SMA. The Committee further agreed to present the item for Vote as shown in Item Under Consideration at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, Ms. Tina Butcher (NIST, OWM) indicated that the purpose of Appendix D of NIST Handbook 44 is to define terms that are used in one or more of the codes in the handbook and to specify how they are intended to apply in those codes. The term “batching system” does not appear in the Scales Code of NIST Handbook 44 and, therefore, it would be inappropriate to include a definition in NIST Handbook 44 with a reference to that code.

She stated that the term “batching scale” does appear in NIST Handbook 44; however, there is no definition in NIST Handbook 44 for the term. The following definition appears in a 1975 edition of a publication titled, “Terms and Definitions for the Weighing Industry” once made available by the SMA:

BATCHING SCALE, N. Any scale which, by design or construction, lends itself readily to use in proportioning admixtures by weight.

OWM does not consider a batching scale and batching system the same device given the differences in the two definitions provided. That is, the definition of the term “batching scale” from the SMA publication differs from the definition of the term “batching system” presented in the proposal.

Ms. Butcher also indicated that OWM does not understand the purpose of the proposal, that is, what the submitter is trying to achieve by proposing a new definition be added. If adding a definition and referencing it to the Scales Code is to recognize the existence of some automated batching systems in which the scales used in those systems return to zero-load balance after each draft load is discharged from the weighing/load-receiving element when being used in automatic operation, the Scales Code already addresses the operation of those scales. She noted that OWM had already acknowledged in earlier comments, the existence of some automated weighing systems that by virtue of their design, fail to meet the definition of an ABWS and, therefore, the application of the ABWS Code; yet, these systems retain a “heel” following the discharge of the product comprised in each draft. The heel is part of the load that has failed to discharge during the discharge cycle. To determine accurately the amount of product discharged in each draft, these systems must take into account the weight of each remaining heel and subtract it from the weight indicated for its corresponding load. OWM believes the reason Kansas has submitted a proposal to update the ABWS Code (S&T agenda Item 322-2) is to address these systems. Adding a new definition and referencing it to the Scales Code might tend to confuse some into believing such systems don’t necessarily have to start each draft load from a zero-load balance condition or take into account the weight of each remaining heel, which would be a false conclusion.

She recommended that, if the submitter of this proposal believes a gap exists in the Scales Code and that gap is the application of that code to some of the weighing equipment used in a particular type of batching operation, then a proposal that identifies that equipment, along with corresponding proposed requirements to be applied, should be drafted and submitted for consideration. It would be inappropriate to consider the addition of a new definition into NIST Handbook 44 until a proposal supporting the inclusion of the term into the code has been submitted to the S&T Committee and adopted.

Mr. Richard Suiter (Richard Suiter Consulting, LLC) commented that the term “automated batching systems” appeared in an earlier “companion” proposal to amend the Scales Code of NIST Handbook 44, but the earlier proposal had been Withdrawn by the Committee at the 2016 NCWM Interim Meeting. It was his intent in offering the two proposals, to try and differentiate between the scales used in an automated batching system from those used in other weighing applications. He pointed out that the terms “batching scales” and “weighing systems” appear in Scales Code paragraph S.1.2. and that he believes the definition being proposed would fit these terms. He indicated there was a

need for NIST Handbook 44 to define “batching scale” and “batching systems” and asked the Committee to consider agreeing to an Information status on the item to allow for its further development.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA reported that the SMA opposes the item because currently there are no specifications and tolerances defined to support the definition.

Mr. Henry Oppermann, (W&M Consulting, LLC) reported that he had submitted written comments to the Committee in opposition to the item. He stated the proposed definition is incorrect and inappropriate based on the written comments provided.

In consideration of the comments received on this item and the submitter’s request to the Committee to assign an Information status to the item to allow time for him to develop a new Scales Code proposal intended to address scales used in batching systems, the Committee agreed to maintain the item as an Information item on its agenda.

Regional Association Comments:

During its 2015 Annual Meeting, the WWMA S&T Committee decided to strike the word “raw” from the proposal due to concerns that it might be viewed as unnecessarily restrictive. No opposition to this action was voiced during the voting session. The WWMA forwarded the item to the NCWM with the recommendation that it be a Voting item as amended below:

batching system. – One in which ~~raw~~ materials are measured in pre-determined quantities by weight and/or liquid measure. [2.20]

The CWMA reported at its 2015 Interim Meeting, it agrees that the terms “batching scale” and “batching system” are commonly used terms and should be defined. The CWMA forwarded the item to the NCWM and recommended that it be a Voting item. At its 2016 Annual Meeting, the CWMA recommended the item move forward as an Information item based on a request to downgrade the status of the item by the submitter.

NEWMA commented that this item is developed and forwarded it to NCWM, recommending it be a Voting item at its 2015 Interim Meeting. However, at its 2016 Annual Meeting, NEWMA reported it cannot recommend the item as Voting because Item 320-1 (a companion item) was Withdrawn and it was commented that there is no benefit to adding a definition unless this item was adopted. NEWMA recommended that it be an Information item to see how it can be defined.

360-4 V Appendix D – Definitions: Calibration Parameter

(This item was adopted.)

Source:

NCWM Multi-Point Calibration Group (MPCG) (2015)

Purpose:

Update the definitions in Appendix D to reflect advances in device calibration technology.

Item under Consideration:

Amend NIST Handbook 44, Appendix D – Definitions as follows:

calibration parameter. – Any adjustable parameter that can affect measurement or performance accuracy and, due to its nature, needs to be updated on an ongoing basis to maintain device accuracy, e.g., span adjustments, linearization factors, and coarse zero adjustments. [2.20, 2.21, 2.24, 3.30, 3.31, 3.32, 3.34, 3.35, 3.37, 3.38, 3.39, 5.56(a), and 5.58]

(Amended 2016)

Background/Discussion:

Calibration parameter.

In 2006, “calibration parameter” was added to sections 3.31., 3.32., 3.34., and 3.35.; these sections now need to be added to the reference string in the definition of “calibration parameter.”

Multi-point calibrated device.

New technology makes it possible to use linearization factors to optimize accuracy at multiple measurement points on devices such as meters, weighing devices, and other devices. This new technology requires a term so that devices capable of being optimized at multiple measurement points can be distinguished from devices with single point calibration. The term is used in proposals already before the Committee, and if those proposals are adopted, the term should be included in the definitions. Multi-point calibrated devices are increasingly used as commercial scales and meters. Whether or not the current meter proposals are adopted, the Conference will need to have a term to describe these devices.

In addition to proposing additional code references be added within the bracketed area immediately following the definition of “calibration parameter” in Appendix D of NIST Handbook 44, this item also previously proposed that a new definition for the term “Multi-point calibrated device” be added to Appendix D. See the Committee’s 2015 Annual Report for additional background information on this item, including the Committee’s decision to eliminate the proposed new definition from the proposal.

2016 NCWM Interim Meeting:

Mr. Clark Cooney (California, DMS) and former NIST representative on the NCWM Multi-Point Calibration Group said that the proposal includes references to additional sections where the term “calibration parameter” was used. He recommended removing the words “and multi-point calibrated device” from the title since that definition was being removed, and also recommended this item be designated as a Voting item.

Ms. Tina Butcher (NIST, OWM) recommended also including references to Sections 3.38., 3.39., and 5.58. to the bracketed portion of the definition, since the term “calibration parameter” also appears in those sections.

The Committee agreed with the recommendations heard at the open hearings and amended the proposal as shown in Item Under Consideration. The Committee further agreed to present the item for vote at the Annual Meeting.

2016 NCWM Annual Meeting:

At the 2016 NCWM Annual Meeting, Ms. Butcher (OWM) stated that OWM recommends the seven additional NIST Handbook 44 code references be added within the brackets associated with the definition of “calibration parameter” because the term currently appears in those codes and there have been no objections to including those references.

In consideration of Ms. Butcher’s comments, the Committee agreed to present the item for vote unchanged.

Regional Association Comments:

The WWMA S&T Committee did not receive comments on this item during its open hearings at the 2015 WWMA Annual Meeting. The WWMA recommended that this item be an Information item.

The CWMA at both its 2015 Interim and 2016 Annual Meetings, recommended that this item be a Voting item on the NCWM agenda.

NEWMA reported at its 2015 Interim Meeting, it realizes that multi-point calibrations are not going away and need to be addressed; however, this item needs further work by the Committee to address concerns. NEWMA recommended that this item be an Information item. At its 2016 Annual Meeting, NEWMA recommended the item be forwarded to NCWM as a Voting item.

The SWMA reported at its 2015 Annual Meeting, it believes this item is ready if Items 330-3 and 331-4 are moved forward for Voting.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

360-5 D Appendix D – Definitions: Remote Configuration Capability

Source:

NIST Office of Weights and Measures (NIST, OWM)

Purpose:

Expand the scope of the definition for "remote configuration capability" to cover instances where the "other device," as noted in the current definition, may be necessary to the operation of the weighing or measuring device or which may be considered a permanent part of that device.

Item Under Consideration:

This item is under development. Comments and inquiries may be directed to NIST Office of Weights and Measures.

A proposal to modify the definition for "remote configuration capability" as follows is under consideration:

remote configuration capability. – The ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that ~~is not~~ may or may not itself be necessary to the operation of the weighing or measuring device or ~~is not~~ may or may not be a permanent part of that device. [2.20, 2.21, 2.24, 3.30, 3.37, 5.56(a)]

(Added 1993, Amended 20XX)

Background/Discussion:

Removable digital storage devices can be used in Grain Moisture Meters (GMMs) as either data transfer devices that are not necessary to the operation of the GMM or as data storage devices which are necessary to the operation of the GMM. If removable data storage devices are necessary to the operation of the device, they are not covered by the current definition of remote configuration capability.

A USB flash drive is most likely to be used as a data transfer device. In a typical data transfer application, the USB flash drive is first connected to a computer with access to the GMM manufacturer's web site to download the latest grain calibrations that are then stored in the USB flash drive. The USB flash drive is removed from the computer and plugged into a USB port on the GMM. The GMM is put into remote configuration mode to copy the new grain calibration data into the GMM's internal memory. When the GMM has been returned to normal operating (measuring) mode, the USB flash drive can be removed from the GMM.

Although a Secure Digital (SD) memory card could also be used as a data transfer device, it is more likely to be used as a data storage device. In a typical "data storage device" application, the SD memory card stores the grain calibrations used on the GMM. The SD memory card must be plugged into an SD memory card connector on a GMM circuit card for the GMM to operate in measuring mode. To install new grain calibrations, the GMM must be turned "off" or put into a mode in which the SD memory card can be safely removed. The SD memory card can either be replaced with an SD memory card that has been programmed with the new grain calibrations or the original SD memory card can be re-programmed with the new grain calibrations in much the same way as that described in the preceding paragraph to copy new grain calibrations into a USB flash drive. In either case, the SD memory card containing the new calibrations must be installed in the GMM for the GMM to operate in measuring mode. In that regard, the SD memory card (although removable) can be considered a permanent part of the GMM in that the GMM cannot operate without it.

Note: In the above example, an SD memory card could be any removable flash memory card such as the Secure Digital Standard-Capacity, the Secure Digital High-Capacity, the Secure Digital Extended-Capacity, and the Secure Digital Input/Output, which combines input/output functions with data storage. These come in three forms: the original size, the mini size, and the micro size. A Memory Stick is a removable flash memory card format, launched by Sony in 1998, and is also used in general to describe the whole family of Memory Sticks. In addition to the original

Memory Stick, this family includes the Memory Stick PRO, the Memory Stick Duo, the Memory Stick PRO Duo, the Memory Stick Micro, and the Memory Stick PRO-HG.

At its 2011 meeting, Grain Analyzer Sector agreed by consensus that the following changes to Table S.2.5. of §5.56.(a) of NIST Handbook 44 should be forwarded to the S&T Committee for consideration:

- Add a note to Table S.2.5. to recognize the expanded scope of remote capability.
- Delete “remotely” from the second paragraph of Category 3 requirements that begins, “When accessed remotely ...” to make it clear that the requirements of Category 3 apply whether accessed manually using the keyboard or accessed by remote means.
- Add the modified second paragraph of Category 3 requirements to Categories 3a and 3b to make it clear that these requirements apply to all the subcategories of Category 3.

Because a change to the definition of remote configuration capability will apply to other device types, NIST OWM recommended that the changes to Table S.2.5., approved by the Sector in 2011, be separated into two independent proposals. One proposal would deal with the changes to Category 3 and its subcategories. The second would recommend a modification of the definition of “remote configuration capability” appearing in Appendix D of NIST Handbook 44 to recognize the expanded scope of remote capability; this proposal would be an alternative to adding a note to the bottom of Table S.2.5. to expand the definition for remote configuration for grain moisture meters (as shown in this proposal).

At its 2012 Meeting, the Grain Analyzer Sector agreed to separate its original proposal into two separate proposals and agreed to forward this proposal to change the definition of “remote configuration capability” to the S&T Committee for consideration. See also August 2012 NTEP Grain Analyzer Sector Summary, Item 5.

See the Committee’s 2013, 2014, and 2015 Final Reports for additional background information and to review the different proposals considered by the Committee to address security of equipment; the metrological parameters of which can be changed by use of some form of removable digital storage device.

2016 NCWM Interim Meeting:

At the Committee’s 2016 NCWM Interim Meeting open hearings, Ms. Tina Butcher (NIST, OWM) provided the following update on this item:

- Work on this item by members of OWM’s Legal Metrology Devices Program (LMDP) is ongoing.
- The LMDP has not done further work on this item since the 2015 NCWM Annual Meeting, but anticipates resuming work in the spring of 2016.
- The LMDP has received feedback from the Measuring Sector and Regional Associations, which it will consider when developing any new revisions to the proposal.
- The LMDP hopes to be able to complete additional draft revisions and circulate them for consideration and feedback by the W&M Community by the 2016 NCWM Annual Meeting.
- As noted at the 2015 NCWM Annual Meeting, the LMDP plans to propose a new General Code requirement to address the sealing of equipment using this technology; this would allow the same “sealing requirement” to be applied to all the different device types that might use this technology.
- Some of the device codes in NIST Handbook 44 would need to be amended to exempt equipment adjusted using a removable digital storage device from having to comply with the current sealing requirements in those codes and to reference the proposed new General Code requirement.

- Although still in early draft form, members of the LMDP presented draft revisions for the General Code requirement and an example of a proposed change to the Scales Code at the 2015 NCWM Annual Meeting and would appreciate feedback from the weights and measures community as it continues to develop this item.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA reported that the SMA looks forward to the further clarification of this item. The SMA has concerns about changing metrological parameters without proper re-sealing.

The Committee believes this item has merit and needs further development. It looks forward to being able to consider a final proposal that addresses security of equipment using this type of technology.

2016 NCWM Annual Meeting:

At its 2016 NCWM Annual Meeting, the Committee heard an update on this item from Ms. Tina Butcher (NIDT, OWM). Ms. Butcher reported that OWM had not been able to further develop the item since the 2016 Interim Meeting of the NCWM, but hoped that it could find time in the coming months to finalize a proposal for consideration in the 2017 NCWM cycle. Ms. Butcher provided a brief summary of the work that had already been completed on this item by members of OWM's Legal Metrology Devices Program and requested the Committee maintain its Developing status on the item to allow time for OWM to finish this effort. She emphasized the need for there to be new sealing requirements developed for NIST Handbook 44 to address this technology (i.e., removable digital storage devices, which can change configuration and/or calibration parameters), noting that current sealing requirements never envisioned this technology. She reported that the Grain Sector was able to resolve its issue with respect to the sealing of grain equipment; however, the problem still exists with respect to other types of devices. She further stated that if OWM is unable to further develop this item such that a proposal can be presented for consideration at the 2017 NCWM Interim Meeting, OWM would request the item be Withdrawn.

Mr. Russ Vires (Mettler-Toledo, LLC), speaking on behalf of the SMA, reported the SMA opposes the item. The SMA has concerns about changing sealable parameters without proper re-sealing.

In consideration of Ms. Butcher's request to maintain a Developing status to allow time for OWM to complete its work on the item, the Committee agreed to carry the item over on its agenda and to change the submitter from NTEP Grain Analyzer Sector to NIST OWM.

Regional Association Comments:

The WWMA, at its 2015 Annual Meeting, received comment from Ms. Tina Butcher, NIST, OWM, that work will continue on this item and proposed developing separate sealing requirements for other devices, which are adjusted using removable media. She recommended that this item be reassigned to NIST and retained it as a Developing item. The WWMA S&T Committee agrees with this request. The WWMA recommended that the item be a Developing item.

The CWMA, at its 2015 Interim Meeting, referenced concerns raised at the 2015 NCWM Interim meeting by NIST, OWM and recommended that this item remain a Developing item. At its 2016 Annual Meeting, the CWMA reported it feels this item has merit and the comments received were in support of it, but it needs development. The CWMA maintained its recommendation to the NCWM that the status of the item be kept as Developing.

NEWMA, at both its 2015 Interim and 2016 Annual Meetings recommended the item be forwarded to NCWM as a Developing item. OWM provided comments at NEWMA's 2016 Annual Meeting indicating work on the item by OWM was still ongoing.

At its 2015 Annual Meeting, the SWMA reported it understood NIST, OWM will take over the development of this item.

Additional letters, presentations, and data may have been part of the Committee's consideration. To review the supporting documentation, please refer to the "Report of the 100th National Conference on Weights and Measures" (SP1210, 2015).

Mr. Mahesh Albuquerque, Colorado | Committee Chair
Ms. Jane Zulkiewicz, Town of Barnstable, MA | Member
Dr. Matthew Curran, Florida | Member
Mr. Ivan Hankins, Iowa | Member
Ms. Rachelle Miller, Wisconsin | Member
Mr. Luciano Burtini, Measurement Canada | Canadian Technical Advisor
Mr. Rick Harshman, NIST, OWM | NIST Technical Advisor
Mr. Darrell Flocken, NCWM | NTEP Technical Advisor

Specifications & Tolerances Committee


Appendix A

Agenda Item 320-2: SMA’s Presentation Slides – V_{\min}



The slide is titled "What is V_{\min} ?" in large, bold, black letters. In the top left corner, there is a logo for "SMA" (Society for Mass Automation) featuring a stylized scale and the letters "SMA". The background is a blue gradient.

According to NIST Handbook 44, V_{\min} is the smallest load cell verification interval, expressed in units of mass, into which the load cell measuring range can be divided. V_{\min} is specified by the load cell manufacturer and verified during evaluation by NTEP or OIML.




How do you know if the V_{\min} is appropriate for the application?

S.5.4 of NIST Handbook 44 states:
For scales without a lever system:

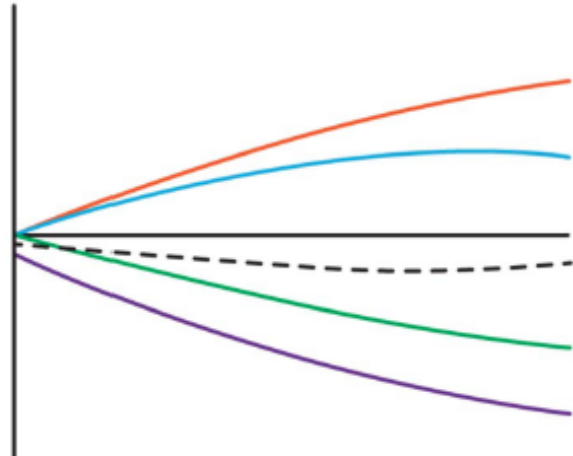
$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

Where:
d = scale division
N = number of load cells

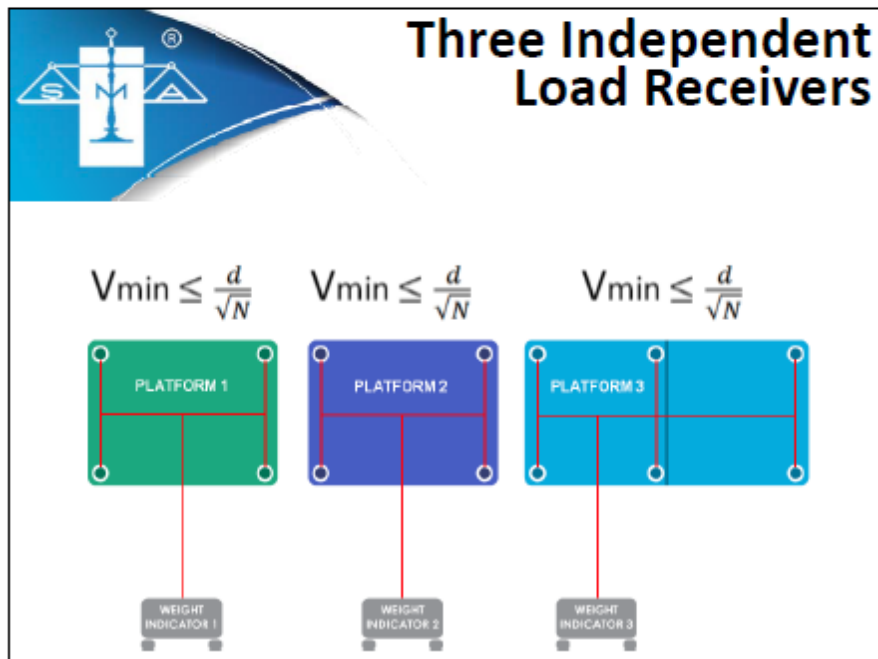
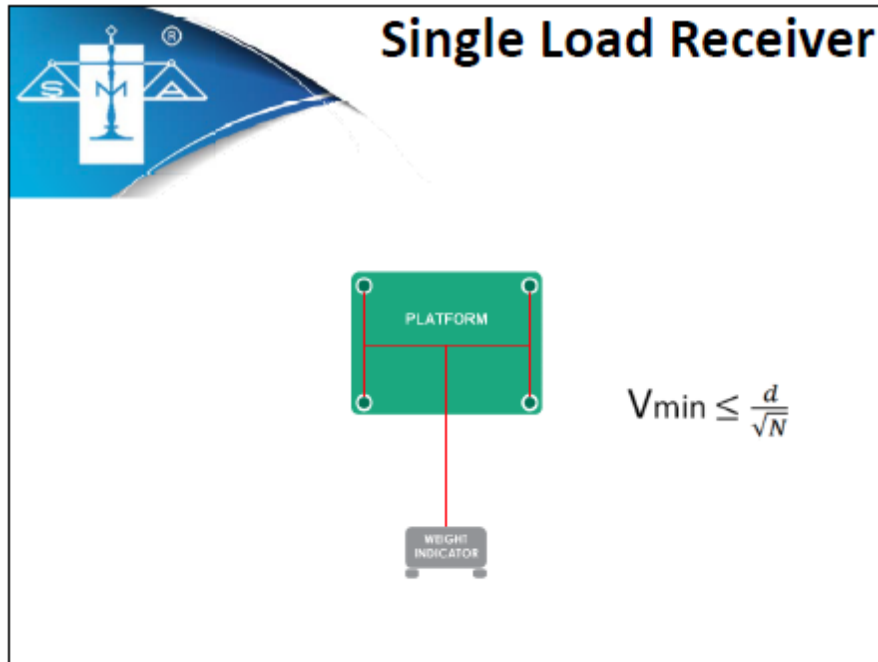


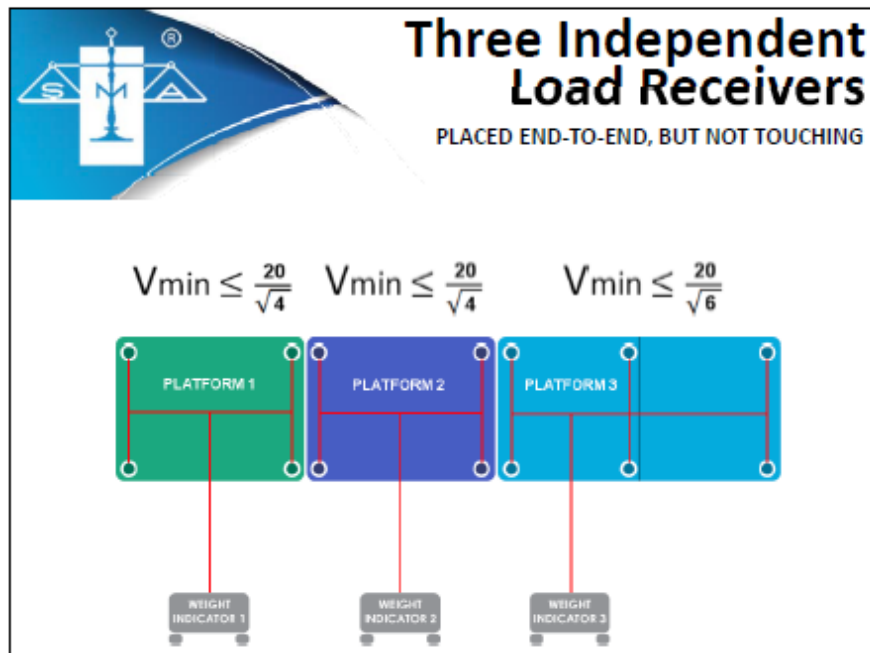
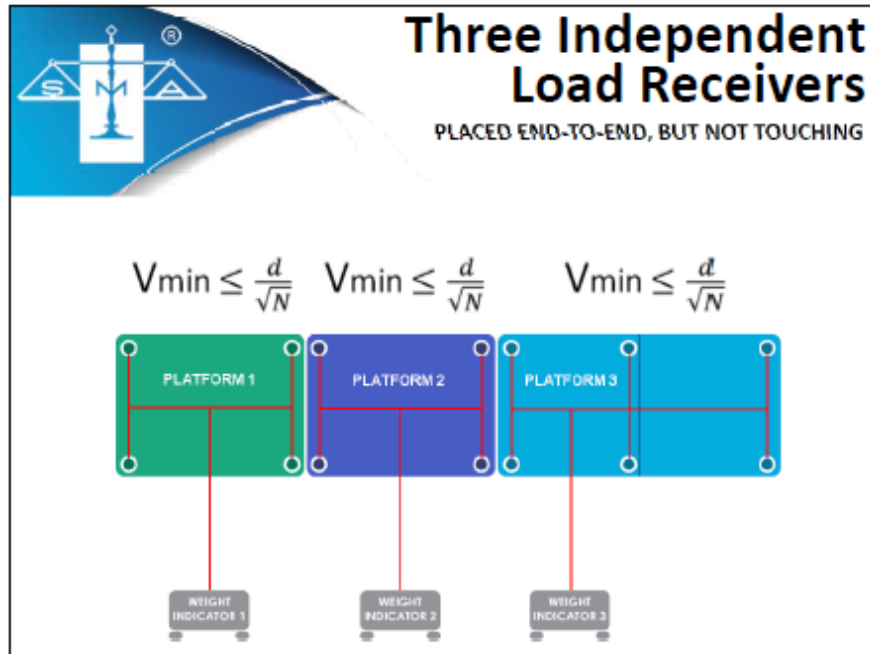
Load Cell Errors

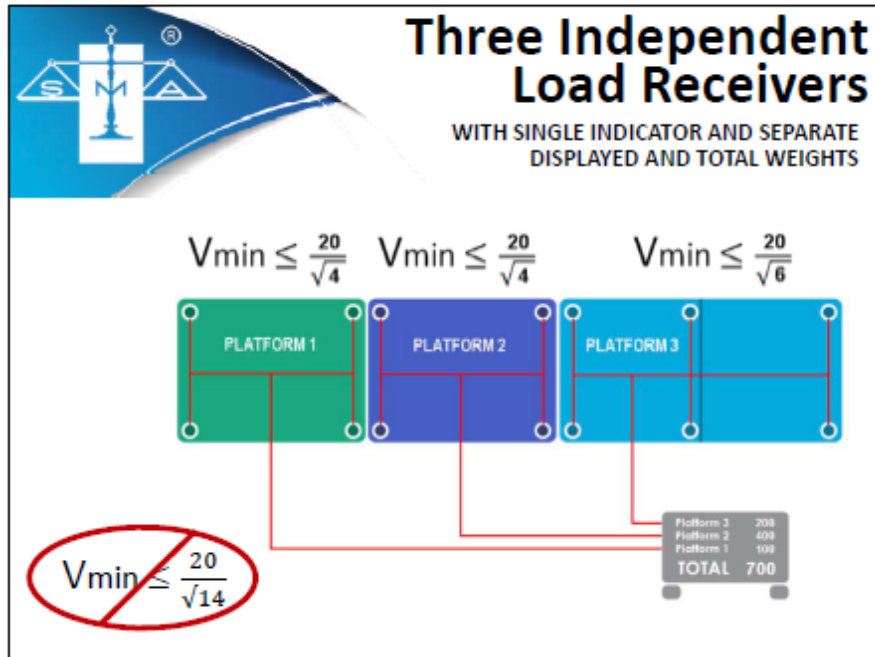
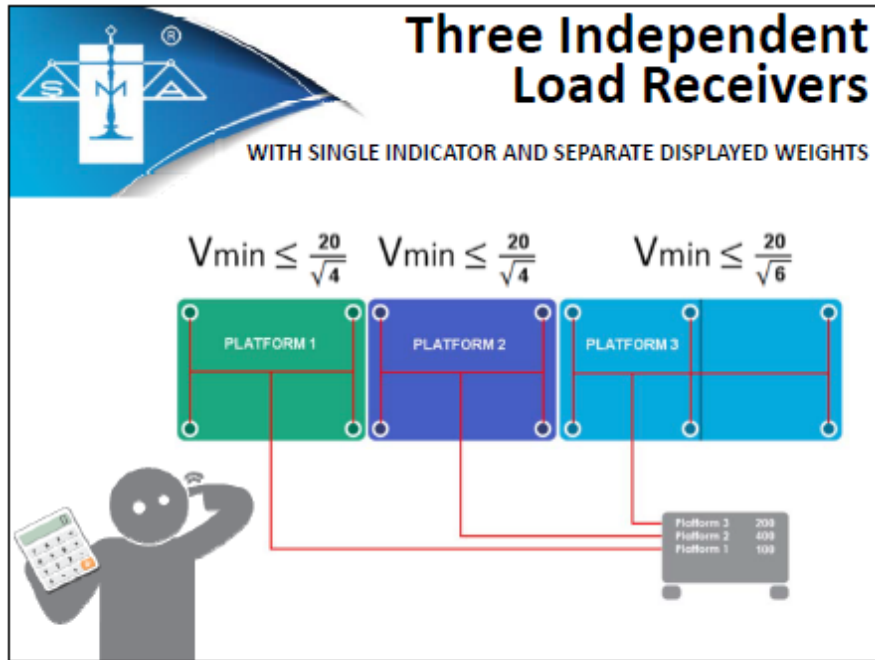
- Can be positive or negative
- Square root is used to address randomness of errors



$$V_{\min} \leq \frac{d}{\sqrt{N}}$$

Cell 1	●
Cell 2	●
Cell 3	●
Cell 4	●
TOTAL	---










Total Weight Display

- Sum of individual load receiver weight readings.
- It is **NOT** a fourth scale.
- It has no measuring function in the calculation of the total weight. It is simply the mathematical summation and nothing else.
- Because there is no measurement function, there is no scale and therefore not subject to V_{MIN} requirements.




UR.3.3 Single-Draft Vehicle Weighing

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

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

Note: This paragraph does not apply to highway-law-enforcement scales and scales used for the collection of statistical data.
(Added 1992)



LOAD RECEIVERS COMMONLY FOUND IN COMMERCIAL VEHICLE WEIGHING AND OTHER APPLICATIONS:

- Have their own weight displays for each load receiver
- Each load receiver has its own unique serial number and security seal
- May have a single catalog number that lists the individual load receivers comprising the system
- Have a single total weight display that sums the individual load receiver weight displays
- Comply with T.N. 4.4. for Shift or Section Tests




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Appendix B

Rinstrum WIM Presentation

Rinstrum WIM Presentation

NCWM 2016 Interim Meeting
San Diego CA



rinstrum
SMART WEIGHING SOLUTIONS

NCWM 2016 Interim Meeting

axleWEIGH™

- WIM Axle Scale
- Operate at 1-3 miles per hour
- Patent pending design virtually eliminates mechanical noise from load introduction
- Self contained pre cast slab with integrated weigh bridge
- Factory adjusted and leveled to ensure smooth transition
- Installed on foundation of compacted crushed stone to help absorb vibration

WIM Axle Scale



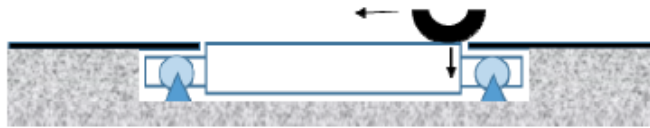


rinstrum
SMART WEIGHING SOLUTIONS

NCWM 2016 Interim Meeting

Why does it work?

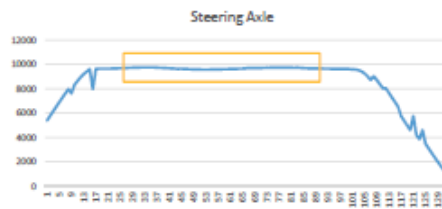
- Load Cell mounting geometry virtually eliminates mechanical noise when transitioning on/off the scale
- No “opposite lifting effect” as found on traditional designs that place the load cells in each corner under the weighbridge
- The downward force is always inside the fulcrum point(s) for all cells
- The scale “acts” as if the load is static, when in fact it is dynamically rolling across the platform



NCWM 2016 Interim Meeting



How Does It Work?



Samples	84
Average	9640
Max	9770
Min	9590
Speed	2.4
Variance	180

5385 9775 6150 6520 6890 7260 7620 7980 8330 8650 8955 9215 9410 9620 7980 9640 9650 9660 9660 9670 9680 9690 9700 9710 9725 9735 9745 9755 9765 9770 9785 9790 9770 9740 9715 9700 9685 9670 9660 9660 9625 9625 9625 9590 9590 9595 9595 9595 9595 9595 9610 9595 9610 9620 9635 9635 9645 9645 9655 9655 9715 9715 9715 9715 9715 9740 9725 9745 9750 9750 9730 9745 9745 9745 9725 9745 9725 9700 9685 9685 9685 9665 9670 9675 9675 9635 9630 9630 9640 9635 9640 9635 9640 9625 9610 9590 9540 9435 9265 9090 8730 9050 8730 8400 8045 8045 7645 7290 6910 6530 5755 5370 4985 4625 5755 4225 3855 4625 3480 3100 2730 2365 2010 1665 1325 1325

There is no special “magic” with this scale. The performance comes from reduction of mechanical noise resulting from a patent-pending load cell mounting geometry. Because the load cells work so well the controller has time and a high number of samples to average.

NCWM 2016 Interim Meeting



5 Consecutive Runs of the Same Vehicle

	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	GVW	Error
Run 1	9,640	16,000	15,600	12,560	12,580	11,780	78,160	+20 lbs.
Run 2	9,600	16,040	15,580	12,540	12,560	11,760	78,080	-60 lbs.
Run 3	9,640	16,000	15,560	12,560	12,600	11,800	78,160	+20 lbs.
Run 4	9,600	16,060	15,580	12,520	12,580	11,840	78,180	+40 lbs.
Run 5	9,620	16,040	15,580	12,500	12,560	11,860	78,160	+20 lbs.
Average	9,620	16,028	15,580	12,536	12,576	11,808		
Rounded	9,620	16,020	15,580	12,540	12,580	11,800		
Divisions	2	3	2	3	2	5		

Actual truck GVW as measured on a certified full length scale is 78,140 lbs.

NCWM 2016 Interim Meeting



NIST Traceable Test Procedure

- Dynamically test with unloaded (empty) test truck
 - Make 3 or more runs across the scale between 1 and 3 MPH
 - All runs must be in the same direction
 - Minimize engine idling and distance driven between runs for fuel-load economy
 - Take an average of all runs and set that as the vehicle TARE weight

- Dynamically test with loaded test truck
 - Load test truck with a minimum of 21,000 lbs. of NIST traceable known weights
 - Make 3 or more runs across the scale between 1 and 3 MPH
 - All runs must be in the same direction as the test runs in step 1
 - Minimize engine idling and distance driven between runs for fuel-load economy
 - Take an average of all runs and set that as the vehicle GROSS weight

- Verify Tolerance
 - Calculate the NET weight by subtracting the TARE weight from the GROSS weight
 - The scale will PASS if the NET weight is within Class III L maintenance tolerance of the test load of NIST traceable known weights used in step 2
 - Class III L Maintenance tolerance at 21,000 test load is 3d or 60 lbs.
 - Pass criteria is only applied to NET weight vs. NIST test load

NCWM 2016 Interim Meeting



Example of NIST Traceable Test Report

EXAMPLE: NIST Traceable Dynamic Test in 20 Lb. Graduations			
Vehicle Description	Item	Displayed Reading	Tolerance
Empty Test Truck	Run 1	28,360	-2d
	Run 2	28,440	+2d
	Run 3	28,420	+1
	Average	28,406	
	Calculated TARE (rounded)	28,400	
Loaded Test Truck with 21,000 lbs. Traceable Weights	Run 1	49,400	-1d
	Run 2	49,440	+1d
	Run 3	49,420	0d
	Average	49,420	
	Calculated GROSS (rounded)	49,420	
	Calculated NET Weight	21,020	+1d
	Test Load	21,000	PASS
	Variance	20 lbs.	

NCWM 2016 Interim Meeting



We heard your feedback (and want more)

1. Provide data and test results supporting the accuracy claims
2. Improve the Test Procedure with direct traceability to NIST Standards
3. Seek guidance from a new WIM work group and Conference members
4. Consider putting the WIM legal-for-trade proposal in the Scales Code
5. Remove the Direct Law Enforcement application

NCWM 2016 Interim Meeting



Appendix C

(Draft) Guidance on Empirical Analysis

This guide is intended for:

- Service agents acting under the auspices of their local regulatory authority, who are calibrating or placing meters into service with multiple linearization factors;
- Regulatory officials who witness the calibration or placing-in-service of meters with multiple linearization factors;
- Regulatory officials and service agents who are verifying the accuracy of meters with multiple linearization factors.

In theory, any properly performing meter system should be able to be calibrated with one calibration setting and remain in tolerance at any flow rate for one product, or group of similar products. Meter systems with mechanical calibrators operate in this manner. They have one calibration setting and are limited to dispensing only one product or one group of similar products. Accuracy is typically optimized at the normal flow rate for the most frequently dispensed product. This usually means there are slight errors at other flow rates, and for other products. These errors should be of no concern to the regulatory official if they are within applicable tolerances, but the device owner may wish to reduce these inaccuracies.

Modern meter registration technology allows accuracy to be optimized for multiple products at multiple flow rates through the use of linearization factors. Establishing, maintaining, and verifying these linearization factors can be time-consuming, however, because meter performance can be affected by system configurations. Differences in product density and viscosity can affect meter performance. Differences in storage tank size, location and plumbing configurations upstream of the meter may also affect meter technologies sensitive to flow profile configurations.

Device owners must weigh the benefits of optimization against the time commitment necessary to establish and maintain multiple linearization factors. It is the device owner's prerogative to determine whether each meter will be programmed with multiple flow rates and factors for each product, or with just one factor regardless of flow rate and product. If a meter is configured with only one linearization factor, it should be calibrated and verified exactly like a meter with a mechanical calibrator and register.

Meters with multiple linearization factors must initially be physically tested on each non-identical product at each configured flow rate in order to characterize the system and to determine the appropriate linearization factors. Using this initial data, regulatory officials can then determine which products can be treated as if they were identical and which as similar or discreet. The regulatory official may then also decide if and when empirical analysis may be used in conjunction with physical testing to reduce the time burden on subsequent calibrations and verifications.

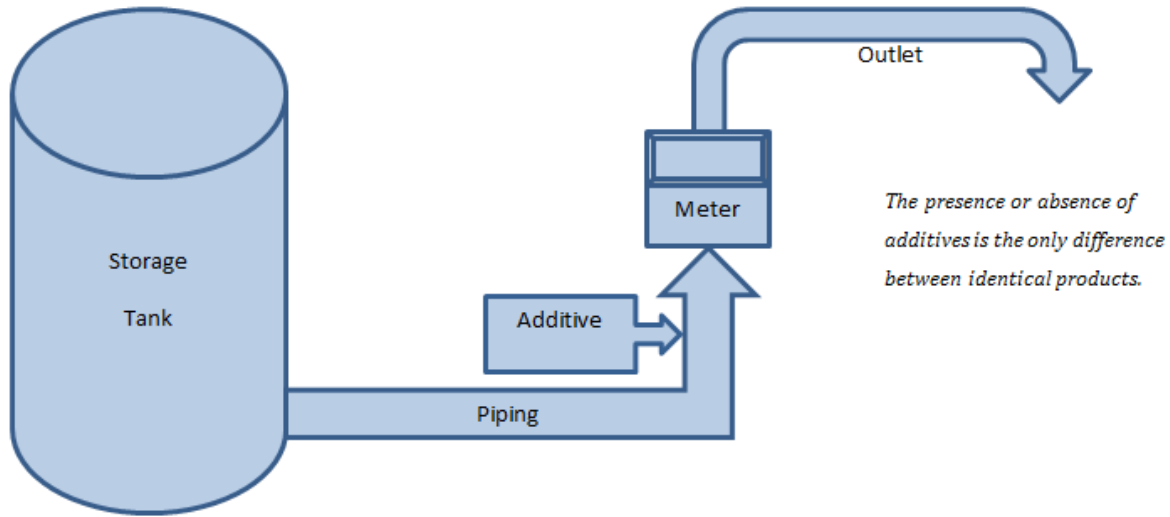
The purpose of this guidance is to aid regulatory officials (and service agents acting under the auspices of their local regulatory authorities) in determining how and when empirical analysis can be properly utilized.

INITIAL TESTING - IDENTICAL VS SIMILAR VS DISCREET PRODUCTS

Products are considered identical when:

- The base product is the same; and
- The base product flows from the same storage tank; and
- The base product uses the same piping; and

- Any differences are due only to the injection of octane enhancer or corrosion inhibitors, dye, or similar additives that do not significantly change the product's properties.



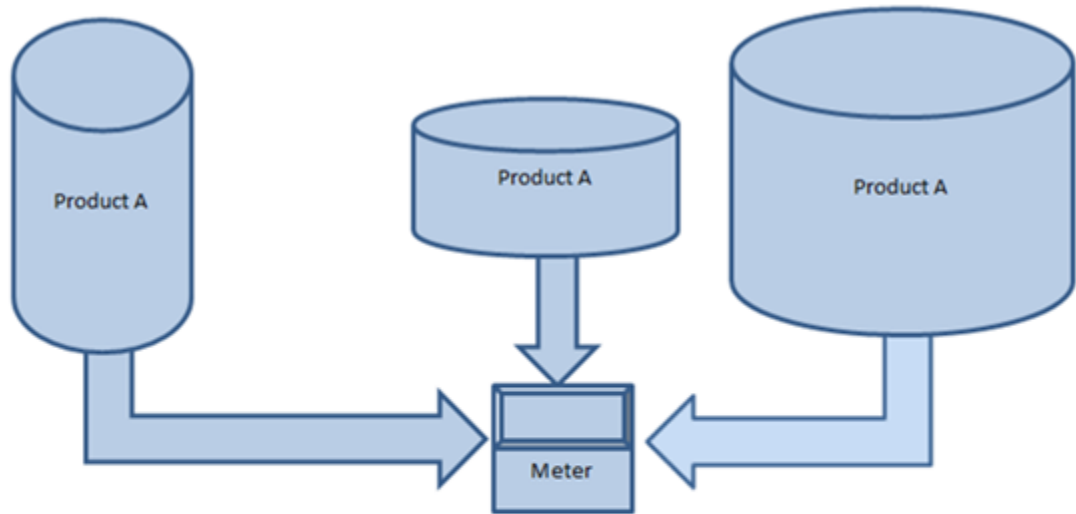
Identical products should be configured identically. Flow rates, and linearization factors at each flow rate, should be identical. Initially, only one product in a group of identical products needs to be physically tested, but it should be tested at all flow rates for which the meter is configured. On subsequent verifications, some of the flow rates may be verified empirically at the discretion of the regulatory official.

Consider, for example, a terminal meter which delivers taxed (clear) and untaxed (dyed) #2 diesel, drawn from the same tank, and delivered through the same piping. The red dye for the untaxed diesel is injected at the rack and there are no other differences between the products other than the dye. The meter is configured with the same slow flow rate, high flow rate, and intermediate flow rate for both products. It would be appropriate to physically test only the clear diesel on initial inspection at all three flow rates. The linearization factors for the dyed product should be the same as the linearization factors of the clear product. If any adjustments were made to the clear product's linearization factors, the same adjustments should be made to the dyed products factors.

At future inspections, the regulatory official may decide that the clear diesel will be physically tested at high and low flow rate rates, and its linearization factor will be empirically verified at the intermediate flow rate. The dyed diesel will always be empirically compared to the clear diesel, and its linearization factors will always match those of the clear.

Products are considered similar when:

- They are the same grade of product but flow from different storage tanks; or
- They are the same grade of product but they reach the meter through different piping; or
- They are different products listed in the same Product Family on the meter's NTEP Certificate of Conformance, and they differ by –
 - No more than 10% in viscosity (for positive displacement, turbine and similar meters); or
 - No more than 10% in specific gravity (for mass flow meters).



The size and shape of storage tanks, the horse power of different pumps, and the length and configuration of the plumbing, can affect the performance of some meters. Initial testing is needed to determine if the same product coming from different tanks can be considered to be similar, or if the product in each tank must be treated as if it was discreet.

Initial physical testing of the meter should be done with all non-identical products at all flow rates. The official with regulatory authority will use the initial test data to determine whether similar products can be treated as if they were identical on subsequent verifications and calibrations.

Initial data may show that the meter performs as if some products were identical. For example, different batches of gasoline with the same octane but drawn from different tanks may have identical linearization factors at every flow rate. Such products can be treated as if they are identical. [Note: Some meter technologies are sensitive to upstream flow dynamics caused by environmental factors like pump horse power, tank shape and size, or plumbing configurations. Do not assume that the meter will perform identically with product of the same grade from different tanks. Verify through physical testing before making that determination.] Similar products which can be treated as if they were identical should be configured with the same flow rates and identical factors at each flow rate. Only one product in the group needs to undergo physical testing on subsequent verifications. Any adjustments made to the product being physically tested should be made to the other products in the group.

Initial testing may show that some products have optimal linearization factors which are not the same, but which are so close that the products can be treated as if they were identical. For example, consider a terminal meter which delivers sub-grade, mid-grade, and premium gasoline. Initial physical testing shows that the maximum difference between their optimal linearization factors at any flow rate is less than 0.05 %. (One quarter of acceptance tolerance)

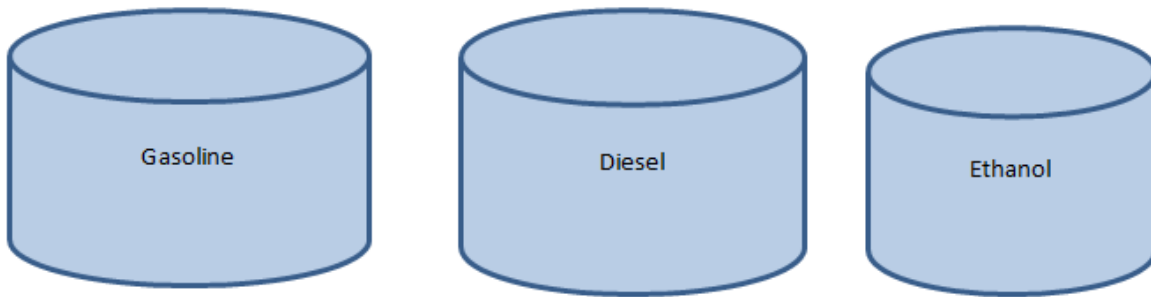
If the owner prefers to save time on subsequent verifications, the regulatory official would be justified in allowing the high and low factors to be averaged for every flow rate, and those factors to be input for all three products. These products could be treated as if they were identical on subsequent verifications. Only the intermediate product in the group would need to undergo physical testing on subsequent verifications. Any adjustments made to the product being physically tested should be made to the other products in the group.

If, however, the owner prefers to optimize accuracy and accepts that more physical testing will be required, each product can utilize its optimal linearization factor at each flow rate. The regulatory official must then determine if

physical testing will be required for all products at all flow rates, or some combination of physical and empirical testing will be allowed.

Products are considered discreet when:

- They meet the criteria of similar products except that their optimal linearization factors differ from those of other products so much that they could not utilize the same factor as another product and still be in tolerance; or
- They are listed in the different Product Families on the meter’s NTEP Certificate of Conformance; or
- They are different products listed in the same Product Family on the meter’s NTEP Certificate of Conformance, and they differ by –
 - More than 10 % in viscosity (for positive displacement, turbine and similar meters); or
 - More than 10 % in specific gravity (for mass flow meters).



Discreet products are from different product families as listed on the NTEP certificate, are from the same product family but they differ by more than 10% in viscosity or specific gravity, or are similar but initial testing has determined that they cannot use the same linearization factors and still be in tolerance.

An example of a discreet product would be ethanol dispensed through a meter that is also configured to dispense various grades of gasoline. Discreet products must always be physically tested at all flow rates initially. Regulatory officials may decide to allow empirical analysis on some flow rates during subsequent verifications.

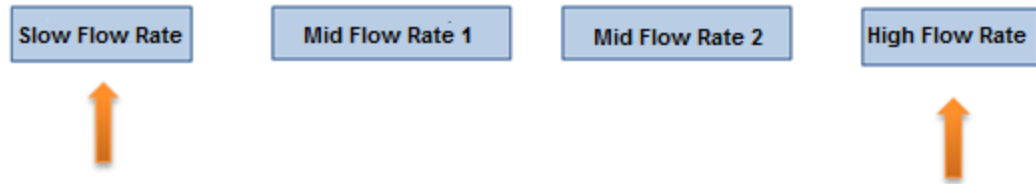
Empirical Analysis

Based on data analysis of the initial testing, the official with regulatory authority will determine if and when empirical analysis can be used on subsequent tests.

Acceptable Methods of Empirical Analysis

1. Evaluation between linearization factors on the same product, or identical products.

A product with unique linearization factors at different flow rates should not have linearization factors which are significantly different from adjacent factors. The regulatory official does not have to conduct physical testing at every flow rate, but should test the high and low flow rates at a minimum. The official can review the factors for flow rates which were not tested. Most meters have calibration curves which are roughly (not exactly) linear, so any factor which stands out as abnormally high or low should be physically verified. Identical products should always have identical factors at every flow rate.

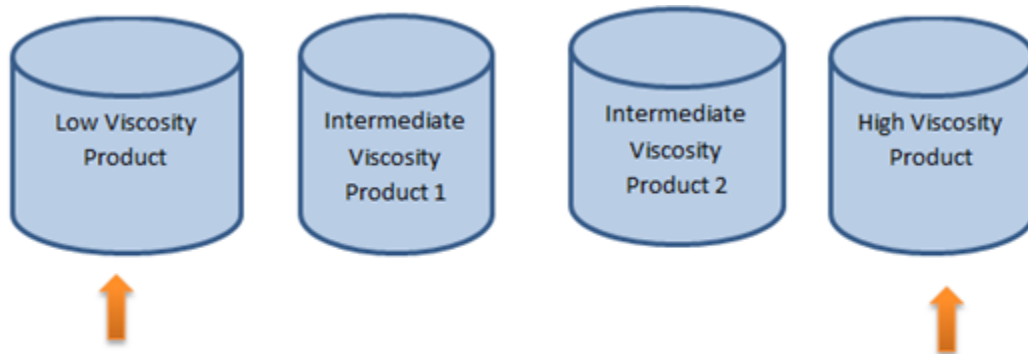


Test the slow flow rate first, and then the high flow rate. The factors for the middle flow rates should be between the factors for the high and low flow rates. The factors should be roughly linear.

2. Evaluation between linearization factors on a group of similar products.

If a group of similar products all have the same linearization factors, testing the highest and lowest viscosity products should be enough to determine whether the intermediate viscosity products will be in tolerance or not.

If the similar products have different factors, test the high and low viscosity products. The linearization factors of the intermediate products should fall between the linearization factors for the two extreme products in a progression that mirrors the relation to the viscosities of the high/low viscosity products.



Test the highest and lowest viscosity products, and then evaluate the linearization factors of the intermediate products. All products should have the same linearization factors at every configured flow rate, or the intermediate products should have factors which fall between the factors of the high and low viscosity products.

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