National Type Evaluation Program (NTEP)
Weighing Sector Agenda

August 23-24, 2016 / Denver, CO

INTRODUCTION

The charge of the NTEP Weighing Sector is important in providing appropriate type evaluation criteria based on specifications, tolerances and technical requirements of NIST Handbook 44 Sections 1.10. General Code, 2.20 Scales, 2.22 Automatic Bulk Weighing Systems, and 2.24 Automatic Weighing Systems. The Sector's recommendations will be presented to the National Type Evaluation Program (NTEP) Committee each January for approval and inclusion in NCWM Publication 14 *Technical Policy, Checklists, and Test Procedures* for national type evaluation.

The Sector is also called upon occasionally for technical expertise in addressing difficult NIST Handbook 44 issues on the agenda of National Conference on Weights and Measures (NCWM) Specifications and Tolerances (S&T) Committee. Sector membership includes industry, NTEP laboratory representatives, technical advisors and the NTEP Administrator. Meetings are held annually, or as needed and are open to all NCWM members and other registered parties.

Suggested revisions are shown in **bold face print** by **~~striking out~~** information to be deleted and **<u>underlining</u>** information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***.

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Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
ABWS	Automatic Bulk Weighing Systems	NCWM	National Conference on Weights and Measures
AREMA	American Railway Engineering Maintenance-of-Way Association	NTEP	National Type Evaluation Program
AWS	Automatic Weighing Systems	OIML	International Organization of Legal Metrology
CC	Certificate of Conformance	OWM	Office of Weights and Measures
DES	Digital Electronic Scales	R	Recommendation
IZSM	Initial Zero-Setting Mechanism	SS	National Type Evaluation Program Software Sector
LMD	Liquid Measuring Device	S&T	Specifications and Tolerances Committee
MC	Measurement Canada	SMA	Scale Manufacturers Association
MRA	Mutual Recognition Agreement	WS	National Type Evaluation Program Weighing Sector

Details of All Items
(In order by Reference Key)

CARRY-OVER ITEMS

1. Recommended Changes to NCWM Publication 14 Based on Actions at the 2016 NCWM Annual Meeting

Source:
Mr. Richard Harshman, National Institute of Standards and Technology (NIST) Technical Advisor will provide the Sector with specific recommendations for incorporating test procedures and checklist language based upon actions of the 2016 NCWM Annual Meeting. The Sector is asked to briefly discuss each item and, if appropriate, provide general input on the technical aspects of the issues.

1.a. Item 310-1 G-S.1. Identification. – (Software)

Source:
- 2010-2015 Final Reports of the S&T Committee: https://www.ncwm.net/meetings/annual/meeting-reports
- 2008-2015 Software Sector summaries: http://www.ncwm.net/committees/ntep/sectors/software/archive
- 2013-2015 Weighing Sector summaries: http://www.ncwm.net/committees/ntep/sectors/weighing/archive
- 2016 Final Report of the S&T Committee: *To Be Added*

Technical Advisor's note: This item has appeared on the Weighing Sector's Agenda from 2010 to 2015 and was titled, "Acceptable Symbols/Abbreviations to Display the Certificate of Conformance (CC) Number Via a Device's User Interface."

Background / Discussion:
At the 2016 NCWM Annual Meeting, NCWM voted to amend NIST Handbook 44 (HB 44) paragraph 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)

(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 2017)**

(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 2017)

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 2017)

(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 2017)**

(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 2017**)

Recommendation:

The marking requirements pertaining to software included in NIST Handbook 44 paragraph G-S.1. Identification. currently only apply to not-built-for-purpose software-based devices. The changes adopted by the NCWM in 2016 expand the application of paragraph G-S.1. to include all software-based devices and equipment. Some of the changes that were adopted take effect immediately (i.e., January 1, 2017); while other changes don't take effect until January 1, 2022. It is suggested that the Sector consider recommending changes to only those parts of NCWM Publication 14 that are affected by the changes that will take effect at the beginning of next year. The Sector should revisit this issue at their 2021 meeting to recommend additional changes to NCWM Publication 14 to take into account the HB 44 changes taking effect in 2022.

The following changes to NCWM Publication 14 are suggested in consideration of the changes taking effect on January 1, 2017:

Amend NCWM Publication 14 DES Sections 1. and 3. as follows:

1. Marking - Applicable to Indicating, Weighing/Load-Receiving Elements and Complete Scales

…

The system must be clearly and permanently marked on an exterior surface, visible after installation, **with the following information** ~~**as follows**~~:

1.1. …

1.2. ...

1.3. Except for equipment with no moving or electronic component parts and ~~**not built for purpose**~~, software ~~**based devices**~~, a non-repetitive serial number. The serial number shall be prefaced by the words "Serial Number" or an abbreviation, or a symbol, that clearly identifies the number as the required serial number. 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.)

3. Additional Marking Requirements- 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

Identification of Certified Software:

…

Code Reference: G.S.1.1. Location of Marking Information for Not Built-for-Purpose, Software-Based Devices

3.1. For not built-for-purpose, software-based devices the following shall apply:

3.1.1. The Certificate of Conformance (CC) Number shall be: ☐ Yes ☐ No ☐ N/A

3.1.1.1. Permanently marked on the device. OR

…

Note: For (3.1.~~1.~~2.), clear instructions for accessing the information required in G-S.1. (a), (b), and (d) shall be listed on the CC, including information necessary to identify that the software in the device is the same type that was evaluated.

3.1.2. The version or revision identifier shall be prefaced by the word "Version" or "Revision" as appropriate and either word may be followed by the word "Number." The abbreviations for the word "Version" shall, as a minimum, begin with the letter "V." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R." The abbreviations for the word "Number" shall, as a minimum, begin ☐ Yes ☐ No ☐ N/A

with the letter "N" (e.g., No or No.) ~~**Accep"**~~ **Prefix lettering may be initial capitals, all capitals, or all lowercase.** Unacceptable abbreviations include "v 1234," "ver 1234," "r 1234," and "rev 1234."

Note: If the equipment being evaluated is incapable of prefacing the software version or revision with a "V" or "R," a different method of indication may be deemed permissible providing that method is specified on the CC.

Technical Advisor's suggestion regarding the above proposed note for consideration: *Might the Sector provide guidance in NCWM Publication 14 to assist evaluators in determining the conditions in which a different method of indication could be deemed permissible. For example, might it be specified that the note was added to address some built-for-purpose indicators with very small displays that are incapable of meeting the formatting requirement.*

Amend NCWM Publication 14 ECR Interfaced with Scales Section 5 as follows:

5. Identification

Example Modular System
Point-of-sale systems may consist…

The cash register shall be clearly and permanently marked for the purposes of identification with the following information:

5.1. The name, initials, or … ☐ Yes ☐ No ☐ N/A

5.2. A model identifier … …

5.3. Except for equipment with no moving or electronic component parts and ~~**not built for purpose**~~, software ~~**based devices**~~, a non-repetitive serial number. The serial number shall be prefaced by the words "Serial Number" or an abbreviation, or a symbol, that clearly identifies the number as the required serial number. 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.) ☐ Yes ☐ No ☐ N/A

5.4 For not built-for-purpose, software based devices the current software version designation. The version or revision identifier shall be prefaced by the word "Version" or "Revision" as appropriate and either word may be followed by the word "Number." The abbreviations for the word "Version" shall, as a minimum, begin with the letter "V." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R." The abbreviations 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.** ☐ Yes ☐ No ☐ N/A

Note: If the equipment being evaluated is incapable of prefacing the software version or revision with a "V" or "R," a different method of indication may be deemed permissible providing that method is specified on the CC.

…

Amend NCWM Publication 14 Automatic Bulk Weighing Systems Section 17 as follows:

17. Marking – General

Code Reference: G-S.1.
All equipment, except weights…

17.1. **…**
17.1.1. **…**
17.1.2. **…**
17.1.3. Except for equipment with no moving or electronic component parts and ~~**not built for purpose,**~~ software ~~**based devices**~~, a non-repetitive serial number. The serial number shall be prefaced by the words "Serial Number" or an abbreviation, or a symbol, that clearly identifies the number as the required serial number. 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.) ☐ Yes ☐ No ☐ N/A

17.1.4 For not built-for-purpose, software based devices the current software version designation. The version or revision identifier shall be prefaced by the word "Version" or "Revision" as appropriate and either word may be followed by the word "Number." The abbreviations for the word "Version" shall, as a minimum, begin with the letter "V." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R." The abbreviations 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.** ☐ Yes ☐ No ☐ N/A

Note: If the equipment being evaluated is incapable of prefacing the software version or revision with a "V" or "R," a different method of indication may be deemed permissible providing that method is specified on the CC.

…

Amend NCWM Publication 14 Automatic Weighing Systems Section 1 as follows:

1. General Code Requirements, Identification

Code Reference: G-S.1. and S.7.
Virtually all weighing…

…

1.1. The system must be clearly and permanently marked on an exterior surface, visible after installation, as follows:

1.1.1. The name, initials, … ☐ Yes ☐ No ☐ N/A

…

1.1.3. Except for equipment with no moving or electronic component parts and ~~**not built for purpose,**~~ software ~~**based devices**~~, a non-repetitive serial number. The serial number shall be prefaced by the words "Serial Number" or an abbreviation, or a symbol, that clearly identifies the number as the required serial number. 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.) … ☐ Yes ☐ No ☐ N/A

1.1.4. For not built-for-purpose, software based devices the current software version designation. The version or revision identifier shall be prefaced by the word "Version" or "Revision" as appropriate and either word may be followed by the word "Number." The abbreviations for the word "Version" shall, as a minimum, begin with the letter "V." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R." The abbreviations 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.** ☐ Yes ☐ No ☐ N/A

Note: If the equipment being evaluated is incapable of prefacing the software version or revision with a "V" or "R," a different method of indication may be deemed permissible providing that method is specified on the CC.

…

1.b. Item 310-2 G-S.9 Metrologically Significant Software Updates.

Source:

- 2013-2015 NTEP Software Sector: http://www.ncwm.net/committees/ntep/sectors/software/archive
- 2013 NTEP Weighing Sector: http://www.ncwm.net/committees/ntep/sectors/weighing/archive
- 2013 - 2014 NTEP Measuring Sector: http://www.ncwm.net/meetings/ntep/measuring/archive
- 2016 S&T Committee Final Report: To Be Added

Technical Advisor's note: This item appeared on the Weighing Sector's Agenda in 2013 as Agenda Item 11. Software Maintenance and Reconfiguration.

Background / Discussion:
At the 2016 NCWM Annual Meeting, NCWM voted to add a new NIST Handbook 44 General Code paragraph G-S.9. Metrologically Significant Software Updates. - 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 20XX)

Recommendation:
It is suggested that members of the Sector discuss how an NTEP evaluator is to verify compliance with this new General Code paragraph when conducting an NTEP evaluation on equipment that utilizes metrologically significant software and whether or not the testing required to make this determination should be performed by the evaluator in a lab setting. In order to verify compliance, wouldn't it be necessary for the applicant to submit a software update with his/her equipment when applying for a CC? That update would then need to be installed as part of the NTEP evaluation to determine whether or not the device's audit trail was capable of detecting that new software, which changed one or more of the sealable parameters or features, had been installed. If the Sector concludes that such testing is to be part of the NTEP evaluation, then draft procedures should be developed by the Sector and proposed for addition into the different checklists associated with weighing devices to provide guidance on how the testing is to be performed.

Included in the different text boxes below are some specific portions of the different weighing device sections of NCWM Publication 14 that Mr. Harshman has identified/targeted for possible change. Members of the Sector are asked to review these changes to determine whether or not they are appropriate. Members of the Sector should also review the existing sealing requirements and the different checklists associated with sealing in each of the weighing device portions of NCWM Publication 14 to determine whether or not additional changes might be needed.

Given the amount and scope of the information contained in NCWM Publication 14 DES and AWS Appendix A and B relating to sealing, the Sector might want to consider asking the Software Sector to review this information at their September 2016 meeting and provide feedback to the Weighing Sector, including any suggested revisions.

Amend NCWM Publication 14 DES Section 10 as follows:

10. Provision For Metrological Sealing of Adjustable Components or Audit Trail

Code References: G-S.8.1., G-S.9., and S.1.11.
The current language in *NIST Handbook 44* paragraph G-S.8. states: "A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism."

Thus, for parameters protected by physical means of security, once a physical security seal is applied to the device, it should not be possible to make a metrological change to those parameters without breaking that seal. Likewise, for parameters protected by electronic means of security, it should not be possible to make a metrological change to those parameters without that change being reflected in the audit trail. **Additionally, updates to software, which result in a metrological change to one or more of the "sealable" parameters shall itself be considered a sealable event and also reflected in the audit trail.** Since this philosophy addresses provisions for protecting access to any metrological adjustment, the philosophy should be applied consistently to all electronic device types.

Due to the ease of adjusting the accuracy of electronic scales, all scales (except for Class I scales) must provide for a security seal that must be broken or provide an audit trail, before any adjustment that detrimentally affects the performance of the electronic device can be made. Only metrological parameters that can affect the measurement features that have a significant potential for fraud and features or parameters whose range extends beyond that appropriate for device compliance with *NIST Handbook 44* or the suitability of equipment, shall be sealed.

For additional information on the proper design and operation of the different forms of audit trail, *see Appendix B for the Requirements for Metrological Audit Trails.*

The judgment of whether or not a method of access to an adjustment represents a "significant potential for fraud" and will normally require sealing for security will be made based upon the application of the *Philosophy for Sealing in Appendix A.*

Amdnd NCWM Publication 14 DES and Automatic Weighing Systems Appendix A as follows:

Add a new bulleted feature/parameter to the table titled, "Scale Features or Parameters" as follows:

Scale Features and Parameters

Typical Features or Parameters to be Sealed	Typical Features or Parameters NOT Required to be Sealed
• Coarse Zero • Initial Zero-setting Mechanism (IZSM) on Separable Indicating Elements with Limits That Can Be Adjusted More Than 20% Beyond the Maximum Capacity of the Load-receiving Element … • **Software update that changes the metrologically significant software**	*No changes recommended*

Add the following new sub-heading and new paragraph at the end of Publication 14 DES Appendix A:

Software Updates

When software is updated, the updated version, upon installation into the device, can change one or more of the typical features or parameters to be sealed without these changes being reflected in a device's audit trail. For this reason, it is

important that any update to software that changes the metrological significant software be considered a sealable event as required by Handbook 44 paragraph G-S.9. Metrologically Significant Software Updates.

Alternatively, the following is offered for consideration:

Software Updates

When software is updated, the update itself can change one or more of the typical features or parameters to be sealed without these changes being reflected in a device's audit trail. For this reason, it is important that any update to software that changes the metrological significant software be considered a sealable event as required by Handbook 44 paragraph G-S.9. Metrologically Significant Software Updates.

Amend NCWM Publication 14 Automatic Weighing Systems Section 8 as follows:

8. Provision for Metrological Sealing of Adjustable Components or Audit Trail for Other than Automatic Checkweighers

Code Reference: S.1.3.

Due to the ease of adjusting the accuracy of electronic scales, all Automatic Weighing Systems (except for automatic checkweighers) must have provision for a security seal that must be broken, or an audit trail provided, before any adjustment that detrimentally affects the performance of the electronic device can be made. Security seals are not required for automatic checkweighers in field applications where it would prohibit an authorized user from having access to the calibration functions of the device. Only metrological parameters that can affect the measurement features that have a significant potential for fraud, and features or parameters whose range extends beyond that appropriate for device compliance with *NIST Handbook 44* or the suitability of equipment, shall be sealed. **This includes software updates that change the metrological significant software.**

For additional information on the proper design and operation of the different forms of audit trail, see "Appendix B for the Audit Trail."

The judgment as to whether or not a method of access to an adjustment represents a "significant potential for fraud" and will normally require sealing for security will be made based upon the application of the following philosophy.

…

Amend NCWM Publication 14 ECR Interfaced with Scales Section 6 as follows.

6. Provision For Metrological Sealing of Adjustable Components or Audit Trail

Code Reference: S.1.11.

All components of a point-of-sale (POS) system must comply with Section 10 of the Digital Electronic Scale Checklist if they have a metrological effect on the system. POS Cash Register features, not addressed in this checklist, maybe covered and shall comply with applicable sections in the Digital Electronics Scales Checklist.

Due to the ease of adjusting the accuracy of electronic scales, all scales (Except for Class I scales) must provide for a security seal that must be broken or provide an audit trail, before any adjustment that detrimentally affects the performance of the electronic device can be made.

Only metrological parameters that can affect the measurement features that have a significant potential for fraud and features or parameters whose range extends beyond that appropriate for device compliance with *NIST Handbook 44* or the suitability of equipment, shall be sealed. **This includes software updates that change the metrological significant software.**

Verify that the electronic cash register (ECR) has not sealable parameters and cannot adjust the accuracy of the POS.

6.1 Does the ECR have sealable parameters or features? *See table of typical "Scale Features and Parameters" in the Digital Electronics Scales checklist, Section 10. Provision For Metrological Sealing of Adjustable Components or Audit Trail.* ☐ Yes ☐ No ☐ N/A

6.1.1. If yes, the ECR shall comply with the Digital Electronic Scales checklist Section 10 Provision for Metrological Sealing of Adjustable Components or Audit Trail. ☐ Yes ☐ No ☐ N/A

Technical Advisors note: The WS was opposed to adding the following sentence to NCWM Publication 14 when considering the item in 2013 at the request of the Software Sector:

> **The updating of metrologically significant software, including software that checks the authenticity and integrity of the updates, shall be considered a sealable event.**

It is recommended that members of the Sector compare the language in the sentence that was reviewed in 2013 for addition to NCWM Publication 14 to that which was recently adopted for addition to NIST Handbook 44 and consider whether or not the language in G-S.9. is appropriate. If it is not, the Sector may wish to draft a new proposal to address any remaining concerns.

1.c. Item 320-2 Relationship of Load Cell Verification Interval to the Scale Division

Source:

- 2015 NTEP Weighing Sector
- Scale Manufacturers Association Recommendations 2016 Spring Meeting
- 2016 S&T Committee Final Report *To Be Added*

Background / Discussion:
At the 2016 NCWM Annual Meeting, NCWM voted to amend HB 44 Scales Code paragraph S.5.4. Relationship of Load Cell Verification Interval to the Scale Division 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* ***independent***[1] ***weighing/load-receiving element*** ~~***scale***~~ *(such as hopper,* ~~***or***~~ ***railroad track or*** *vehicle scale weighing/load receiving elements);*
>
> *(a)* $v_{\min} \le \frac{d*}{\sqrt{N}}$ *for scales without lever systems; and*
>
> *(b)* $v_{\min} \le \frac{d*}{\sqrt{N} \times (scale\ multiple)}$ *for scales with lever systems.*
>
> [1] ***Independent means with a weighing/load-receiving element not attached to adjacent elements and with its own A/D conversion circuitry and displayed weight.***

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

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

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

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

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

[Nonretroactive as of January 1, 1994]

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

Recommendation:
The following changes are suggested:

***Amend NCWM Publication 14 DES Sections 8 and 22 as follows*:**

8. Weighing Systems, Scales or Weighing/load-receiving elements Greater than 30 000 lb Capacity

8.1. Additional criteria**…**

…

8.3.2. Range of Parameters for Modular Scales

The following range of parameters…

a. Nominal capacities …

b. Platform area …evaluated. Increased lengths for scales with two or more modules are not restricted as long as the width complies with 8.3.2. (e) and the load cells meet the vmin formula (e.g., vmin ≤ d / √ ~~n~~ **N where "N" is the number of load cells in a single independent weighing/load-receiving element. Independent means with a weighing/load-receiving element not attached to adjacent elements and with its own A/D circuitry and displayed weight.** (Additional modules to increase length must be of the same type as those used in the device submitted for evaluation (e.g., 4-cell, 2-cell, and 0-cell.)

…

22. Relationship of vmin to d

Code Reference: S.5.4.

The relationship of the value for the minimum load cell verification interval, v_{min}, to the scale division, d, for a specific scale using NTEP load cells shall comply with the following formulae where N is the number of load cells in a single *independent weighing/load-receiving element. ~~**If the scale uses National Type Evaluation Program (NTEP) load cell, the load cell verification interval must satisfy one of the following relationships**~~ (~~**w**~~**When** the value of the scale division, d, is different than the verification scale division, e, for the scale, the value of e must be used in the formula below.~~)~~

22.1 $v_{min} \leq \frac{d}{\sqrt{N}}$ Where: N is the number of load cells in the scale without lever systems.	☐ Yes ☐ No ☐ N/A
22.2 $v_{min} \leq \frac{d}{\sqrt{N} \times (\text{scale multiple})}$ for scales with lever systems.	☐ Yes ☐ No ☐ N/A
***Independent means with a weighing/load-receiving element not attached to adjacent elements and with its own A/D conversion circuitry and displayed weight.** This requirement does not apply to complete scales and weighing/load-receiving elements which satisfy the following criteria: 1. The device has been evaluated for compliance with T.N.8.1. Temperature under the NTEP 2. The device has received an NTEP Certificate of Conformance. **AND** 3. The device must be equipped with an automatic zero-setting mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-setting mechanism is permissible, provided the scale cannot function normally while in this mode.)	

2. NCWM Publication 14 DES Section 31 Multi-Interval Scales

Source:
Measurement Canada/Canada (2015)

Background:
This item appears as Agenda Item 10 on the 2015 NTEP Weighing Sector Agenda. During the 2015 Weighing Sector Meeting, Mr. Pascal Turgeon (Measurement Canada) identified conflicts in various parts of NCWM Publication 14, DES Section 31. Multi-Interval Scales and suggested some changes be made to NCWM Publication 14 based on the type evaluation criteria developed and used by Measurement Canada (MC) in their evaluation of a tare feature on a multi-interval scale. The conflicts identified by MC were disclosed during a routine general maintenance of the Canadian documents, and in particular, the requirements pertaining to multi-interval scales. Noting the importance of being careful not to change something that could conflict with Handbook 44 or NCWM Publication 14 because of the US and Canadian Mutual Recognition Agreement, MC requested an interpretation of the following sections of NCWM Publication 14, which it viewed as conflicting:

- The preamble to Section 31. contains examples and clauses that conflict with the requirements set out in 31.1. and 31.2. For example, the tare calculation example shows a net weight value that is not consistent with the scale interval of the weighing segment in which it falls, but both 31.1. and 31.2. require that it be consistent. The preamble also states that "Except for semi-automatic tare, all tare values shall not exceed the maximum capacity of the first weighing segment" whereas as 31.1.5. states "Tare may be taken to the maximum capacity of the smallest weighing range (segment) of the scale," leading to another contradiction

- Another issue with Section 31. is the applicability of 31.1. vs 31.2. It seems to be implied that either one or the other applies, depending on how the device operates, but it is not clear. It seems that 31.1. applies to devices that display all three values, while 31.2 is for devices that only display in one mode. However, review of the sub-clauses in each section show that this isn't correct (e.g. 31.1.9. refers to scales that

only show net weight). We feel that section 31 needs to be reviewed to consolidate redundant clauses and clearly state the applicability of 31.1. and 31.2.

The Sector was asked to review NCWM Publication 14, Section 31. for consistency and recommend changes as needed to resolve any conflicts or ambiguous parts. Members of the Sector concluded there are conflicts within Section 31. and it was generally accepted that at least some of the conflicts identified are the result of grouping together the different requirements that apply to the various types of tare, e.g., semi-automatic, keyboard, etc., used with multi-interval scales and scales designed with a single versus dual weight display.

Mr. Rick Harshman (NIST Technical Advisor) noted that the tare requirements contained in the Scales Code of NIST Handbook 44 do not provide the same level of detail as those in the Publication 14 checklist. He noted that members of OWM's Legal Metrology Devices Program believe more work is needed to further develop requirements that apply to tare taken on multi-interval scales. Mr. Darrell Flocken (NCWM) suggested a small work group be formed to further develop the checklist and eliminate the conflicts in Section 31. of Publication 14 DES. Mr. Harshman suggested a review of the requirements in Section 31. to determine their intended application, e.g., those intended to apply to scales equipped with semi-automatic tare versus keyboard tare, etc. He further noted that he believed that much of this work had already been completed by the Sector in previous meetings.

The Sector agreed with Mr. Flocken's suggestion to form a small work group to further develop the checklist and eliminate the inconsistencies that had been identified. The following members of the Sector volunteered to participate on the work group:

Tom Buck (OH)
Scott Davidson (Mettler-Toledo)
Paul Lewis (Rice Lake Weighing)
Pascal Turgeon (MC) or (Justin Rae)
Rick Harshman (OWM)

Mr. Harshman agreed to host the first work group tele-conference and it was agreed that the work group would attempt to develop a proposal for the Sector to consider at next year's meeting.

A final recommendation made by Mr. Pascal is to move 31.1.9. and all of its subparts to 31.2. since all of 31.1.9. applies to scales that display or record only net weight values and 31.2. applies to scales that indicate in only one mode (gross or net). This recommendation to be considered by the work group as part of their review and further development of Section 31.

Prior to the 2016 NTEP Lab Meeting, Mr. Harshman developed a draft document titled "Principles of Tare - Multi-Interval and Multiple Range Scales" to be shared with the NTEP Weighing evaluators and members of the small work group formed by the WS to further develop the NCWM Publication 14 checklist. This document was created with the thought that if agreement could be achieved on some basic principles of tare for the different kinds of tare offered, it might make it easier to identify in Publication 14 those requirements that deviate from those principles that they could then be eliminated. It might also be possible to reorganize the remaining tare requirements in Publication 14 so as to list the requirements by tare type using headings to identify the different types so they could be more easily located and applied regardless of whether a scale is single interval, multi-interval, or multiple range.

The draft document was reviewed at the 2016 Lab Meeting, feedback provided, and a revised version of the document has been completed.

Recommendation:
Members of the Sector are asked to review the revised draft document titled, "Principles of Tare – Multi-Interval and Multiple Range Scales" and provide feedback on whether or not they agree or disagree with the different tare principles that are specified in the document and to identify any remaining gaps in those principles. That draft document appears as the first attachment to this agenda. If there is agreement on the

principles of tare, it is recommended that the Sector review the specific portions of DES Section 13 that MC had previously identified as being in conflict and recommend corrective action as necessary.

The Sector may also want to consider recommending that a final completed version of this draft document be inserted as an Appendix to the DES Section of NCWM Publication 14 for future reference.

NEW ITEMS

3. NCWM Publication 14 DES Section 57. Device Tolerances

Source:
Ohio NTEP Lab

Background:
The acceptance tolerances specified for a Class IIII scale in the table of tolerances included in DES Section 57. Device Tolerances of NCWM Publication 14 are not the same as those specified for wheel-load weighers and portable axle-load weighers of Class IIII design in the Scales Code of NIST Handbook 44 (HB 44). That is, HB 44 Scales Code paragraph T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class IIII specifies the tolerance values are two times the values specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerances Values. HB 44 Scales Code paragraph T.N.3.1. Maintenance Tolerances Values specifies the maintenance tolerance values are as specified in Table 6. Maintenance Tolerances. Paragraph T.N.3.2. Acceptance Tolerance Values specifies the acceptance tolerance values shall be one-half the maintenance tolerance values. Thus, it can be concluded from paragraphs T.N.3.1., T.N.3.2., and T..N.3.3. that the maintenance tolerance values for wheel-load weighers and portable axle-load weighers of Class IIII design are two times the value of the tolerances specified in Table 6 Maintenance Tolerances. Acceptance tolerance values would, therefore, equal the values of the tolerances specified in Table 6 for Class IIII scales. HB 44 Scales Code paragraphs T.N.3.1., T.N.3.2., and T.N.3.3. and Scales Code Table 6 (Class IIII Maintenance Tolerances) have been copied below for easy review.

NIST Handbook Tolerances Applicable to Wheel-Load Weighers and Portable Axle-Load Scales of Class IIII design

T.N.3.1. Maintenance Tolerance Values. – The maintenance tolerance values are as specified in Table 6. Maintenance Tolerances.

T.N.3.2. Acceptance Tolerance Values. – The acceptance tolerance values shall be one-half the maintenance tolerance values.

T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class IIII. – The tolerance values are two times the values specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values.
(Amended 1986)

Table 6.
Maintenance Tolerances

(All values in this table are in scale divisions)

Tolerance in Scale Divisions				
	1	**2**	**3**	**5**
Class	**Test Load**			
IIII	0 - 50	51 - 200	201 - 400	401 +

Recommendation:
If the Sector agrees that the acceptance tolerance values for wheel-load weighers and axle-load scales of Class IIII design in the DES Section 57 table are incorrect, (i.e., one-half of what they should be) it may want to recommend an explanatory note be added to the table clarifying that the acceptance tolerance values for Class IIII Wheel-Load Weighers and Portable Axle-Load Weighers are two times the tolerances specified. The following proposed changes to the table are offered for consideration:

Amend NCWM Publication 14 DES Section 57 as follows:

57. Device Tolerances

Code References: G-T.1. (e), T.N.3.2., T.N.3.5. and Table 6.

The acceptance tolerances …

Acceptance Tolerances (All values in this table are in scale divisions)				
Tolerance in scale divisions				
Complete Devices	0.5	1.0	1.5	2.5
Separable Main Elements[1]	0.35	0.7	1.05	1.75

Separable Indications w/o Expanded Resolution	0	0	1	1
Class	Test Load			
I	0 - 50 000	50 001 - 200 000	200 0001 +	
II	0 - 5 000	5 001 - 20 000	20 0001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII*	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1/2d for each additional 500d or fraction thereof)	
***For Wheel-Load Weighers and Portable Axle-Load Weighers of Class IIII, acceptance tolerance values are two times the values specified.**				

It is strongly recommended that indicating elements submitted separately for evaluation have a test mode providing reading indications to 0.1e to provide adequate resolution to apply the tolerance (expanded resolution). If the indicator provides indications to only the maximum number of divisions requested for the Certificate of Conformance, the tolerance will be truncated to the number of divisions that can be indicated.

4. NCWM Publication 14 DES Section 61. Power Voltage Variations

Source:
NCWM/NTEP

Background:
The "Variation of Voltage Report Form" located in NCWM Publication 14 DES Section 61. is not consistent with the instructions for the actual test. Test procedure 3. beneath the heading "Test" instructs you to:

> "*Conduct increasing and decreasing load tests with at least three different test loads, including the maximum test loads at each tolerance level.*"

For a typical indicating element with 10 000 scale divisions (i.e., n=10 000), this test would produce four test points. The current version of the test report only provides space for recording three test loads and specifies that the test loads should be at "10e," "½ max," and "max."

Submitters note: the existing test report was taken directly from OIML, R76 and was not modified to fit the test instructions of Publication 14.

Recommendation:
The submitter proposes that the current report form be replaced with a revised report form. The revised report form appears as the second attachment to this agenda.

This revised report form removes the suggested test loads of "½ max", and "max" and provides 3 blank locations plus a location for "max" load, for recording the actual test loads used when conducting the test.

5. NCWM Publication 14 Automatic Weighing Systems Technical Policy Section C. Certificate of Conformance Parameters

Source:
OCS Checkweighers, Inc.

Background:
NCMW Publication 14 defines the formula BL – PLmax >= SD, and requires to mention the formula in all NTEP CCs.

Since the values for SD and DATmin written in the NTEP CCs can in no time be verified by an inspector, the SD, the DATmin, the formula (BL – PLmax >= SD) and the note ("The formula above … will be noted on all NTEP CCs") should be deleted from publication 14.

The SD, the DATmin and the formula (BL – PLmax >= SD) should not be in the CCs and should be deleted from all CCs.

Recommendation:
The submitter recommends deleing the following struck-through portions of Section C. of the Technical Policy:

C. Certificate of Conformance Parameters

Certificates of Conformance (CC) shall detail the main elements, load cells, and auxiliary devices used during an evaluation, including model designation and other significant parameters, under the "Test Conditions" portion of the CC. Test conditions will include the number of chains, the type, number, material of the belts. Only the standard features and options that have been evaluated will be included on the CC.

The Following Guidelines Apply:

Device Parameters:

- Minimum data acquisition time (dynamic only)
- Width of load receiving element
- Belt width
- Length of load receiving element
- Load cell
- Maximum scale conveyor speed (dynamic only)

~~**DAT_{min} (minimum data acquisition time in metric units)**~~
~~**For the purpose of uniformity in National Type Evaluation Program evaluations, the formula used for data acquisition time is:**~~

~~**DAT_{min} = (BL – PLmax) / SBSmax**~~

~~**Where:**~~

~~**BL = Belt length in meters**~~

~~**PL_{max} = Maximum Package length in meters**~~

~~**SBS_{max} = Maximum scale belt speed in m/s**~~

~~**SD (System Data for the device submitted) = DATmin x SBSmax**~~
The models to be submitted for evaluation shall be those having:

a. Highest Capacity *
b. Smallest e_{min} *
c. Highest n_{max} *
~~d.~~ ~~**The Minimum Data Acquisition Time**~~
e. Widest Load Receiving Element (LRE)

* One device may be submitted to meet a, b, and c.

A CC Will Apply to All Models That Have:

- Equivalent metrological hardware and software, including the:
  - Same scale (LRE) transport construction (e.g., chain system, belt system)
  - Same number of load cells
  - *See section D Substitution of Load Cells*
- The same or smaller number of divisions
- Subsets of standard options and features of the equipment evaluated
- Equal or greater than the minimum data acquisition time
- Equal or smaller LRE width, including belt width**
- ~~**Met the formula:**~~

  ~~**$BL - PL_{max} \geq SD$**~~

  ~~**Where:**~~

  ~~**BL = Belt length in meters**~~

  ~~**PLmax = Maximum Package length in meters**~~

  ~~**SD = System Data for the device submitted**~~

- Length with 4:1 from both directions of the device submitted (e.g., 10 m submitted, accepted range is 2.5 m to 40 m?) (determination of length noted on all NTEP CC's)
- A scale division(e) equal to or larger than that of the device evaluated
- Equal or slower scale belt speed*
- Equal or smaller capacity of the device evaluated

*The manufacturer must specify in the application form whether or not the Automatic Weighing Systems is of a fixed-speed or variable-speed design. If equipped with variable scale belt speeds, the systems covered must have equal or slower scale belt speeds for each weighing range.

** The width of the LRE is typically the LRE dimension that is perpendicular to the direction of travel. In some cases, the width of the belt or other conveyor mechanism will represent the width of the LRE if objects can only be weighed on the belt or if the belt or conveyor mechanism is wider than the LRE.

~~***Note: The formula above, $BL - PL_{max} \geq SD$, will be noted on all NTEP CC's***~~

APPENDIX A – ATTENDEES

To be added

ATTACHMENTS

Attachment to Agenda Item 2. Principles of Tare

Principles of Tare – Multi-Interval and Multiple Range Scales

Multi-Interval Scales

Digital, Keyboard, and Programmable Tare

- It shall not be possible to enter or program a tare value that exceeds the capacity of WS1
- All tare values shall be equal to the value of the displayed scale division of WS1
    - If an attempt is made to enter a tare to a different value of d of WS1, the scale shall either reject the tare entry or round the tare entry to the nearest value of d of WS1
- Which of the following two bullet points in the box below is a correct statement (i.e. principle of tare) or should it be specified that either "rounding" method is appropriate?

1. A tare entered (or programmed) to the value of the displayed scale division of WS1 will automatically round to the closest value of the displayed scale division of the WS in which the net weight happens to fall once a gross load has been applied; *or*
2. A tare entered (or programmed) to the value of the displayed scale division of WS1 will be subtracted from the weight of a gross load and the net result then rounded to the closest value of the displayed scale division of the WS in which the net result happens to fall.

The example below provides indication of the difference in the net weight results depending on which value (tare or net) gets rounded.

Consider the following capacity statements marked on a multi-interval scale for this example:

WS1 0-1000 lb x 2 lb

WS2 1000 – 5000 lb x 5 lb

	Displayed and/or Printed	
	Actual	Acceptable
Gross	1010 lb	1010 lb

Tare	- 12 lb	- 12 lb
Net	998 lb	1000 lb

In this example, if the scale rounds tare to the closest value of the displayed division in the range of the resulting net weight, it would round the 12 lb tare to 10 lb and the net result would be 1 000 lb. However, if it is the net weight that gets rounded after subtraction of tare, the net weight would round to the closest 2 lb and the result would be 998 lb.

The decision is important becasuse if it decided that rounding is to the net weight (i.e., after subtraction of tare) then there is only one correct answer and that is 998 lb. If rounding of tare is permitted, then both net results would be considered correct (that is, 998 would still be considered acceptable due to the exception allowed by Scales Code paragraph S.1.2.1.)

NCWM Pub 14 DES Section 31. currently specifies the following:

In applying these principles, it is acceptable to:

- **Round the indicated and printed tare values to the nearest appropriate net weight scale division.**

In reviewing this example during the 2016 NTEP Lab meeting, Darrell indicated that the net result could be either 998 lb or 1 000 lb. For the net result to be 1 000 lb, the 12 lb tare must round to the nearest value of d in the second weighing range (10 lb). That is, rounding would have to occur before subtraction of tare from gross. If rounding occurred after subtraction, then the only acceptable answer would be 998 lb. A 2 lb rounding error is significant because it represents approximately 0.2 % of the net load. Review answers again with Darrell just to confirm he believes both answers are correct.

Which is correct? What is the rule or principle that applies?

- The value of the scale division for the net weight, whether positive or negative, must be displayed in scale divisions consistent with the weighing segment in which the net weight falls.
- If a tare value can be cleared when a load is on the platform, a clear indication that the tare value has been eliminated must be provided.
- In all cases, any displayed or recorded net weight value must be in mathematical agreement with the gross and tare values indicated or recorded (i.e., gross - tare = net).
    - This applies to both when a tare value and the resulting net weight value fall in the same WS (i.e., WS1) and when a tare value and the resulting net weight value fall in different WSs (e.g., tare in WS1 and the resulting net weight in WS2)

- A multi-interval scale may indicate and record tare weights in a lower weighing segment (WS) and net weights in a higher WS and provide a mathematically correct net weight result in accordance with the examples provided in HB 44 Scales Code paragraph S.1.2.1. Digital Indicating Scales, Units.

The following examples are provided to better show how these principles apply:

Consider the following capacity statements marked on a multi-interval scale for Examples A-D shown in the table below:

WS1	0-5 lb x 0.002 lb
WS2	5 – 10 lb x 0.005 lb
WS3	10 – 30 lb x 0.01 lb

Example A
Displayed and/or Printed

	Actual	Acceptable
Gross	13.38 lb	13.38 lb
Tare	- 0.122 lb	- 0.122 lb
Net	13.258 lb	13.26 lb

In the "Acceptable" column 13.258 lb has been rounded up to the nearest scale division of WS3.

Example B
Displayed and/or Printed

	Actual	Acceptable
Gross	13.38 lb	13.38 lb
Tare	-0.004 lb	-0.004 lb
Net	13.376 lb	13.38 lb

In the "Acceptable" column 13.376 has been rounded up to the nearest scale division of WS3. *In this case, the scale clears the tare value once the load is applied. The scale is required to provide a clear indication of that it has done so.*

Example C
Displayed and/or Printed

	Actual	Acceptable
Gross	13.38 lb	13.38 lb
Tare	-0.006 lb	- 0.006 lb
Net	13.374 lb	13.37 lb

In the "Acceptable" column 13.374 has been rounded to the nearest scale division of WS3.

Example D
Displayed and/or Printed

	Actual	Acceptable
Gross	10.54 lb	10.54 lb
Tare	- 0.626 lb	- 0.626 lb
Net	9.914 lb	9.915 lb

In the "Acceptable" column 9.914 has been rounded to the nearest scale division of WS2.

In each of the examples shown above, the net values shown beneath both "Actual" and "Acceptable" would be considered the only acceptable results given the principles of tare on a multi-interval scale.

Push-button (Semi-automatic) Tare

- There are no capacity limitations for semi-automatic tare. Tare may be taken to the capacity of any WS.
- A semi-automatic tare rounds the weight of the object being tared to the closest value in the range where taken.
- Entries of tare shall be to the value of the displayed scale division of the WS in which the tare is taken and then rounded to the closest value of the displayed scale division in the WS in which the net weight results once a load is applied.
- In all cases, any displayed or recorded net weight value must be in mathematical agreement with the gross and tare values indicated or recorded (i.e., gross - tare = net).
- The value of the scale division for the net weight, whether positive or negative, must be displayed in scale divisions consistent with the weighing segment in which the net weight falls.

Multiple Range Scales

- It is important to think of each weighing range of a multiple range scale as if a single scale. There are multiple range scales in which the range is manually selected and there are those in which the range changes automatically with the amount of load applied.
    - For those in which the range is manually selected, tare can only be taken to the value of the displayed scale division of the range selected. An attempt to enter a keyboard (or programmable) tare value that differs from the value of the displayed scale division can either be rejected or rounded and accepted to the closest value of the displayed scale division.
    - For those in which the range changes automatically, the scale must only accept a tare entry to the displayed scale division of the range in which the tare value falls. A tare entry accepted in a lower WR will automatically round to the nearest displayed scale division of a higher weighing range once the application of a load causes the net weight indication to breach the higher WR. However, if the applied load is then decreased, the value of the tare scale division (that was previously rounded to the higher WR) must not change, nor shall the value of the displayed net weight scale division change to that of the lower WR.

- If a tare value can be cleared when a load is on the platform, a clear indication that the tare value has been eliminated must be provided (*What constitutes a clear indication that tare has been removed?*

Both Multi-Interval and multiple range scales

- The tare mechanism shall only operate in a backward direction with respect to the zero-load balance condition of the scale.
- Scales must provide a clear indication that tare has been taken.
- If tare is set to zero, there must be a clear indication that tare has been removed.
- If a tare value can be cleared when a load is on the platform, a clear indication that the tare value has been eliminated must be provided. What is not known is how the scale will identify the quantity being displayed once tare is erased. I believe some scales revert back to a gross. What constitutes a clear indication that tare has been removed? Under what conditions would NTEP accept the deletion of a tare entry?
- Scales designed to automatically clear tare, shall be designed to prevent the clearing of tare until a complete transaction has been indicated.
- A pre-programmed tare cannot replace a manually entered tare without obvious indication.
- The tare weight plus the net weight must always equal the gross weight. In all cases, any displayed or recorded net weight value must be in mathematical agreement with the gross and tare values indicated or recorded (i.e., gross - tare = net).
- Keyboard and programmable tare entries must be visible at some point in the transaction so the entry can be verified. (Re: DES Section 48). Do you agree that this principle also applies to multi-interval and multiple range scales?

Attachment to Agenda Item 4 – Amended Voltage Test Report Proposal

Variation of Voltage Report Form

Code Reference: T.N.8.3.1.

Control No.: _____
Pattern Designation: _____
Date: _____
Observer: _____
Verification Scale Interval e: _____

	At Start	At Max	At End
Temp.:	°C		
Rel. h:			
Time:			
Bar. Pres. (Only Class I):	hPa		

Automatic Zero-Setting and Zero-Tracking Device Is:
☐ Non-existent ☐ Not In Operation ☐ Out of Working Range ☐ In Operation

Marked Nominal Voltage or Voltage Range AC or DC (from main): _____
Marked Nominal DC Voltage Battery Operated Instruments: _____
E = I + 0.5 e –) L – L
E = E – E_0
E_0 = error calculated at or near zero (*)

Voltage (**)	U (V)	Load L		Indication I	Add. Load) L	Error E	Corrected Error E_c	mpe
Reference Value		10 e						
Reference Value – 15% (or lower limit of battery voltage)		10 e						
		max						
Reference Value + 10% (or upper limit of battery voltage)		10 e						
		max						
Reference Value		10 e						
		max						

*** In case a voltage range (v_{min}, v_{max}) is marked, then the test shall be performed at $v_{min,}$ $v_{max\ and}$ at the nominal line voltage of the laboratory.*

☐ Passed ☐ Failed

Remarks:

NEXT MEETING:

TBD