National Type Evaluation Program (NTEP)
Weighing Sector Meeting Summary

August 21-23, 2018 / Louisville, KY

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	NIST	National Institute of Standards and Technology
AWS	Automatic Weighing Systems	NTEP	National Type Evaluation Program
CC	Certificate of Conformance	OIML	International Organization of Legal Metrology
DES	Digital Electronic Scales	OWM	Office of Weights and Measures
HB 44	NIST Handbook 44	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 2018 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 2018 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. SCL-6 S.1.2.2.3. Deactivation of a "d" resolution

Source:
2018 S&T Committee Final Report

Background/Discussion:
In 2017, OWM received indication there exists in the commercial marketplace some Accuracy Class II scales equipped with a "d" value that differs from "e," which fail to round properly (i.e., to the nearest increment) if the "d" value is deactivated such that only the "e" value is displayed. OWM was made aware of this concern while researching a proposal on the 2017 S&T Committee's agenda which would require the value of "e" to be equal to "d" on Class I and Class II scales used in a direct sale application (i.e., one in which both parties are present when the quantity is determined). That proposal, shown below, was later adopted and added to the Scales Code in 2018.

> ***S.1.2.2.2. Class I and II Scales used in Direct Sales. When accuracy class I and II scales are used in direct sale applications the value of the displayed division "d" shall be equal to the value of the verification scale interval "e."***
>
> **(Added 2017)** ***(Nonretroactive as of January 1, 2020. To become retroactive as of January 1, 2023***

The adoption of new paragraph S.1.2.2.2. in 2017 along with having learned of the possible round off problem resulting from the deactivation of the "d" resolution on some scales prompted OWM to propose adding a new specification paragraph to the Scales Code in 2018 to make officials and scale technicians aware of this concern.

At its 2018 Annual meeting, the NCWM voted to add OWM's proposed new paragraph S.1.2.2.3. Deactivation of a "d" Resolution, which prohibits the deactivation of a "d" resolution on a Class I or II scale equipped with a scale division value "d" that differs from the scale verification interval "e" if such action causes the scale to round improperly (i.e., to a value other than the closest "e" interval). The following paragraph was adopted at the 2018 NCWM Annual Conference:

> **S.1.2.2.3. Deactivation of a "d" Resolution. - It shall not be possible to deactivate the "d" resolution on a Class I or II scale equipped with a value of "d" that differs from "e" if such action affects the scale's ability to round digital values to the nearest minimum unit that can be indicated or recorded as required by paragraph G-S.5.2.2.**
> **(Added 20XX)**

Recommendation:
There are two suggested recommendations for the Sector to consider as follows:

1. Provide an explanation in the appropriate section of NCWM Publication 14 DES of how NTEP evaluators can readily determine if the "d" value on a Class I and Class II scale (in which the values of d and e are different) can be disabled (deactivated). Regarding this first recommendation, the Sector may also want to recommend the checklist portion of NCWM Publication 14 DES include an area for an evaluator to enter the values of "d" and "e" for Class I and Class II scales.

   Technical Advisor's note: As mentioned in last year's Weighing Sector Agenda for item 1.a. 3200-2 Verification Scale Interval, OWM checked with one U.S. scale manufacturer concerning whether or not the Class I and II scales it currently produces would round properly if the "d" resolution were disabled (or deactivated) on those Class I and II scales in which the value of "d" differed from "e." The manufacturer reported that there was no possible means of disabling the "d" resolution on any of the models of Class I and II scales it manufactures in which the value of "d" and "e" are different.

2. Add new type evaluation criteria to NCWM Publication 14 DES that establishes whether a Class I and Class II scale rounds properly should the "d" value be deactivated.

Discussion/Conclusion:
Mr. Rick Harshman provided OWM's interpretation of new paragraph S.1.2.2.3., which had originally been proposed by OWM as the result of the NCWM adopting paragraph S.1.2.2.2. in 2017. Mr. Harshman explained that it was OWM's understanding that some, but not all Class I and Class II scales, in which the value "e" and "d" are different, fail to round properly (i.e., to the closest value of "e") if the "d" value is disabled or turned off. OWM felt it necessary to add paragraph S.1.2.2.3. to make officials and service technicians aware of this potential issue because the disabling of the "d" resolution only causes this effect on some, and not all, Class I and II scales.

Mr. Harshman said he thought it was important that the Sector first agree on the application of paragraph S.1.2.2.2. because he sensed from the discussions at last year's Sector meeting concerning the adoption of this paragraph there might be differences in how some might think the paragraph is intended to be applied. He then provided a handout to members of the Sector which included page 2 of the NTEP Certificates of Conformance (CC) for two different Class II scales. Page 2 included a table listing the various models for which the CC applied and their associated values of "d" and "e." Some of the models included in the table had different values of "d" and "e" and others specified the same value. Mr. Harshman indicated that OWM's interpretation of paragraph S.1.2.2.2. is that only the models having the same value of "d" and "e" would comply with paragraph S.1.2.2.2. as of its date of enforcement. That is, paragraph S.1.2.2.2. would not allow someone to simply disable the "d" resolution so that only "e" were displayed to enable the scale to be used in a direct sale application. The paragraph specifies the two values must be equal and the information provided on CC confirms whether they are or aren't equal.

This prompted several members of the Sector to offer opinions on how they viewed the proper application of paragraph S.1.2.2.2. and to raise questions about OWM's interpretation of it. Most comments suggested a belief that it should be acceptable to disable the "d" value and still be able to comply with paragraph S.1.2.2.2. It was also suggested, and several members agreed, that the paragraph was improperly worded to specify "e" and "d" values had to be equal. The intent of paragraph S.1.2.2.2. is not to require "e" and "d" to be the same value, but rather the paragraph should specify when "e" and "d" are different values, only the "e" value can be displayed on Class I and Class II scales used in a direct sale application. Others agreed with this assertion, at which time Mr. Darrell Flocken (NCWM) and Mr. Harshman offered to work on a draft NCWM Form 15 together to amend the paragraph to reflect the Sector's technical position on this issue. It was also suggested that the mechanism to disable/enable the "d" resolution needed to be secured (i.e., behind whatever means of security is provided). A

final concern relating to Sector's plan to amend paragraph S.1.2.2.2. to allow for the disabling of the "d" resolution is the effect this might have on the display of values for scales that differentiate values of "d" and "e." Mr. Flocken felt this concern could very easily be addressed by scale manufacturers. One means would be for manufacturers to use two different lenses; one which blocks the display of the "d" resolution and the other, which doesn't. Software would control the proper rounding of values on those versions in which the "d" value is disabled.

With respect to the two suggested recommendations pertaining to this item included on the agenda, no immediate changes are being recommended by the Sector to any parts of NCWM Publication 14 at this time. In discussing the first recommendation, Mr. Flocken stated that he believed the easiest means for an evaluator to determine if the "d" resolution has been disabled would be to include an area on the NTEP application for an applicant to provide values of "d' and "e." From this information, an evaluator would be able to tell if the resolution had been turned off on a scale under evaluation. Mr. Tom Buck (NTEP evaluator from OH) suggested possibly adding an area on the checklist for the evaluator to include values of "d" and "e." In discussing the second suggested recommendation, it was agreed that the procedures for testing discrimination in NCWM Publication 14, DES paragraph 44.2, and subparagraphs 44.2.1. and 44.2.2. would disclose if a scale is rounding improperly. It was also agreed that on a Class I and II scale in which the values of "e" and "d" are different and both values are displayed, there would be no need to test discrimination based on the "e" value because the "d" value would provide indication of the applied load between values of "e."

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

Source:
Measurement Canada/Canada (2015)

Background:
This item appeared as Agenda Item 10 on the 2015 NTEP Weighing Sector Agenda. During the 2015 Weighing Sector Meeting, Mr. Pascal Turgeon (MC) 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 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.

- A final recommendation made by Mr. Pascal at the 2015 Sector meeting was to move 31.1.9. and all 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.

At its 2015 meeting, the Sector agreed to form a small work group to further develop the checklist and eliminate inconsistencies after reviewing NCWM Publication 14 Section 31 for consistency.

The following members of the Sector volunteered to participate on the work group at the meeting:

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

Much of the Sector's discussion of this item at the 2016 WS meeting revolved around a revised draft document developed by Mr. Harshman (NIST Technical Advisor) titled, "Principles of Tare - Multi-Interval and Multiple Range Scales." This document was provided as an attachment to the Sector's 2016 agenda. Mr. Harshman reported he had developed the draft document in hopes that if agreement could be achieved on some basic principles of tare for the different types of tare operation, e.g., keyboard, push-button, etc., it might make it easier to identify in NCWM Publication 14 those requirements that deviate from the agreed upon principles that they could then be eliminated. That is, if U.S. scale manufacturers could agree on some basic principles of how tare is to operate on multi-interval and multiple range scales, these principles could quite possibly help resolve the conflicts that had been identified by MC in NCWM Publication 14. They might also be used to help establish a means of grouping together the different tare requirements in NCWM Publication 14 by tare type, should someone wish to take on this effort, so they are better organized and can be more easily followed.

Several of the scale representatives, upon being asked to provide input on the "Principles of Tare" document drafted by Mr. Harshman, indicated that they were not familiar enough with how their scales determined net weight under the different conditions outlined and would therefore need to consult with engineering staff and report back at some later date. Consequently, it was agreed this item could not be concluded during the 2016 meeting because it required additional input from the US scale manufacturers. As a result, the Sector agreed this item would remain on its agenda in 2017 as a carryover item.

Mr. Robert Meadows (KS) and Mr. Eric Golden (Cardinal Scale Manufacturing, LLC) were added as new participants to the tare work group in 2016. Additionally, Mr. Darrell Flocken (NCWM) offered to assume lead of the work group after Mr. Harshman requested to step down due to a staffing shortage within the Legal Metrology Devices Program of OWM.

See the Sector's 2015 and 2016 Meeting Summary for additional details.

During the Sector's 2017 meeting, members received an update from Mr. Flocken on this item. He reported that he had been able to contact a few U.S. scale manufacturers to discuss with them the operational characteristics of tare taken on single range, multiple range, and multi-interval scales. This contact was made to try and determine if US scale manufacturers are consistent in how tare is designed to operate for the different kinds of tare offered (e.g., semi-automatic, manually-entered, etc.) on scales manufactured by US companies. Mr. Flocken noted that based upon those discussions, he did not believe, US scale manufacturers are consistent in how they've designed tare to operate for the different kinds of tare and particularly as an operational feature on multi-interval and multiple range scales. He further reported that he didn't believe scale manufacturers necessarily needed to agree on the specifics of how tare should operate to be able to resolve the conflicts identified by MC.

Mr. Flocken suggested the Sector consider splitting the item into two separate and distinct parts and trying first to resolve the more immediate concern of the two; that being, the existence of conflicts in NCWM Publication 14 DES associated with the taking of tare on multi-interval scales. The second part, which would likely take longer to resolve and could be worked on as time permits and at a less accelerated pace, is for the weights and measures community to agree on some basic principles of how different types of tare are to function on multi-interval and multiple ranges scales. Once basic principles of tare have been established, the Sector could then propose

additional changes, as needed, to NIST HB 44 and NCWM Publication 14 DES. Members of the Sector agreed to the approach suggested my Mr. Flocken.

Mr. Flocken then shared his understanding of how single range scales, multiple range scales, and multi-interval scales typically function when different types of tare is taken. The following are some significant points made by Mr. Flocken relating to the conflicts identified by MC:

- There is an exception in HB 44 to requiring the value of a scale division to be expressed as 1, 2, or 5, (or a decimal multiple or submultiple of 1, 2, or 5) for net weight indications and recorded representations calculated from the gross and tare weight indications when the scale division of the gross weight is different from the scale division of the tare weight(s) on multi-interval or multiple range scales. For example, a tare may be taken in a lower weighing segment or range and then subtracted from the gross indication in a higher weighing segment or range and the net weight result be mathematically correct and expressed to a value other than 1, 2, or 5 (or a decimal multiple or submultiple of 1, 2, or 5). This exception is provided in Scales Code paragraph S.1.2.1. Digital Indicating Scales, Units. MC requirements provide no such exception; so, in this regard, MC requirements are different than U.S.

- A rounding problem occurs on a multiple range scale having three ranges when the scale division values of the three ranges are 1 lb, 2 lb, and 5 lb, when the scale user enters a 1 lb tare and the applied load is in the 5 lb range. The problem created from this scenario is that the scale will zero the tare, which isn't permitted.

- Hand-entered tare cannot be taken above the capacity of weighing segment one on a multi-interval scale, however, semi-automatic tare (i.e., push-button tare) can be taken in any weighing segment.

Mr. Flocken acknowledged that different scale manufacturers may design tare to operate somewhat differently than he had described, especially with respect to multi-interval scales.

Mr. Flocken then requested Mr. Turgeon identify the different conflicting sections of Publication 14 DES. He also asked members of the Sector to consider possible solutions to those conflicts as Mr. Turgeon identified and described each one. The following three conflicts were identified, and possible solutions discussed:

1. The preamble to Section 31 contains examples and clauses that conflict with the requirements set out in subsections 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.

   Possible Solution: Identify within subsections 31.1. and 31.2. an appropriate location to add a sentence, similar to the following, appearing in HB 44 Scales Code paragraph S.1.2.1.:

   The requirement that the value of the scale division be expressed only as 1, 2, or 5, or a decimal multiple or submultiple of only 1, 2, or 5 does not apply to net weight indications and recorded representations that are calculated from gross and tare weight indications where the scale division of the gross weight is different from the scale division of the tare weight(s) on multi-interval or multiple range scales.

2. The preamble to Section 31 also states that "Except for semi-automatic tare, all tare values shall not exceed the maximum capacity of the first weighing segment (WS1);" whereas, 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.

   Possible Solution: Consider adding the words, "Except for semi-automatic tare" as a lead in to the sentence in 31.1.5.

3. Another issue with Section 31 is the applicability of 31.1. versus 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 subsections 31.1. and 31.2.

Discussion/Possible solution: It is believed that subsection 31.1., at the time when first added to Publication 14 was intended to apply to scales equipped with a separate display for gross-, tare-, and net-weight indications and that subsection 31.2. was intended to apply to single display scales. Most computing scales are equipped with only a single display and because 31.1.9. identifies "most computing scales" as the example of a scale that displays or records only net weight values, it is believed that 31.1.9. and all its subparts, should be part of subsection 31.2. rather than subsection 31.1. Consequently, the agreed upon solution for this conflict is to move 31.1.9. and all its subparts to subsection 31.2.

There was general agreement amongst Sector members that the possible solutions discussed for each of the conflicts identified by MC seemed appropriate. Mr. Flocken, acknowledging the fact that members seemed to agree on the solutions to these issues, suggested that a new proposal to amend the pertinent sections of Publication 14 be drafted and presented for consideration at the Sector's 2018 meeting. Members of the Sector agreed with his suggestion and Mr. Turgeon offered, at Mr. Flocken's request, to draft a proposal that would address each of the conflicts.

In concluding the discussion on this item, the NIST Technical Advisor shared the following concern: Any agreement on the principles of how tare is to function on multi-interval and multiple range scales needs to take into consideration the weights and measures model law. The law prohibits a person, by himself, or by his servant or agent, to sell, offer, or expose for sale less than the amount represented of any commodity or object. In the case of a multi-interval or multiple range scale having to change a tare entered in a lower weighing range or segment in which the net weight happens to fall, if by changing the tare value (e.g., the scale rounds the tare down because the net result is in a higher weighing range) it causes customers to receive less product than the amount represented, might the manufacturer of that scale be held responsible? Mr. Flocken and others agreed this concern needed to be part of the discussion on tare for multi-interval and multiple ranges scales.

Recommendation:
There are two recommendations suggested by the NIST Technical advisor as follows:

Recommendation 1:
Members of the Sector are asked to consider the following proposed changes drafted and submitted by Mr. Turgeon in an effort to eliminate the existing conflicts in NCWM Publication 14 DES:

31.1. **For scales that indicate in two modes (gross and net),** ~~T~~the requirements for the displayed scale division and the mathematical agreement of gross, tare, and net values depend on the information that can be displayed or recorded by the weighing system and may be summarized as follows:

31.1.1.	The number of scale divisions in each weighing range (segment) must meet Table 3 of the Scales Code.	☐ Yes ☐ No ☐ N/A
31.1.2.	For all weighing segments, e must equal d.	☐ Yes ☐ No ☐ N/A
~~**31.1.3.**~~	~~**The scale division for gross and positive or negative net, weights for both increasing and decreasing loads must be displayed in scale divisions consistent with the weighing segment in which the weight falls.**~~	~~☐ Yes ☐ No ☐ N/A~~
31.1.3.	Weight indications at the break-over point of weighing ranges (segments) must be displayed properly.	☐ Yes ☐ No ☐ N/A
31.1.4.	**Except for semi-automatic tare,** ~~**T**~~**t**are may be taken to the maximum capacity of the smallest weighing range (segment) of the scale.	☐ Yes ☐ No ☐ N/A

31.1.5. Keyboard, programmable, and digital, tare entries, and tare stored in memory for multiple transactions must be consistent with the displayed division size. Incorrect entries may be rounded to the nearest displayed scale division or rejected. ☐ Yes ☐ No ☐ N/A

31.1.6. Devices equipped with a tare capability must, at all times, indicate and record values that satisfy the equation net = gross - tare. ☐ Yes ☐ No ☐ N/A

31.1.7. Devices equipped with a semi-automatic (push-button) tare must meet the tolerances for net loads for any tare value. ☐ Yes ☐ No ☐ N/A

~~**31.1.8. Scales that display or record only net weight values (e.g., most computing scales.)**~~

~~**31.1.8.1. May take semi-automatic (push-button) tare and gross values to the internal resolution of the scale. Printed and displayed net weights shall be rounded to the nearest division. OR** ☐ Yes ☐ No ☐ N/A~~

~~**31.1.8.2. May take all tare values to the displayed scale division. AND** ☐ Yes ☐ No ☐ N/A~~

~~**31.1.8.3. Must always begin with the lowest weighing segment on the device regardless of the amount of tare that is taken.** ☐ Yes ☐ No ☐ N/A~~

31.2. For scales that indicate in only one mode (gross or net) while under load, the scale division for the net weight, whether positive or negative, must be displayed in scale divisions consistent with the weighing range in which the net weight falls.

31.2.1.	The number of scale divisions in each weighing range must meet Table 3 of the Scales Code.	☐ Yes ☐ No ☐ N/A
31.2.2.	The scale divisions for both increasing and decreasing loads must be the same.	☐ Yes ☐ No ☐ N/A
31.2.3.	Devices equipped with a tare capability must indicate and record values that satisfy the equation net = gross - tare.	☐ Yes ☐ No ☐ N/A
31.2.4.	Devices equipped with semi-automatic (push-button) tare must meet the tolerances for net loads for any tare taken up to the tare capacity of the scale.	☐ Yes ☐ No ☐ N/A
31.2.5.	Whenever semi-automatic (push-button) tare is taken and a scale is equipped with only a net display mode, the net weight values must always begin with the lowest weighing range on the device.	☐ Yes ☐ No ☐ N/A
31.2.6.	Keyboard tare entries must be consistent with the displayed scale division.	☐ Yes ☐ No ☐ N/A
31.2.7.	The scale division for the net weight, whether positive or negative, must be displayed in scale divisions consistent with the weighing range in which the net weight falls.	☐ Yes ☐ No ☐ N/A
31.2.8.	Weight indications at the break-over point of weighing ranges must be displayed properly.	☐ Yes ☐ No ☐ N/A
31.2.9.	For all weighing segments, e must equal d.	☐ Yes ☐ No ☐ N/A
31.2.10.	**Scales that display or record only net weight values (e.g., most computing scales.)**	
	31.2.10.1. May take semi-automatic (push-button) tare and gross values to the internal resolution of the scale. Printed and displayed net weights shall be rounded to the nearest division. OR	**☐ Yes ☐ No ☐ N/A**
	31.2.10.2. May take all tare values to the displayed scale division. AND	**☐ Yes ☐ No ☐ N/A**
	31.2.10.3. Must always begin with the lowest weighing segment on the device regardless of the amount of tare that is taken.	**☐ Yes ☐ No ☐ N/A**

31. Multiple Range Scales

Existing Table:

Capacity x d:
WR1 = 0 – 4 kg x 2 g
WR2 = 4 – 10 kg x 5 g
WR3 = 10 – 20 kg x 10 g

	Displayed and/or Printed	
	Preferred	Acceptable
Gross	13.380 kg	13.380 kg
Tare	-3.814 kg	-3.810* kg
Net	9.566 kg	9.570 kg

Corrected Table:

Capacity x d:
WR1 = 0 – 4 kg x 2 g
WR2 = **~~4~~0** – 10 kg x 5 g
WR3 = **~~1~~0** – 20 kg x 10 g

	Displayed and/or Printed	
	Preferred	Acceptable
Gross	13.380 kg	13.380 kg
Tare	-3.814 kg	-3.810* kg
Net	9.566 kg	9.570 kg

Note: The example of the scale build shown in Section 32 is incorrect. Multiple range scales, by definition, are scales that have more than one range, where each range starts at 0 and finishes to max of that range. The build example should show each range starting at "0".

Recommendation 2:
Considering this item was split into two parts at last year's Sector meeting, the second recommendation is to determine if the need still exists (or do scale manufacturers find it of benefit) to try and agree on some basic principles of how different types of tare are to function on multi-interval and multiple range scales. Mr. Flocken reported last year that he did not believe US scale manufacturers are consistent in how they've designed tare to operate for the different kinds of tare and particularly as an operational feature on multi-interval and multiple range scales. An effort to develop some basic principles was started in 2016 through the drafting of the document titled, "Principles of Tare - Multi-Interval and Multiple Range Scales," which remains an attachment to this year's agenda. Is there a need to finish this effort? Might such principles be used to help establish a means of grouping together the different tare requirements in NCWM Publication 14 by tare, so they are better organized and can be more easily followed? Agreement on some basic principles might also be of use in identifying possible gaps in the evaluation of the different tare features associated with these scales.

Discussion/Conclusion:
Mr. Pascal Turgeon (MC) reviewed with members of the Sector the three remaining conflicts in Publication 14 that MC had earlier identified and the solutions to each of these conflicts that had been agreed upon at last year's Sector meeting. He then reviewed the proposed changes he had submitted for consideration at this year's meeting to resolve these issues. Members of the Sector agreed that each change recommended resolved its associated

conflict. Consequently, the Sector agreed to recommend all changes as proposed for adoption by the NTEP Committee.

With regards to Recommendation 2, members of the Sector did not wish to continue efforts to try and come to agreement on some basic principles of tare operation on multiple range and multi-interval scales. Several members acknowledged having little time available in their schedules to allocate to this effort given the time needed to work on assignments of greater priority. It was stated that the document developed by OWM would be a useful starting point for future work should the need arise to complete this effort. The Sector agreed to withdraw this part of the item from its agenda.

NEW ITEMS

3. NCWM Publication 14 DES – Section 11. Indicating and Recording Elements – General Section 11.18.

Source:
NCWM/NTEP

Background:

NCWM Publication 14 identifies a test in Section DES, paragraph 11.18. that is not being performed. This test was identified by Measurement Canada in the mutual recognition evaluation checklist. NTEP does not perform this test; however, Measurement Canada would perform the test if appropriate for the device type submitted.

Recommendation:

It is recommended that paragraph 11.18., including all subparts of 11.18., be eliminated and all remaining paragraphs/subparagraphs of Section 11 be renumbered. The following changes are suggested:

~~**11.18. In the event the indicating or recording element can be disconnected from the load cell(s) or weighing/load receiving element (W/LRE) input(s) without the use of a tool or breaking a security seal, any weight indication or other information (error codes) that remains on the display shall not be interpreted, printed, or stored in memory as a valid weight. This should be tested and verified by disconnecting the load cell(s) or W/LRE(s) while the indicating element is displaying; a negative gross weight or error condition, a zero load condition, a positive gross weight, and an overload condition.**~~

~~**11.18.1. First remove power from the indicating element, disconnect the load cell input or W/LRE, then reapply power to the indicating element. The indicating element should display an error code or other meaningless information that cannot be interpreted, printed or stored as a correct weight.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.1. Perform the test with the display at a gross load zero indication.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.2. Repeat the test with the indicator displaying the following conditions prior to removal of the load cell input.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.3. A negative gross weight or behind zero error indication.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.4. A positive gross weight.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.5. An overcapacity indication.** ☐ Yes ☐ No ☐ N/A~~

~~**11.18.1.6. Reconnect the load cell. The display should indicate the correct weight or an error code or other meaningless information that cannot be interpreted, printed, or stored as a correct weight.** ☐ Yes ☐ No ☐ N/A~~

11.~~19~~**18**.

…

Discussion/Conclusion:
Mr. Darrell Flocken (NCWM), the submitter of this item, explained that the US NTEP weighing evaluators are no longer performing any of the tests proposed for deletion by this item and nor are the MC evaluators performing these tests. US evaluators no longer perform these tests for fear of damaging an applicant's equipment which could result in the evaluator and/or the NTEP lab being held responsible for the damage. It was also reported these procedures had been developed by Germany many years ago at a time when it was believed the testing was needed; today this is not the case. Based upon these comments and hearing no opposition to deleting the procedures, the Sector agreed to recommend they be deleted.

4. NCWM Publication 14 DES – Technical Policy Section 8. Weighing Systems, Scales or Weighing/load-receiving elements Greater than 30 000 lb Capacity

Source:
Fairbanks Scales/Mr. Lou Straub

Background:

At the 2017 Weighing Sector meeting, Mr. Eric Golden (Cardinal Scales) submitted an item for consideration that would make changes to NCWM Publication 14. The Weighing Sector agreed with this proposal and platform lengths no shorter than seven feet were added to DES Technical Policy - Section 8, Subsections 8.2. and 8.3. During the review of this item in 2017, I questioned NTEP's policy in Subsections 8.2. (scales greater than 200,000 lb capacity), which specifies the platform length for vehicle scales is only 100 percent of the length evaluated; however, for railroad track and the railway track portion of combination scales, the platform length is 150 percent of device evaluated. Also, Subsection 8.1. (scales over 30,000 lb and up to and including 200,000 lb) permits a platform length for all scale types to 150 percent of the device evaluated.

Fairbanks Scales believes there is no difference in design of a non-module scale that supports the current restriction to 100% of the platform evaluated in Subsection 8.2. The structural design of a 200,000 lb vehicle scale is really no different when you cross the "200,000 lb threshold" and manufacture a vehicle scale with a 250,000 lb capacity. After further review of Subsections 8.1. and 8.2., why is the criteria ("nominal capacities", "spans", and "lengths") for vehicle scales over 30,000 lb and up to and including 200,000 lb different than the criteria for vehicle scales over 200,000 lb?

I have reviewed the meeting notes from all previous NTEP Weighing Sector Meetings and I have discussed this item with Mr. Jim Truex (NTEP Administrator) at the NCWM Annual Meeting in July. There does not appear to be any "documented" discussion or rationale on why the restrictions exist for "nominal capacities," "spans," and "lengths" in Subsection 8.2. for vehicle scales greater than 200,000 lb, but not for vehicle scales in Subsection 8.1. with capacities of 200,000 lb or less.

I believe a better solution would be to have two sections in NCWM Publication 14; a section addressing criteria for non-module truck scales and a section that addresses criteria for module scales.

Recommendation:

Amend Subsection 8.2. as follows:

8.2. Additional criteria for vehicle scales, railway track scales, combination vehicle/railway track scales, and other platform scales greater than 200 000 lb.

A CC Will Apply to All Models Having:

a. Nominal capacities **up to 135% of** ~~**no greater than**~~ the evaluated capacity.

b. Widths up to 120% of the width of the platform tested that of the device tested.[3]

c. Lengths no shorter than 7' and up to ~~**100**~~ **150**% of the length of the platform tested. [4] ~~**(for railway track and railway track portion of combination scales length to 150% of device evaluated.)**~~

d. Spans between sections of not more than 20% greater than the equipment evaluated. ~~**(for vehicle scale no greater than the device evaluated.)**~~

Notes For d:

…

Another option would be to combine Subsections 8.1. and 8.2. The requirements found in NCWM Publication 14 could be included in one section that addresses scales over 30,000 lb. The following changes are suggested should members of the Sector prefer this alternative option:

8.1. Additional criteria for vehicle scales, railway track scales, combination vehicle/railway track scales and other platform scales over 30,000 lb ~~**and up to and including 200 000 lb**~~.

A CC Will Apply to All Models Having:

a. Nominal capacities up to 135% of evaluated capacity.

b. Widths up to 120% of the width of the platform tested.[3]

c. Lengths no shorter than 7' and up to 150% of the length of the platform tested.

d. A span between sections of not more than 20% greater than the equipment evaluated.

~~**8.2 Additional criteria for vehicle scales, railway track scales, combination vehicle/railway track scales, and other platform scales greater than 200 000 lb.**~~

~~**A CC Will Apply to All Models Having:**~~

~~**a. Nominal capacities no greater than the evaluated capacity.**~~

~~**b. Widths up to 120% of the width of the platform tested that of the device tested.[3]**~~

~~**c. Lengths no shorter than 7' and up to 100% of the length of the platform tested (for railway track and railway track portion of combination scales length to 150% of device evaluated.)**~~

~~**d. Spans between sections of not more than 20% greater than the equipment evaluated (for vehicle scale no greater than the device evaluated.)[4]**~~

Notes For d:

…

Delete footnote 4 at the bottom of page DES 7 since this particular footnote appears only in Subsection 8.2. and does not appear in Subsection 8.1. Footnote 3 would remain because it appears in Subsection 8.1.

Renumber all subsequent subsections.

Discussion/Conclusion:

Mr. Lou Straub (Fairbanks Scales) provided a brief summary of the reasons why he had submitted this item and asked if anyone was aware of why the NTEP criteria ("nominal capacities", "spans", and "lengths") for vehicle scales over 30,000 lb and up to and including 200,000 lb would be different than the criteria for vehicle scales over 200,000 lb. Mr. Straub reported, based upon conversations he had had with engineers at Fairbanks Scales, that the structural design of a 200,000 lb capacity vehicle scale is no different than that of a 250,000 lb capacity vehicle scale. From a search of previous Weighing Sector summaries, he could find no justification supporting the different criteria. He also reported that he had talked with Mr. Jim Truex (NTEP Administrator), and that he too could not provide reason for the different criteria. Mr. Straub concluded by suggesting that the Sector recommend the changes proposed to Subsection 8.2., or, alternatively combine Subsections 8.1. and 8.2. as proposed by his alternative option. No one was able to provide any justification for the different criteria.

Mr. Darrell Flocken (NCWM) clarified that the subsections Mr. Straub was recommending being changed do not apply to modular scales. They only apply to complete scales and there are few complete vehicle scales manufactured today that have capacities greater than 200,000 lb. Mr. Flocken concluded the changes proposed would affect very few NTEP applications since most vehicle scales manufactured today having a capacity greater than 200,000 lb are modular scales. Mr. Flocken also commented that he is not currently in favor of merging Subsections 8.1. and 8.2 together, although this might be considered sometime in the future.

Mr. Eric Golden (Cardinal Scale Manufacturing) commented he supported the proposal to make the requirements consistent for vehicle and railroad track scales.

The Sector agreed to recommend Mr. Straub's proposed changes to Subsection 8.2 and also agreed to possibly combine Subsections 8.1. and 8.2. at some future date.

5. Elimination of the Temperature Range that NTEP Initially Evaluates Devices From All Current and Future NTEP Certificates of Conformance (CC)

Source:
NCWM/NTEP

Background:
Compliance with temperature requirements by NTEP is limited to temperatures that are no lower than − 10 °C and no higher than 40 °C. This temperature range (− 10 °C to 40 °C) along with equivalent Fahrenheit values (14 °F to 104 °F) is currently being specified on completed NTEP Certificates of Conformance at the bottom of the "Standard Features and Options" box included on the CC providing the equipment for which the CC applies met the evaluation criteria when tested at the lower and higher temperatures specified by this range. Temperature limits is <u>not</u> a required marking on equipment meeting NTEP's (limited) temperature requirements during type evaluation. Additionally, the fact that NTEP does not perform testing at lower or higher temperatures than − 10 °C and 40 °C (14 °F to 104 °F) respectively, does not restrict use of the equipment once installed into commercial service to within this limited range of temperatures.

Equipment is allowed to be installed and used outside of the limited temperature testing range of NTEP providing the equipment: 1) passed the NTEP evaluation (i.e., NTEP performance tests) when tested at − 10 °C and 40 °C (14 °F to 104 °F); and 2) provides accurate results when tested in the field at temperatures outside the range in which NTEP performed temperature testing. NIST Handbook 44 paragraph G-UR.1.2. Environment. addresses this issue by requiring equipment to be suitable for the environment in which it is used, which includes at temperatures outside the limited range that NTEP performs its evaluation.

If equipment submitted to NTEP for type evaluation fails to comply with performance requirements when tested at − 10 °C and 40 °C (14 °F to 104 °F), the applicant is given the opportunity to specify to NTEP a narrower temperature range. Note: There are also situations where the device manufacturer requests a reduced temperature range within the limits specified in NIST Handbook 44, Scales Code, paragraph T.N.8.1.2. Once the applicant provides this information, NTEP then re-evaluates the equipment at the limits of that narrower range. Providing the equipment

passes those performance tests, the applicant is required to mark the temperature limits on the equipment, which then, also limits use of that equipment to the temperature limits specified. In this case, the narrower temperature range is specified on the completed NTEP Certificate of Conformance at the bottom of the "Standard Features and Options" box rather than the normal temperature range NTEP initially used. If an official observes equipment being used outside the lower or higher temperatures specified by this narrower range, the official should stop the operator from using the device because a temperature limitation has been specified by the applicant and the equipment is being used inappropriately (outside of those limits).

NTEP has received several questions and complaints providing indication that the values − 10 °C to 40 °C (14 °F to 104 °F) are being misinterpreted as being the NTEP certified operating temperature. Specifying these values on a CC is not intended to limit the use of equipment to within these temperatures if testing in the field proves the equipment is accurate when tested outside of these temperatures. It is only when a narrower band has been specified and marked on the equipment that official action can be taken when that equipment is observed being used outside the range of temperatures marked.

Recommendation:

It is suggested that members of the Sector discuss the possibility of removing the "normal" temperature range values currently being listed at the bottom of the "Standard Features and Options" box on the first page of an NTEP Certificate of Conformance.

The "normal" temperature range in which NTEP evaluates equipment is: − 10° to +40° C.

It is also suggested Sector members discuss the possibility of only listing a reduced temperature range, if applicable, in this location on the certificate. The "normal" temperature would be mentioned in the Test Conditions portion of the CC as a test parameter.

Discussion/Conclusion:

Mr. Darrell Flocken (NCWM) explained to members of the Sector that NTEP performs temperature testing on equipment submitted for type evaluation at − 10 °C and 40 °C (14 °F and 104 °F) by placing the equipment into an environmental chamber and conducting performance testing at these temperatures. If the equipment passes performance testing at − 10 °C and 40 °C (14 °F and 104 °F), the temperature range "− 10 °C to 40 °C" (14°F - 104 °F) is being specified on completed NTEP Certificates of Conformance at the bottom of the "Standard Features and Options" box. This temperature range was never intended to limit use of the equipment in commercial or law-enforcement applications where temperature extremes might exceed the temperatures NTEP uses to perform temperature tests. Some, however, are interpreting this information as a limit for use, which it is not. HB 44 specifies equipment must be suitable for the environment in which it is used, making it permissible for equipment to be installed and commercially used in temperatures outside the limits tested by NTEP providing the equipment can perform to within applicable HB 44 tolerances when tested at these temperatures.

Mr. Flocken also clarified that if equipment submitted for type evaluation fails NTEP temperature testing at − 10 °C and 40 °C, an applicant can specify a narrower temperature range and NTEP will then test at that range. If the equipment passes performance tests at this narrower range, the submitter must specify the narrower range on the device for Class III, IIIL, and IIII scales in accordance with HB 44 Scales Code Table 6.3.a. Marking Requirements or in the operating instructions for Class I and II scales (in accordance with HB 44 Scales Code paragraph T.N.8.1.1.).

Mr. Flocken noted this item only proposes when equipment is able to pass performance testing at NTEP's "normal" temperature testing limits of − 10 °C and 40 °C (14 °F and 104 °F) that the range of these temperatures will no longer be included on the CC at the bottom of the "Standard Features and Options" box. This temperature range will still be included on the CC on page 2 under the heading "Test Conditions." It is only when a narrower range is specified will that range appear in the "Standard Features and Options" box on a CC.

In consideration of the explanation provided, the Sector agreed to recommend future completed NTEP CC's exclude NTEP's "normal" temperature testing limits of − 10 °C and 40 °C (14 °F and 104 °F) in the "Standard Features and Options" box and to only provide this information under "Test Conditions" on page 2 of the CC. If, however, a narrower temperature range is specified, it will continue to be listed in the "Standard Features and Options" box on the CC.

ADDITIONAL ITEMS AS TIME ALLOWS

If time permits, OWM, NTEP and/or other groups would appreciate input from the WS on the weighing-related issues that are outlined in the remaining agenda items below. For each item in this section, the Sector is asked to review the item and consider providing input that might assist these groups.

6. Scales Designed with Primary Scale Functions Accessible from a Sub-Screen and Marking of Operational Controls, Indications, and Features

Source:
NTEP/OWM

Background:
In the Fall of 2017, NTEP requested feedback from OWM concerning the zeroing features made available by design on a small capacity retail-computing scale having three different means to zero the scale as follows:

1. The power on/off switch accessed from one of the exterior sides of the scale identified as such using an acceptable symbol. There was also an adhesive label, which specified "zero" positioned immediately above the on/off power switch.
2. A push-button (semi-automatic) zero accessible from a sub-screen (not the main screen). To access the sub-screen, it was necessary for the operator to press a hidden touchscreen key (store logo) on the main screen.
3. Pressing and hold the weight value being displayed. This semi-automatic zeroing feature was not identified anywhere on the scale itself, but step by step procedures using this method were specified in the operational instructions of the owner's manual.

OWM responded by noting the following deficiencies based upon its review of the information and material (photographs) provided:

1. We consider the key that is hidden behind the store logo, which calls up a second page, an operational feature of the scale. It must be clearly and definitely identified as required by paragraph G-S.6 Marking Operational Controls, Indications, and Features.
2. If pressing and holding the weight indication resets the scale to zero, it too must be clearly and definitely identified as an operational feature of the scale.

Due to these deficiencies, we don't view the scale as being acceptable in either a direct sale or self-service application.

An additional concern was the fact that one of the zeroing features could only be accessed from a sub screen rather than the main screen. The zero function is a primary operational feature and one that should be very easily accessed. OWM does not think it is appropriate for primary operational features to be behind a main screen.

Discussion/Conclusion:
Comments received by Sector members were predominantly opposed to requiring primary scale functions to be only accessible from a main screen. There were comments suggesting current technology dictates less restrictive requirements. Training can teach scale operators how and where to access primary scale functions. One Sector member cautioned using the word "sub-screen" in any proposed new paragraph intended to require primary scale

functions on the main screen. A dropdown window could be considered a sub-screen although it is really part of the main screen that simply drops down. He referred to this as a "slippery slope." Thus, if a primary scale function was part of the dropdown window, it would "technically" not be considered a sub-screen, although two actions would still be necessary to access the primary scale functions.

7. Application of NIST Handbook 44 Requirements to Class I and II Scales Equipped with a Value of "d" that Differs from "e"

Source:
NTEP/OWM

Background:
In March 2018, NTEP received an inquiry from a scale manufacturer wanting to know which value, "d" or "e," should be used when applying HB 44 Scales Code requirements for Automatic Zero Tracking (AZT) and Center-of-Zero (CZ) on a Class II scale equipped with a value of "d" that differs from "e." Handbook 44 does not clearly identify whether the center of zero (CZ) or automatic zero tracking (AZT) requirements should be based upon "e" or "d." It is believed these requirements and others in HB 44 should always be based on the value of "e," regardless of whether the values of "e" and "d" are different or equal. Members of the Sector are asked to share their perspective on this issue.

The following HB 44 Scales Code paragraphs apply to the CZ and AZT, respectively:

S.1.1.1. Digital Indicating Elements.

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

(b) A digital indicating device shall either automatically maintain a "center-of-zero" condition to ± ¼ scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± ¼ of a scale division or less. A "center-of-zero" indication may operate when zero is indicated for gross and/or net mode(s).

[Nonretroactive as of January 1, 1993]

(Amended 1992 and 2008)

S.2.1.3.2. Automatic Zero-Tracking Mechanism for Scales Manufactured on or after January 1, 2007. – The maximum load that can be "rezeroed," when either placed on or removed from the platform all at once under normal operating conditions, shall be:

(a) for vehicle, axle load, and railway track scales: 3.0 scale divisions; and

(b) for all other scales: 0.5 scale division.

(Added 2005)

To try and determine the application of OIML R-76 Nonautomatic weighing systems to these operational features, the NIST Technical Advisor conducted a review of R 76 and the following requirements are thought to apply to these features:

R-76 Center of Zero requirement:

> **4.5 Zero-setting and zero-tracking devices**
>
> An instrument may have one or more zero-setting devices and shall have not more than one zero-tracking device.
>
> **4.5.5 Zero indicating devices on an instrument with digital indication**
>
> An instrument with digital indication shall have a device that displays a special signal when the deviation from zero is not more than ± 0.25 *e*. This device may also work when zero is indicated after a tare operation.
>
> This device is not mandatory on an instrument that has an auxiliary indicating or a zero-tracking device provided that the rate of zero-tracking is not less than 0.25 d/second.

R -76 Automatic Zero Tracking requirement:

> **4.5.7 Zero-tracking devices**
>
> A zero-tracking device shall operate only when:
>
> - the indication is at zero, or at a negative net value equivalent to gross zero;
> - the equilibrium is stable; and
> - the corrections are not more than 0.5 *d*/second.
>
> When zero is indicated after a tare operation, the zero-tracking device may operate within a range of 4 % of Max around the actual zero value.

Discussion/Conclusion:
Mr. Harshman provided an overview of the efforts put forth by OWM to determine which value, "e" or "d" are HB 44 Scales Code paragraphs S.1.1.1. and S.2.1.3.2. and other paragraphs in HB 44 to be based when applying them to a Class I or II scale in which the values of "e" and "d" are different. HB 44 does not clearly specify whether center-of-zero (COZ), automatic zero tracking (AZT), and other applicable HB 44 requirements should be based on the value of "e" or "d." OWM believes, having had the opportunity to complete its review of available background information relating to this issue, the application of all requirements in HB 44 should be based on a scale's verification scale interval "e."

Mr. Harshman noted HB 44 Scales Code Table 3 Parameters for Accuracy Classes and Table 6 tolerances are based on verification scale interval "e." During the course of OWM's research into this issue, those offering opinions on the application of these two Scales Code tables had agreed their application was intended to be based on the value of "e." OWM supports the philosophy that the same requirements should apply to equipment used in the same application regardless of technology or design. Thus, given that the value of "e" establishes the permissible commercial uses of a scale (and also that HB 44 tolerances are based on the value of "e"), in cases where "e" and "d" are different values, one shouldn't be basing the application of HB 44 requirements on the "d" value because the "d" resolution only makes

possible reading the "commercial" increment (e) to a finer resolution. Commercial transactions are to be based on values of "e."

Mr. Harshman noted that as a Weights and Measures Coordinator for OWM, he is expected to try and harmonize US and International weights and measures requirements when it makes sense to do so in order to make it easier for US manufacturers to sell their products abroad. He then reviewed with members of the Sector the different HB 44 and OIML paragraphs that pertain to COZ and AZT and in doing so he further noted:

- OIML R76 paragraph 4.5.5. *Zero indicating devices on an instrument with digital indication* is believed to be the international equivalent to HB 44 Scales Code paragraph S.1.1.1., both of which address the COZ feature on a scale.
- OIML R76 paragraph 4.5.7. *Zero-tracking devices* is believed to be the international equivalent to HB 44 Scales Code paragraph S.2.1.3.2. Automatic Zero-Tracking Mechanism for Scales Manufactured on or after January 1, 2007, both of which address an operational AZT feature on a scale.
- OIML paragraphs 4.5.5. and 4.5.7. are very specific in providing indication of which value "e" or "d" is to be used when applying those paragraphs. For example, paragraph 4.5.5. specifies "not more than ± 0.25 ***e***" to describe a condition of the COZ requirement, whereas, one of the conditions listed beneath paragraph 4.5.7. is that the corrections cannot be "more than 0.5 ***d***/second." OWM's interpretation of the scale resolution references in these two OIML paragraphs is that "e" is intended to mean "verification scale interval" and "d" is intended to mean "scale division."

Mr. Harshman also noted that OIML paragraph 4.5.5. seems to align with HB 44 Scales Code paragraph S.1.1.1. OWM's interpretation of these two paragraphs is that they are very similar; both require COZ to be within one-quarter verification scale interval (e) or less. Thus, on a Class I or II scale in which the values of "e" and "d" are different, the application of both paragraphs should be based on the value of "e."

With respect to AZT, Mr. Harshman reported HB 44 and OIML R76 approach testing quite differently and that US and OIML requirements do not closely align. The US AZT requirement (HB 44 Scales Code paragraph S.2.1.3.2.) is based on an amount of test load that gets added or removed from a scale's load-receiving element all at once from a zero-load balance starting condition. The OIML AZT requirement (R76 paragraph 4.5.7.) is based on a maximum load and rate in which the AZT is allowed operate (i.e., the AZT corrections cannot exceed 0.5 *d*/second). These are significant differences not only in the test procedures, but also in the determination of amount of test load to be applied during tests. Scales Code paragraph S.2.1.3.2. bases the amount of test load to be applied and removed on a scale's verification scale interval (e). OIML R76 paragraph 4.5.7. bases the test load amount on a decimal fraction of the scale's division value (d). In conclusion, Mr. Harshman advised US scale manufacturers to be aware of these differences and if intending to produce scales for both US and international markets, the AZT requirements in both

standards (HB 44 and OIML R76) will need to be met. Mr. Darrell Flocken (NCWM) stated that he agreed with this conclusion.

A member of the Sector questioned if the HB 44 AZT requirement should be changed to more closely align it with the requirement in R 76, but the few members responding to the question were not in favor of amending the HB 44 requirement at this time.

Members of the Sector agreed with OWM's assessment that on Class I and II scales in which the values of "e" and "d" are different, the application of all HB 44 requirements are to be based on the value of the verification scale interval "e."

8. Applying the v_{min} Relationship Formula Exception to the Automatic Weighing Instruments Code

NOTE: This item does not appear on the Weighting Sector's 2018 agenda because it was not submitted by an August 1st deadline to submit new items. Prior to the start of the Sector's 2018 meeting, it was agreed that this item should be discussed, and a possible recommendation made by the Sector on the item providing there was still meeting time available after all other items on the Sector's agenda had been discussed and completed. There was time available and for this reason members of the Sector agreed to consider this item during the 2018 meeting.

Source:
NTEP/NCWM

Background:
NTEP received an inquiry from a manufacturer of an Automatic Weighing System (AWS) regarding the requirement of satisfying the v_{min} relationship formula when the complete instrument was evaluated to the full temperature range -10 °C to 40 °C (14 °F to 104 °F). The manufacturer questioned why there was an exception to comply with the formula in the Scales Code and not in the Automatic Weighing Systems Code.

To answer the manufacturer's question, Mr. Darrell Flocken (NCWM) researched the implementation of the v_{min} relationship formula in both codes and found the following:

- Handbook 44, Scales Code, (2018 edition), page 2-19, paragraph ***S.5.4. Relationship of Minimum Load Cell Verification Interval Value to the Scale Division***. lists three criteria which, if satisfied, removes the need to comply with the formula.

- NTEP complies with this specification by not applying the formula during an NTEP evaluation providing that all three criteria have been satisfied. That is, the complete W/LRE or scale: 1) has undergone the temperature testing as described in T.N.8.1. and has performed within all applied tolerances; 2) has received an NTEP Certificate of Conformance; and 3) is equipped with an automatic zero tracking mechanism which cannot be inoperative in the normal weighing mode.

- Handbook 44, Automatic Weighing Systems (AWS) Code, (2018 edition), page 2-96, paragraph ***S.3.2. Load Cell Verification Interval Value*** includes the v_{min} relationship formula. This "Specification" paragraph, however, does not include the three exemption criteria that are included in paragraph S.5.4. of the Scales Code. Due to the absence of the exemption criteria appearing in paragraph S.3.2. of the AWS Code, the v_{min} relationship formula is to be applied regardless if the instrument has undergone temperature testing as specified in AWS Code paragraph T.7.1.

Additional research resulted in the following findings:

- The v_{min} relationship formula was adopted and added to the Scales Code in HB 44 based on the adoption of S&T agenda item 320-3 during the 1993 NCWM Annual Meeting. At the time of the adoption, the three criteria were not part of the adopted recommendation.

- During the 1996 NCWM Annual Meeting the S&T Committee's agenda included a voting item (i.e., Item 320-6) to amend Scales Code paragraph S.5.4. to exempt complete scales and weighing elements from having to comply with the v_{min} formula providing three conditions are met. The item was adopted, and the following text, identifying the three conditions, was added to Scales code paragraph S.5.4. in 1997 and remains today as part of the paragraph:

  This requirement does not apply to complete scales and weighing elements which satisfy the following criteria:

  1. **The device has been evaluated for compliance with T.N.8.1. Temperature under the National Type Evaluation Program (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.)**

- During the 1995 NCWM Annual Meeting the S&T Committee's agenda included a voting item to add a new tentative code into HB 44 that would apply to Automatic Weighing Systems (AWS). The item was adopted, and the AWS Code was added into HB 44 in 1996 and assigned a tentative status.

- During the 2004 NCWM Annual Meeting the S&T Committee's agenda included a voting item proposing to change the status ofthe AWS Code from "tentative" to "permanent." This the item was adopted and the AWS Code became a permanent (enforceable) code in 2005.

Discussion/Conclusion:
Mr. Flocken reviewed the research findings and asked the members for any information or technical justification indicating why the Automatic Weighing Systems Code did not include the three criteria that are part of the Scales Code. All members agreed that the research implied that not adding the three exception criteria to the Automatic Weighing Systems Code was an oversight based on the timing of the inclusion of the Automatic Weighing Systems Code into HB 44 and the adoption of the three criteria into the Scales Code.

The members of the Weighing Sector agreed to support the development and submittal of a proposal to recommend adding the three criteria to the Automatic Weighing Systems Code.

Mr. Flocken agreed to develop the proposal on behalf of the Weighing Sector, and have it reviewed by Mr. Rick Harshman (NIST OWM) and Mr. Rob Upright (VPG Transducers and Sector chairman) before submitting it for consideration.

ATTACHMENTS

Attachment to Agenda Item 2. NCWM Publication 14 DES Section 31 Multi-Interval Scales

The following "Principles of Tare" document was developed in 2016 by NIST Office of Weights and Measures:

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?

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NEXT MEETING:

The Sector agreed to hold its next meeting …TUESDAY AUG 20 -21 DENVER CO.

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