National Type Evaluation Technical Committee (NTETC)
Weighing Sector Meeting Summary

August 28-29, 2012 / Annapolis, Maryland

INTRODUCTION

The charge of the NTETC 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***.

Table A
Table of Contents

Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
CC	Certificate of Conformance	NTEP	National Type Evaluation Program
DES	Digital Electronic Scales	NTETC	National Type Evaluation Technical Committee
GIPSA	Grain Inspection, Packers and Stockyards Administration	OIML	International Organization of Legal Metrology
LMD	Liquid Measuring Device	OWM	Office of Weights and Measures
MRA	Mutual Recognition Agreement	R	Recommendation
NCWM	National Conference on Weights and Measures	S&T	Specifications and Tolerances Committee
MC	Measurement Canada	SMA	Scale Manufacturers Association
NEWMA	Northeastern Weights and Measures Association	WS	National Type Evaluation Technical Committee Weighing Sector

Details of All Items
(In order by Reference Key)

CARRY-OVER ITEMS

1. Recommended Changes to NCWM Publication 14

Source:
Mr. Harshman, National Institute of Standards and Technology (NIST) Technical Advisor provided the sector with specific recommendations for incorporating test procedures and checklist language based upon actions of the 2012 NCWM Annual Meeting. The sector was asked to briefly discuss each item and, if appropriate, provide general input on the technical aspects of the issues.

1.a. Item 320-4 UR.1.2. Grain Hopper Scales, Table T.1.1. Tolerance for Unmarked Scales, and Table 7.a. Typical Class of Device for Weighing Applications

Source:
2012 S&T Committee Final Report

Background / Discussion:
See the Final Report of the 2012 NCWM S&T Committee Agenda Item 320-4 for the adopted language and additional background information on the item to amend HB-44 Scales Code paragraph UR.1.2. Grain Hopper Scales, Table T.1.1. Tolerances for Unmarked Scales, and Table 7a. Typical Class or Type of Device for Weighing Applications to clarify the applicable tolerances for hopper scales used to weigh grain (both unmarked and marked as Class III).

Conclusion:
The WS agreed with the NIST Technical Advisor recommendation that no changes to Publication 14 are needed.

1.b. Item 320-3. N.3.1.2. Interim Approval

Source:
2012 S&T Committee Final Report

Background / Discussion:
See the Final Report of the 2012 NCWM S&T Committee Agenda Item 320-3 for the adopted language and additional background information on the item to amend HB-44 Scales Code paragraph N.3.1.2. Interim and complete additional editorial title changes to paragraphs N.3.1. and N.3.1.1. to clarify the type of tests conducted for an interim approval and to specify how quickly officials are to be notified when scales are repaired and placed in temporary service with an interim test.

Conclusion:
The WS agreed with the NIST Technical Advisor recommendation that no changes to Publication 14 are needed.

1.c. Item 320-6 Appendix D - Definitions (Reference Weight Car)

Source:
2012 S&T Committee Final Report

Background / Discussion:
See the Final Report of the 2012 NCWM S&T Committee Agenda Item 320-6 for the adopted language and additional background information on the item to amend the definition of "reference weight car" in Appendix D of HB-44.

Conclusion:
The WS agreed with the NIST Technical Advisor recommendation that no changes to Publication 14 are needed.

2. Digital Electronic Scale (DES) Section 42. Zero-Load and Tare Adjustment – Monorail Scales Rounding of Intermediate Values in an Equation

Source:
Mr. Cook, Retired NIST Technical Advisor, OWM (2011 NTETC Weighing Sector Agenda Item 2)

Background / Discussion:
NCWM Publication 14 DES Section 42 Zero-Load and Tare Adjustment - Monorail Scales currently reflects language in *NIST Handbook 44* regarding the setting of zero and tare values that are less than 5% of the scale capacity to within 0.02% of scale capacity according to *NIST Handbook 44* Scales Code paragraphs S.2.1.4 Monorail Scales and S.2.3.1.Monorail Scales Equipped with Digital Indications. For example, a 1000 lb x 1 lb monorail scale shall have the capability to set tare values up to 50 lb to within a resolution of 0.2 lb (1000 x 0.02%).

At the 2010 NTETC Weighing Sector Meeting, the sector agreed to recommend that *NCWM Publication 14* Section 42 be amended to clarify rounding of values by adding a new Section 42.3. stating that "rounding is not performed until the last mathematical operation to reduce the uncertainty of the net weight calculation."

The sector also discussed the potential differences and verification of rounding when net weights are determined using a digital indicator's internal or displayed resolution of the gross weight.

At the 2011 NTETC Weighing Sector Meeting, the sector agreed that test criteria needs to be developed to verify whether or not scales submitted for type evaluation comply with the tare requirements in *NIST Handbook 44* Scales Code paragraph S.2.3.1. A few members of the sector agreed to work on developing possible test criteria that could be added to *NCWM Publication 14* to verify whether a device submitted for type evaluation complies. It was also agreed that the work group would seek input from Mr. Ainsworth, United States Department of Agriculture (USDA)/Grain Inspection Packers and Stockyard Administration (GIPSA) and Mr. Vande Berg, Vande Berg Scales, when developing the test criteria.

Following the 2011 NTETC Weighing Sector Meeting, Mr. Cook, NIST, OWM, contacted Mr. Vande Berg for his input on the proposed development of procedures to determine if net weights are determined using the digital indicator's internal or displayed resolution of the gross weight in the calculation of the net weight and verify that tare weights that are smaller than the verification scale division "e" are not rounded to the value of "e" when calculating net weights for both static and dynamic monorail scales. It should also be noted that *NIST Handbook 44* Scales code paragraph S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales allows Class III and unmarked dynamic monorail scales to have a "d" value less than "e" unlike other Class III and unmarked scales.

Mr. Vande Berg stated that he was concerned that the language recommended by the sector in 2010 will cause a much more confusing issue with inspectors and packers. He was unaware of any packer that currently sends gross weights in 1 lb divisions and applies a 0.1 lb tare anymore. This confusion in 1997 or so was dealt with by the State of NE and Packers and Stockyards (Mr. Onwiler and Mr. Blachford in attendance) before the provision allowing different values of "e" and "d" was added to *NIST Handbook 44* in 1999.

Mr. Vande Berg added that there has been little to no confusion and he believes that this issue had been previously addressed and does not currently exist in the major packers since the adoption of paragraph S.1.2.2.1. The value of "e" in dynamic monorails is basically always 1.0 lb. There is some confusion about the value of "d" in dynamic monorails. Most states allow, and Packers and Stockyards encourages (in Mr. Vande Berg's opinion a good thing), scales to display in 0.1 lb divisions regardless of the scale division value listed on the NTEP Certificate of Conformance (CCs) since the producer (cattle seller) is virtually never in attendance at the time of the transaction (which takes place in the packing plant so no transaction confusion due to the difference between "d" and "e" exists). This allows both the Packers and Stockyards inspector and the service agent the ability to more accurately gauge the performance of the dynamic scale during static and dynamic testing that is also recorded in 0.1 lb divisions. States like Illinois require scales comply with the value of "d" specified on the CC, which in Vande Berg Scale's case is 0.2 lb, thus hurting both the packers maintenance people and the Packers and Stockyards inspection.

Mr. Vande Berg believes that accurately arriving at two net weight "d" values first, and then summing the net weights (by adding them together), makes more sense and is more in line with how MOST packers operate. Taking tare after adding gross weight values for cattle monorails (especially) will cause considerable trouble and in his opinion not a good way to handle the potential rounding error problem that he doesn't believe exists significantly in the field anymore. Field problems with subtraction and rounding may stem from weight indication manufacturers or unknowing dealers that are simply not accurately calculating net weight values because their equipment may not be capable of S.2.3.1. Monorail Scales Equipped with Digital Indications (this is often the case as most indicator manufacturers do not understand the monorail tare requirement). Vande Berg Scales generally insist that the tare is subtracted inside the indicator because of those potential rounding error issues.

Mr. Vande Berg recommended that the sector review the language that was added to *NCWM Publication 14* DES Section 42.3 to clarify that in the case of cattle, where the net weights of two half-carcasses are added together, the net weights of the individual weighments remain in the "d" values and that the summed weight will then be rounded to the value of "e". To avoid controversy on this topic, he recommended the language in Section 42.3 be replaced with a statement such as "tare weight subtraction must always be done with weight values that are equal in division size to "d" or less of the scale."

Technical Advisors Note: In the case of dynamic monorail scales, $d < e \leq 10$ d, as specified in Scales code paragraph S.1.2.2.1.Class I and II Scales and Dynamic Monorail Scales. In the case of static monorail scales, the value of "e" must be equal to or less than the value of "d," as specified in paragraph S.1.2.2.2. Class III and IIII Scales.

An additional recommendation made by Mr. Vande Berg was to modify the language in the first sentence of Scales code paragraphs S.2.3.1.Monorail Scales Equipped with Digital Indications and S.2.1.4. Monorail Scales by adding the words "at least" to the first sentence of each paragraph so that the ending portion of those sentences would read as follows:

> "means shall be provided for setting the zero-load balance to within at least 0.02% of scale capacity."

The sector may wish to consider Mr. Vande Berg's additional recommendation as changing the language of these two *NIST Handbook 44* paragraphs may impact the application of *NCWM Publication 14* DES Section 42.1.

Since there have been few rounding problems discovered by Packers and Stockyards since the issue was raised in 2010, the sector may want to discuss the need for developing additional procedures to determine if net weights are determined using the digital indicator's internal or displayed resolution of the gross weight in the calculation of the net weight, and verify that tare weights that are smaller than the verification scale division "e" are not rounded to the value of "e" when calculating net weights for both static and dynamic monorail scales.

Mr. Vande Berg recommended the following changes to *NCWM Publication 14*, Section 42:

42. Zero-Load and Tare Adjustment - Monorail Scales

Code References: S.2.1.4. and S.2.3.1.

Under the regulations of the Packers and Stockyards Administration, the rollers and hooks used on monorail scales within a facility are required to be nearly the same weight. Since **dynamic** monorail scales typically have ~~**scale**~~ **verification (e)** divisions of 1 lb, a monorail scale must be capable of setting tare weights that are less than 5% of the scale capacity to a weight value less than the displayed scale division. This reduces the rounding error in the tare weight that would otherwise be present if the tare weight were rounded to the nearest displayed scale division.

2.1.	Means must be provided for setting the zero-load balance and any tare value less than 5% of the scale capacity to within 0.02% **or less** of scale capacity.	☐ Yes ☐ No ☐ N/A
2.2.	For an in-motion system, the conditions above must be automatically maintained.	☐ Yes ☐ No ☐ N/A
2.3.	Rounding **to the value of (e)** is not performed until the last mathematical operation to reduce the uncertainty of ~~**the**~~ **summed** net weight calculation.	☐ Yes ☐ No ☐ N/A

For additional background information relative to this item and actions taken by the NTETC Weighing Sector during its 2010 and 2011 meetings go to: ncwm.net/content/weighing-archive

Conclusion:
Mr. Vande Berg, Vande Berg Scales, and Mr. Arce, GIPSA, were present at the 2012 WS meeting to assist in explaining and answering questions relative to this item. They reviewed with members of the WS some of the more typical procedures used by U.S. meat packing companies to determine the weight of animal carcasses obtained from monorail scale systems of varying design. As part of that discussion, they also identified some concerns they had relative to some of the weighing practices and designs of some of the monorail scale systems. Two main concerns were identified and discussed:

1. The additional rounding error caused by weighing two halves of an animal carcass separately on a scale with digital indication, and
2. The taking of tare to an increment different from the displayed scale division.

The WS considered whether any of the current requirements in HB-44 might already address the concerns raised by Mr. Vande Berg and Mr. Arce and concluded that they did not. It was then suggested, and the WS agreed, that HB-44 should first be amended, rather than Publication 14, because the evaluation criteria in Publication 14 is intended to determine whether or not equipment submitted for type evaluation complies with HB-44 requirements. Thus, it would be inappropriate to develop type evaluation criteria to address issues that have no corresponding HB-44 requirement. For this reason, the WS agreed to take no action on the item pending possible future changes to HB-44. Mr. Vande Berg and Mr. Arce agreed to develop, with the assistance of Mr. Harshman, NIST Technical Advisor, an NCWM Form 15 proposal to amend HB-44 and address all concerns.

3. Acceptable Symbols/Abbreviations to Display the CC Number Via a Device's User Interface

Sources:

- 2009 NTETC Software Sector Agenda Item 3 and 2010 S&T Item 310-3 G-S.1. Identification. (Software)
- 2010 Final Report of the S&T Committee: ncwm.net/content/annual-archive
- 2010 Software Sector summary: ncwm.net/content/software-archive
- 2011 Software Sector summary: ncwm.net/content/software-docs
- 2011 Final Report of the S&T Committee (Publication 16 and addendum sheets): ncwm.net/content/annual-archive
- 2012 Software Sector summary: http://ncwm.net/content/software-docs

Background / Discussion:

Local weights and measures inspectors need a means to determine whether equipment discovered in the field has been evaluated by NTEP. If so, the inspector needs to know at a minimum the CC number. From this starting point, other required information can be ascertained. *NIST Handbook 44* currently includes three options for marking of the CC:

1. Permanent marking
2. Continuous display
3. Recall using a special operation

Additional background information relative to this item can be found in *2012 NCWM Publication 16* at: ncwm.net/content/annual-archive

At the 2011 NCWM Annual Meeting, the S&T Committee agreed to change the status of this item to Developing because the item was lacking enough information for full consideration and a full proposal has yet to be developed.

At the 2011 NTETC Weighing Sector Meeting the sector agreed to take no additional action on this item pending further development of the item by the NTETC Software Sector.

During the 2012 Software Sector Meeting, Mr. Truex, NTEP Administrator, discussed the difficulty there has been in coming to a consensus on these issues with a representative of the NTEP Committee. Suggestions from NTEP to come to some resolution has been to write an article for the newsletter (which Mr. Bliss, Mettler-Toledo, LLC, had already done, to no effect), sending a questionnaire to the NTEP community, asking what they'd like to see, and sending a representative from this sector to the S&T Committee.

Mr. Roach, California Division of Measurement Standards, was concerned that some people may want to interpret G-S.1. (c) as requiring a serial number for software. Mr. Lewis, Rice Lake Weighing Systems, Inc. pointed out that the computer that the software was running on could have the serial number, not the software itself. That shouldn't matter, regardless.

Mr. Bliss, Mettler-Toledo, LLC, pointed out that the terminology in G-S.1., "All equipment" could be interpreted to mean that it doesn't apply to software. It was proposed that G-S.1.(c) be amended to add "and software." Mr. Bliss suggested submitting a document explaining the reasoning behind the proposed changes, rather than assume that the text is self-explanatory. Making a presentation to the various committees on the subject in addition would be beneficial as well. If a document is written, perhaps the examples given in G-S.1.(d)(3)(a) can be eliminated. "Metrologically significant" isn't explicitly defined, but it's been used since time immemorial.

Attempts to modify G-S.1.1. have been controversial, both in this meeting and in other committees. Unfortunately, there has been little constructive feedback from the other committees. It would probably be easier to incorporate specific examples given in G-S.1.1.(b)(3) in *NCWM Publication 14*. After some discussion, the previously proposed language was modified slightly to address some of the concerns received via feedback from other sectors and interested parties:

NIST Handbook 44 – Software Sector Proposed modifications to *2012 Publication 16* Developing Item 360-2 G-S.1. Identification. (Software) Proposed modifications are described below and shown in shaded text):

The Software Sector modified the Developing item by deleting the proposed additional language in the first sentence in paragraph G-S.1. to read as follows:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect**, *~~and software-based devices covered in G-S.1.1. Location of Marking Information*~~,** 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)

The Software Sector modified the Developing item by replacing the proposed reference to "software-based electronic devices" with the single word "software" to read as follows:

(c) a nonrepetitive serial number, except for equipment with no moving or electronic component parts and ~~**not built for purpose software-based electronic 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]

The Software Sector modified the Developing item by deleting the proposed reference to "software-based electronic devices" to read as follows:

(d) the current software version or revision identifier ~~**for not built for purpose software-based electronic devices**~~;
[Nonretroactive as of January 1, 2004]
(Added 2003) **(Amended 20XX)**

(1) The version or revision identifier shall be 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)

(2) Abbreviations for the word "Version" shall, as a minimum, begin with the letter "V" and may be followed by the word "Number." Abbreviations for the word "Revision" shall, as a minimum, begin with the letter "R" and may be followed by the word "Number." The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).
[Nonretroactive as of January 1, 2007]
(Added 2006)

The Software Sector modified the Developing item by adding a new subparagraph G-S.1. (d) (3) to read as follows:

(3) The version or revision identifier shall be accessible via the display. Instructions for displaying the version or revision identifier shall be described in the CC. As an exception, permanently marking the version or revision identifier shall be acceptable under the following conditions:

(a) The user interface does not have any control capability to activate the indication of the version or revision identifier on the display, or the display does not technically allow the version or revision identifier to be shown (analog indicating device or electromechanical counter) or

(b) the device does not have an interface to communicate the version or revision identifier.

(e) an NTEP CC number or a corresponding CC Addendum Number for devices that have a CC.

(1) The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the word "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

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

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

G-S.1.1. Location of Marking Information for ~~Not Built For Purpose~~ all Software-Based Devices. *~~–~~For* ~~***not built for purpose,***~~ *software-based devices, either:*

The Software Sector modified the Developing item by reinstating references to subparagraphs "*G-S.1. Identification (a), (b), and (e)*" in paragraph G-S.1.1. (a) to read as follows:

(a) The required information in G-S.1. Identification. (a), (b), ~~(d),~~ and (e) ~~(a), (b), (d), and (e)~~ shall be permanently marked or continuously displayed on the device; or

(b) The CC Number shall be:

(1) permanently marked on the device;

(2) continuously displayed; or

(3) accessible through ~~an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, "Help," "System Identification," "G-S.1. Identification," or "Weights and Measures Identification."~~ one or, at most, two levels of access.

(i) For menu based systems, "Metrology," System Identification," of "Help."

(ii) For Systems using icons, a metrology symbol "(M)," (SI)," or a help symbol ("?," "I," or and "I" within a magnifying glass).

Note: *For (b), 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.*

[Nonretroactive as of January 1, 2004]

(Added 2003) (Amended 2006 **and 20XX**)

The new language in G-S.1.1 reflects that the sector reached consensus on the following positions:

- The software version/revision should (with very few exceptions – see D-31 5.1.1) be accessible via the user interface.
- The means by which the software version is accessed must be described in the Certificate of Conformance (CC).

In addition, it was asserted that the previously recommended changes to G-S.1.1 (b)(3) in fact are not really necessary; the current language of *NIST Handbook 44* empowers the laboratories to enforce "easily recognizable" as they see fit. In fact, the previously generated "list" of icons and menu options could certainly be used by the examining laboratories as part of the approval process (e.g. in *NCWM Publication 14*). Of course, a manufacturer who is reviewing *NIST Handbook 44* so as to develop an acceptable device may benefit from more explicit guidance. Where does such guidance belong?

Comments related to the circulated list included a comment from the Scale Manufacturers Association (SMA) suggesting that a definition is needed for "software-based devices." SMA opposed the definitions previously put forth by the sector. It was suggested that perhaps SMA would be more amenable to a definition that doesn't differentiate between software types.

Since this item is currently defined as a Developing Item, it cannot be moved to a Voting Item at the 2012 NCWM Annual Meeting; it will have to wait until 2013. In January of 2013, the item will be reviewed and a decision will be made whether or not to change the status of this item. To upgrade the status of this item, the sector will need to explain the intent behind the proposed changes to G-S.1 and G-S.1.1.

Conclusion:
It was reported that the Software Sector is still actively working on this item and that during the SMA meetings in April 2012 a member of that sector was present and had circulated that sector's proposed modifications to members of the SMA for input. The general view of most members of the SMA was favorable towards the proposed changes. Members of the WS were then offered the opportunity to provide an opinion on the modifications proposed, but no one opted to do so. The WS agreed to take no additional action on this item pending further development of the item by the Software Sector.

4. DES Section 70. - Performance and Permanence Tests for Railway Track Scales Used to Weigh In-Motion

Source:
Mr. Luthy, Stock Equipment Company, Inc. (2011 NTETC Weighing Sector Agenda Item 6)

Background / Discussion:
During the 2011 NTETC Weighing Sector Meeting, the sector discussed a weigh in-motion system using new technology that utilizes continuous rails (no "rail gaps") on the approaches and weighing areas of the scale. The submitter stated that the manufacturer was unable to offer this device for sale in the U.S. in commercial applications because current NTEP type evaluation criteria and *NIST Handbook 44* requirements were written in such a way that makes it impossible for devices incorporating this new technology to comply. For example, *NIST Handbook 44* Scales Code paragraph UR.2.4. Foundations, Supports, and Clearance requires clearance be provided around all live parts to the extent that no contacts may result. *NCWM Publication 14*, DES Section 70, Inspect the Scale, Item 4 Rail Gaps states that "the rail gaps should be set at 3/8 inch." The *AAR Scale Handbook* includes language that allows 1/8 inch to 5/8 inch rail gaps.

The members of the sector agreed that they were not willing to recommend deleting references to the required gaps in the rail until it is proven that the new technology complies with the tolerances in *NIST Handbook 44*. Thus, the sector recommended that the applicant move forward with performance testing to confirm that the new technology complies with the tolerances in *NIST Handbook 44*. The sector agreed that data resulting from the performance testing needed to be submitted to the sector prior to the time that the 2012 NTETC Weighing Sector Agenda was developed or the item should not be included as a carryover item on that agenda.

For additional background information relative to this item and actions taken by the NTETC Weighing Sector during its 2011 meeting go to: ncwm.net/content/weighing-archive

Conclusion:
Mr. Luthy, Stock Equipment Co., provided a brief update on the progress of the performance testing to date. He reported that ongoing testing is still being conducted at the Association of American Railroads (AAR) Transportation Technology Center near Pueblo, Co. Because the testing is still ongoing, the WS agreed to Mr. Luthy's request to maintain the item as a Carryover item on the 2013 NTETC Weighing Sector Agenda providing a report resulting from the testing is submitted to the sector prior to the time that the 2013 NTETC Weighing Sector Agenda is developed. Otherwise, the item should not be included as a Carryover item on the 2013 WS Agenda.

5. DES Appendix C- Acceptable Abbreviations for Short Ton and Long Ton

Source:
Mr. Lewis, Rice Lake Weighing Systems, Inc. (2011 NTETC Weighing Sector Agenda Item 8)

Background / Discussion:
At the 2011 NTETC Weighing Sector Meeting, Mr. Lewis, Rice Lake Weighing Systems, Inc., recommended adding "tn" as an acceptable abbreviation for a U.S. short ton to the current list of acceptable abbreviation of "Ton"

or "TN." Mr. Lewis is also recommended that "lt" be added to the list of acceptable abbreviations for a long ton. He added that the *Canadian Lab Manual*, Part 2, Section Appendix-2A in the table for abbreviations and symbols accepted in Canada, metric ton is abbreviated by "t" and ton (short ton) is abbreviated by "tn."

The sector agreed to add "tn" to the table of Acceptable Abbreviations in Appendix C of *NCWM Publication 14* as an acceptable abbreviation for short ton. Mr. Harshman, NIST Technical Advisor, noted that the abbreviation "tn" does not exist in Appendix C of *NIST Handbook 44* nor in *NIST SP 811* and this change recommended by the sector, if approved, would add the abbreviation to only 1 portion of *NCWM Publication 14* table, that is, to the portion titled *Exceptions to General Tables of NIST Handbook 44*. The sector also agreed to delay taking any action on adding the abbreviation "lt" for long ton until the S&T Committee has had an opportunity to consider the proposal from Mr. Lewis, Rice Lake Weighing Systems, Inc., to amend *NIST Handbook 44* by adding the abbreviations "tn" for short ton and "lt" for long ton.

At the 2012 NCWM Interim Meeting, the original submitter, Mr. Lewis, Rice Lake Weighing Systems, Inc., requested that the proposal in the Interim Agenda be modified to remove the reference to long ton and its associated proposed abbreviation "lt". Mr. Lewis indicated that the intent of the proposal is to align U.S. and Canadian requirements and noted that the abbreviation "tn" is an acceptable Canadian abbreviation for short ton.

Mr. Flocken, speaking on behalf of the SMA, suggested making the item Informational to allow for more discussion. He stated that SMA supports the abbreviation "tn" for short ton but not the long ton abbreviation "lt".

Mr. Ripka, Thermo Fisher Scientific, indicated that several different references for ton (short) have been used with belt-conveyor scale systems over the years. For example, both lower case "t" and upper case "T" have been used to abbreviate short ton. He stated that although he was not opposed to the item, more work is needed to ensure that references are consistent throughout all of *NIST Handbook 44*.

The S&T Committee considered the comments received during the Open Hearings and agreed with the recommendation to amend the Units of Mass table on page C-19 of *NIST Handbook 44 Appendix C* as shown in Item Under Consideration. The committee agreed that additional work was needed on this item. The committee asked the NIST Technical Advisors to undertake a review of the references in *NIST Handbook 44*, the Canadian requirements, and *NCWM Publication 14*, and identify any additional changes that might be needed to ensure consistency. Additionally, the committee is seeking input from the community on the impact that this item might have on existing scales in the marketplace. The 2012 S&T Committee designated this item as an Informational Item.

After the 2012 NCWM Interim meeting had concluded, NIST, OWM, in reviewing summary comments from the 2011 SWMA fall meeting, discovered an additional reference on page C-6 of Appendix C, NIST Handbook 44 that SWMA had identified as needing to be changed in order to be consistent with the change proposed in the Item Under Consideration. NIST, OWM suggested that the committee consider the following changes for future consideration of this item:

Amend the abbreviation "t" representing the "net" or "short" ton on page C-6 of *NIST Handbook 44* Appendix C to "tn" as follows:

Avoirdupois Units of Mass[6]

[The "grain" is the same in avoirdupois, troy, and apothecaries units of mass.]

1 µlb	= 0.000 001 pound (lb)
$27^{11}/_{32}$ grains (gr)	= 1 dram (dr)
16 drams	= 1 ounce (oz)
	= 437½ grains
16 ounces	= 1 pound (lb)
	= 256 drams
	= 7000 grains
100 pounds	= 1 hundredweight (cwt)[7]

20 hundredweights	= 1 ton (tn)
	= 2000 pounds[7]

In "gross" or "long" measure, the following values are recognized:

112 pounds (lb)	= 1 gross or long hundredweight (cwt)[7]
20 gross or long hundredweights	= 1 gross or long ton
	= 2240 pounds

[6] When necessary to distinguish the **avoirdupois** dram from the **apothecaries** dram, or to distinguish the **avoirdupois** dram or ounce from the **fluid** dram or ounce, or to distinguish the avoirdupois ounce or pound from the **troy** or **apothecaries** ounce or pound, the word "avoirdupois" or the abbreviation "avdp" should be used in combination with the name or abbreviation of the **avoirdupois** unit.

[7] When the terms "hundredweight" and "ton" are used unmodified, they are commonly understood to mean the 100 pound hundredweight and the 2000-pound ton, respectively; these units may be designated "net" or "short" when necessary to distinguish them from the corresponding units in **gross** or **long** measure.

Additional letters, presentations and data may have been part of the committee's consideration. Please refer to www.ncwm.net/content/2012pub-16 to review these documents.

At the 2012 NCWM Annual Meeting, the committee acknowledged that the reference to "lt" is no longer under consideration. Mr. Darrell Flocken, speaking on behalf of SMA, reiterated the comments he made at the Central Weights and Measures Association (CWMA) meeting and supported changing the item to Informational.

NIST, OWM noted that the *2011 NCWM Publication 14* Belt-Conveyor Scale Systems type evaluation criteria provides a table on page BCS-4 that indicates the U.S. short ton may be identified as "ton" or upper case "T;" the metric ton as lower case "t;" and the U.S. long ton as upper case "LT." The following abbreviations appear in the 2011 version of Publication 14 BCS systems type evaluation criteria:

Unit	Abbreviation
pounds	lb or LB
U.S. short ton	ton or T
U.S. long ton	LT
Metric ton	t
kilograms	kg

The abbreviation "T" for U.S. short ton in *NCWM Publication 14* conflicts with the acceptable abbreviation for the U.S. short ton specified in Appendix C of *NIST Handbook 44*, which is "t." A search of the word "ton" in Appendix C of *NIST Handbook 44* revealed that nowhere is upper case "T" used, although lower case "t" appears as an acceptable abbreviation for both the U.S. short (or net) ton (page C-6) and the metric ton (page C-19). NIST, OWM is concerned that officials applying paragraph G-S.5.6.1. might be inclined to reject an upper case "T" as an acceptable abbreviation for the U.S. short (or net) ton even though *NCWM Publication 14* indicates that the upper case "T" is acceptable. Officials might also find it confusing if lower case "tn" were made an acceptable abbreviation for the U.S. short or net ton, given that the table on page BCS-4 of *NCWM Publication 14* specifies lower case "t" as the acceptable abbreviation for the metric ton.

NIST, OWM noted that even if everyone were to agree on different acceptable abbreviations for the U.S. short or net ton, the U.S. long ton, and the metric ton, it is not likely that this would completely resolve all the confusion relating to the value of the ton in commercial transactions. The spelled-out version of the word "ton" is often used instead of its abbreviation to identify values displayed or recorded by a commercial device. Thus, unless the word "ton" is further qualified using an appropriate clarifying preface such as metric, short, net, or long, it's unclear as to which ton is being referenced when the word "ton" by itself is used to identify the unit of measure.

NIST, OWM suggested that the committee consider changing the abbreviation "t" (which refers to 1 ton (short), beneath the heading "Avoirdupois Units of Mass" on page C-6 of the 2012 version of *NIST Handbook 44*) to "tn" to avoid conflict with the recommended proposal. NIST, OWM also noted that the abbreviation "lt" was erroneously left in the table.

The committee agreed that the "lt" abbreviation for "1 ton, gross or long" in the table on page S&T 20 of *2012 Publication 16* was erroneously left in the table from the original proposal and should be removed.

The committee reiterated its request for input from the community on the impact that this item might have on existing scales in the marketplace and asks for input regarding what additional changes might be needed to the proposal prior to moving it forward.

The committee recommended deleting the reference to "Long Ton" in the "Purpose" so that it reads as follows:

"Purpose: Establish uniform abbreviations for Short Ton."

The committee also recommended deleting the reference to "lt" in the "Units of Mass" table in the "Item Under Consideration" so that the reference for "1 ton, gross" reads as follows:

1 ton, gross or long[19]

Background information may be obtained online at:
2011 NTETC WS Summary:
http://ncwm.net/sites/default/files/meetings/weighing/2011/2011_Weighing_Meeting_Summary.pdf
2012 S&T Interim Report:
(http://www.ncwm.net/sites/default/files/meetings/annual/2012/S%26T%20docs/2012_Pub16_ST.pdf)
2012 S&T Final Report:
(Link to be inserted)

Conclusion:
Mr. Harshman, NIST Technical Advisor, reviewed background associated with this item and reported that prior to the 2012 NCWM Annual Meeting, Mr. Ripka, Thermo Ramsey had expressed a concern that field officials might find it confusing if lower case "tn" were adopted as an acceptable abbreviation for short or net ton because the abbreviation "t" is considered an acceptable abbreviation for metric ton in Publication 14 BCS. He also pointed out that even if the abbreviation "tn" was adopted, this would not clear up all the confusion surrounding the value of the ton in commercial transactions. In cases where the word ton is spelled out and no abbreviation is used, additional qualifying words are needed to identify which ton is being referenced. Mr. Lewis, Rice Lake Weighing Systems, Inc., commented that the proposal was intended to harmonize U.S. and Canadian requirements, noting that Canada accepts "tn" as an acceptable abbreviation for short ton. Mr. Flocken, Mettler-Toledo, Inc., added that the change would make it easier for scale manufacturers if they could manufacture scales using a single acceptable abbreviation. Luciano Burtini, MC, stated that upper case "T" is not permitted as an acceptable abbreviation for short or net ton as it is in Publication 14 BCS. The lower case "tn" is the acceptable Canadian abbreviation for short ton and lower case "t" is the acceptable abbreviation for metric ton. Mr. Harshman, NIST Technical Advisor, will forward the sector's comments and recommendations to the appropriate regional and NCWM committees for their consideration and comments.

6. Sealing/Capabilities of Smart Junction Boxes

Source:
Mr. Payne, Maryland Department of Agriculture (2011 NTETC Weighing Sector Agenda Item 11)

Background / Discussion:

At the 2011 NTETC Weighing Sector Meeting, Mr. Payne, Maryland Department of Agriculture, requested the sector's guidance on the proper means of sealing, and assistance in determining the capabilities of a "smart junction box,"(aka "smart "J" box") which was about to be submitted to the Maryland Laboratory for NTEP certification. Although not confirmed, it was Mr. Payne's belief (based on discussions with an equipment manufacturer) that the "smart junction box" provided a means of remotely accessing calibration and/or configuration adjustments once installed in a scale.

Mr. Truex, NTEP Administrator, pointed out that such adjustments can generally only be carried out through the indicator of a weighing system comprised of separable components (i.e., an indicator, weighing/load-receiving element, and load cells). NTEP evaluates each of these components separately, issuing a separate CC for each component once that component has passed type evaluation criteria. Notations made on the CC by the evaluator typically provide an indication of the compatibility and/or non-compatibility of a component with other separable components.

During the discussion, it was mentioned that several U.S. scale manufacturers, including some who were represented in the room, design and manufacture smart "J" boxes. Mr. Flocken, Mettler-Toledo, LLC, noted that internationally, as many as seven different components of a scale are type evaluated using test criteria contained in International Organization of Legal Metrology (OIML) Recommendations. He questioned whether the sector might want to further research the capabilities of "smart "J" boxes" and possibly consider developing type evaluation criteria to evaluate them as separate component of a weighing system.

The sector agreed to form a small work group to study the capabilities of this equipment and determine whether or not type evaluation criteria should be developed to evaluate them as a separate component. Mr. Harshman, NIST, OWM agreed to organize the first teleconference to review the requirements for a Smart Junction Box. Additionally, the sector agreed that, the term "smart junction box" refers to a device that contains active components and is used to digitize the output of one or more analog load cells. The box may include a processing component with or without software to scale or calibrate the digitized output. The box transmits the weight information to an indicating element either via a wireless or wired connection.

During the discussion of the November 3, 2011 teleconference, there was general agreement that, because the junction box contained active elements, it should be tested for environmental influence factors as described in *NIST Handbook 44* Scales Code paragraph T.N.8. It was also determined that there are two basic types of smart junction boxes; those that only digitize the load cell signal(s) and those that digitize and then calibrate the load cell signal(s).

It was concluded that checklist procedures and language will be developed to describe the evaluation of this device type and that this would be submitted to the NTETC Weighing Sector at their next regularly scheduled meeting. To accomplish this, a workgroup would be formed. The workgroup would be made up of device manufacturers, representatives of NIST, OWM and NTEP, and lab personnel. Mr. Langford, Cardinal Scale Manufacturing Co., volunteered to serve as the ad hoc chair of the workgroup and indicated the first step would be to develop a list of the devices of this type already assigned NTEP CCs. Mr. Harshman, NIST, OWM, provided the contact information for the participants at the teleconference.

The draft procedures and discussions were developed, reviewed, and agreed upon by the work group by the end of December 2011 and submitted to Mr. Truex, NTEP Administrator, and Mr. Harshman, NIST, OWM for discussion at the 2012 NTETC Weighing Sector Meeting.

For additional background information relative to this item and actions taken by the NTETC Weighing Sector during its 2011 meeting go to: ncwm.net/content/weighing-archive

Conclusion:
Members of the sector, including the NTEP evaluators who were present at the meeting, voiced support to adding the draft evaluation criteria to Publication 14. During the discussion, it was noted that the draft document was developed and borrowed heavily from criteria already existing in Publication 14. The Sector agreed that the draft type evaluation criteria should be recommended for addition to the DES portion of Publication 14 as a new Section 76 and that its title should be "Digital Controller Element for Load Cells." This new section should also be referenced in the DES Table of Contents beneath the heading titled: "Checklists and Test Procedures," as a new

Section 76. The draft evaluation criteria recommended for insertion into Publication 14 can be found in the Attachment section of this summary and is titled: Attachment to agenda Item-6: Sealing/Capabilities of Smart Junction Boxes.

NEW ITEMS

7. NCWM Publication 14 Load Cell Table 6 – Summary Table Examples

Source:
NTEP Administrator

Background / Discussion:
The NTEP Administrator was contacted by an individual questioning tolerance values for repeatability and creep shown in the example summary table in *NCWM Publication 14* – Load Cells Table 6 "Example of a Summary Table for a Class III 3000 Single Load Cell" (the reported errors are shown in Table 6 in shaded text). The individual reported that:

1. The tolerance listed on the table should be the value from Table 3 - Tolerance for Class III Load Cells, page LC-10. That is, the repeatability error of a Class III 3000 single cell requirement (from Table 3) should be 0.7v (0-500v); 1.4v (501-2000v); 2.1v (2001-4000v); 3.5v (4001-10 000v), so the value of repeatability error shown on Table 6 should be other than 0.35v.

2. Similar error on Creep (time dependence) of Table 6, the value should follow the mpe Table T.N.4.6., the value of creep shown on Table 6 should be 1.05v other than 1.5v.

3. Same error on Creep change (I_{20min}-I_{30min}) of Table 6, according to Table T.N.4.6., it should be 0.1575v (0.15 x mpe) other than 0.225v.

Table 6.
Example of a Summary Table for a Class III 3000 Single Load Cell

Summary Table (As requested in Item 12 of the load cell data format paper)				
		Critical Result	Tolerance	Result/Tolerance
a.	Load Cell Error	0.68 v	0.7 v	0.97
	Repeatability Error	0.19 v	0.35 v	0.55
	Temperature Effect on MDLO	0.57 v_{min}/5 °C	0.7 v_{min}/5 °C	0.82
	Creep (time dependence)	0.98 v	1.5 v	0.65
	Δ Creep = $I_{20\ min} - I_{30\ min}$	0.09 v	15 x |mpe| = 0.225 v	0.40
	Creep Recovery	0.17 v	0.5 v	0.34
	Effect of Barometric Pressure	0.185 $v_{min/}$kPa	1.0 $v_{min/}$kPa	0.15

Table 3.
Tolerance for Class III Load Cells

NIST Handbook 44 **Reference**	**Single Cell Requirement**		**Multiple Cell Requirement**	
Load Cell Error Table 6., Class III; T.N.3.2. and T.N.8.1.1.	**0.7 Factor Applied**		**1.0 Factor Applied**	
	Load	**Tolerance**	**Load**	**Tolerance**
	0 – 500v	0.35v	0 – 500v	0.50v
	501 – 2000v	0.70v	501 – 2000v	1.00v
	2001 – 4000v	1.05v	2001 – 4000v	1.50v
	4001 – 10 000v	1.75v	4001 – 10 000v	2.50v
peatability Error; T.N.5. and T.N.8.1.1.	**0.7 Factor Applied**		**1.0 Factor Applied**	
	Load	**Tolerance**	**Load**	**Tolerance**
	0 – 500v	0.70v	0 – 500v	1.00v
	501 – 2000v	1.40v	501 – 2000v	2.00v
	2001 – 4000v	2.10v	2001 – 4000v	3.00v
	4001 – 10 000v	3.50v	4001 – 10 000v	5.00v
Temperature Effect on Minimum Dead Load Output; T.N.8.1.3. and T.N.8.1.1.	0.7 v_{min}/5 °C		0.7 v_{min}/5 °C	
Effects of Barometric Pressure; T.N.8.2.	Applicable only to specified load cells 1 v_{min}/1kPA		Applicable only to specified load cells **1** v_{min}/1kPA	

The sector was asked to review the information provided by Mr. Truex, NTEP Administrator, and agree on an appropriate recommendation to address the reported inaccuracies in *NCWM Publication 14* Load Cells Table 6 - Example of a Summary Table for a Class III 3000 Single Load Cell (e.g., correcting or deleting Table 6, or other possible solutions).

Conclusion:
Mr. Truex, NTEP Administrator, reported that Publication 14 Load Cell Table 6 had been created a very long time ago and that the validity of some of the values in the table was currently being questioned. He supported maintaining the table in Publication 14 and asked that the load cell experts from the WS verify the correctness of the values being questioned. Members of the WS reviewed the values in Table 6 and could not determine how some of the values were determined or derived. Consequently, the WS agreed to maintain this item as a Carryover item on their 2013 agenda to allow additional time for input from load cell experts. It was agreed that Mr. Rusk, Coti Global Sensors, Mr. Upright, Vishay Transducers, Inc., Mr. Flocken, Mettler-Toledo, Inc., Mr. Langford, Cardinal Scale Manufacturing, Inc., and Mr. Harshman, OWM, would consult with load cell experts in an effort to verify and

make corrections to the values in the table where needed. Mr. Harshman offered to consult with Mr. Chesnutwood, NIST Force Lab, regarding this effort.

Shortly after the 2012 WS meeting had concluded, Mr. Chesnutwood provided a review of the values in Table 6 and made corrections where necessary. A corrected version of the table, shown below, incorporating Mr. Chesnutwood's changes, was then circulated to all members of the Sector who were in attendance at the 2012 WS meeting. Members were asked to vote on whether the corrections to the values in the table should be completed or the item remain as a Carryover item on the 2013 WS agenda. All members responding to the poll, with the exception of one member choosing to abstain, voted in favor of making the corrections included in the table. For this reason it was decided that the corrected version of the table would be submitted to the NTEP Committee in January 2013 with the recommendation from the WS that it be included in the next version of Publication 14. Three members of the WS representing load cell manufacturers did not respond to the poll that was taken. Because those three represented a majority of the load cell manufacturers present during the WS meeting, it was decided that the item would still remain as a Carryover item on the 2013 WS agenda to provide additional confirmation by the WS, including more desired representation by the load cell manufacturers, that the changes made to the table were correct.

Table 6 (Corrected)
Example of a Summary Table for Class III 3000 Single Load Cell

Summary Table (As requested in Item 12 of the load cell data format paper)				
		Critical Result	Tolerance	Result/Tolerance
	Load Cell Error	0.68 v	0.7 v	0.97
	Repeatability Error	0.19 v	~~**0.35 v**~~ **0.7 v**	~~**0.55**~~ **0.27**
	Temperature Effect on MDLO	0.57 v_{min}/5 °C	0.7 v_{min}/5 °C	0.82
	Creep (time dependence)	0.98 v	~~**1.5 v**~~ **1.05 v**	~~**0.65**~~ **0.93**
	Δ Creep = $I_{20\ min} - I_{30\ min}$	0.09 v	0.15 x |mpe| = ~~**0.225 v**~~ **0.1575 v**	~~**0.40**~~ **0.57**
	Creep Recovery	0.17 v	0.5 v	0.34
	Effect of Barometric Pressure	0.185 v_{min}/kPa	1.0 v_{min}/kPa	0.15

8. NCWM Publication 14, NTEP Administrative Policy

Source
NTEP Administrator

Background/Discussion
NCWM is working to revise *NCWM Publication 14*, Administrative Policy to put it in a more logical order and more understandable form. The purpose is not to change the intent of the publication, rather to realign and clarify sections as necessary. Sectors, committees and the NTEP labs are asked to review the revised section, NTEP Administrative Policy" and provide feedback.

Conclusion:
Mr. Truex reported that the NTEP Board of Directors maintains responsibility of Publication 14 Administrative Policy and that this document had been recently revised and is currently in draft form. A copy of the draft revision was provided to members of the sector and they were asked to provide a review and report any concerns to Mr. Truex prior to the NTEP Committee meeting planned in early October 2012. Mr. Harshman, OWM, commented that he noticed that the revised draft uses the acronym WMD to reference the NIST Office of Weights and Measures and that a global search of the document should be performed to correct this oversight. The draft revision of Publication 14 Administrative Policy can be found in the NTETC Sector Section of the www.ncwm.net website.

9. Next Sector Meeting

The WS agreed to conduct their next meeting in Albany, NY on Tuesday and Wednesday, August 27 and 28, 2013. Mr. Morabito, NY State Weights and Measures, was asked by Mr. Truex to provide the names of three hotels in the area to accommodate members of the sector during their visit. Mr. Morabito stated that Mr. Sikula, Director of NY State Weights and Measures, hopes to be able to offer a tour of the new lab at that time.

APPENDIX A – ATTENDEES

William Arce
USDA, GIPSA, PSP
210 Walnut Street, Suite 317
Des Moines, IA 50014
P. (515) 323-2510
E. william.arce@usda.gov

Steven Beitzel
Systems Associates, Inc.
1932 Industrial Drive
Libertyville, IL 60048
P. (847) 367-6650
E. SJBeitzel@Systemsassoc.com

Luciano Burtini
Measurement Canada
2008 Matera Avenue
Kelowna, BC V1V1W9
P. (250) 862-6557
E. luciano.burtini@ic.gc.ca

Darrell Flocken
Mettler-Toledo, Inc.
1150 Dearborn Drive
Worthington, OH 43085
P. (614) 438-4393
E. darrell.flocken@mt.com

Rick Harshman
NIST, Weights and Measures Division
100 Bureau Drive, Stop 2600
Gaithersburg, MD 20899-2600
P. (301) 975-8107
E. richard.harshman@nist.gov

Ken Jones
California Division of Measurement Standards
6790 Florin Perkins Road Suite 100
Sacramento, CA 95828
P. (916) 229-3052
E. kenneth.jones@cdfa.ca.gov

Takashi Kawazoe
New Brunswick International Inc.
76 Veronica Ave.
Somerset, NJ 08873
P. (732) 828-3633
E. tkservice@nbidigi.com

Stephen Langford
Cardinal Scale Manufacturing Co.
203 East Daugherty Street
Webb City, MO 64870
P. (417) 673-4631
E. slangford@cardet.com

Paul A. Lewis, Sr.
Rice Lake Weighing Systems, Inc.
230 West Coleman Street
Rice Lake, WI 54868-2404
P. (715) 234-9171 ext.5322
E. plewis@ricelake.com

Ed Luthy
Stock Equipment Co., Inc.
108 Wade Drive
Dover, OH 44622
P. (440) 241-0194
E. ed.luthy@stockequipment.com

Eric Morabito
New York State Weights and Measures
10 B Airline Drive
Albany, NY 12235
P. (518) 457-3452
E. Eric.Morabito@agriculture.ny.gov

Joe Morrison
Ohio Department of Agriculture
Weights and Measures
8995 East Main Street, Building 5
Reynoldsburg, OH 43068
P. (614) 728-6290
E. jmorrison@agri.ohio.gov

Edward Payne
Maryland Department of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401
P. (410) 841-5790
E. edward.payne@maryland.gov

Frank Rusk
Coti Global Sensors
5709 Highway 53
Harvest, AL 35749
P. (256) 852-9900
E. frank@cotiglobal.com

Samuel Sagarsee
Emery Winslow Scale Co.
4530 North 25th Street
Terre Haute, IN 47805
P. (812) 466-5265 ext.112
E. srsagarsee@winslowth.com

Byron School
USDA, GIPSA
1400 Independence Ave. SW
Washington, DC 20250
P. (202) 720-0280
E. Byron.C.School@usda.gov

Louis Straub
Fairbanks Scales, Inc.
3056 Irwin Drive S.E.
Southport, NC 28461
P. (910) 253-3250
E. lstraub@fairbanks.com

James Truex
National Conference on Weights and Measures
88 Carryback Drive
Pataskala, OH 43062
P. (740) 919-4350
E. jim.truex@ncwm.net

Rob Upright, Jr.
Vishay Transducers
42 Countryside Road
North Grafton, MA 01536
P. (508) 615-1185
E. rob.upright@vishaypg.com

David Vande Berg
Vande Berg Scales
770 7th Street N.W.
Sioux Center, IA 51250
P. (712) 722-1181
E. davevb@vbssys.com

ATTACHMENTS

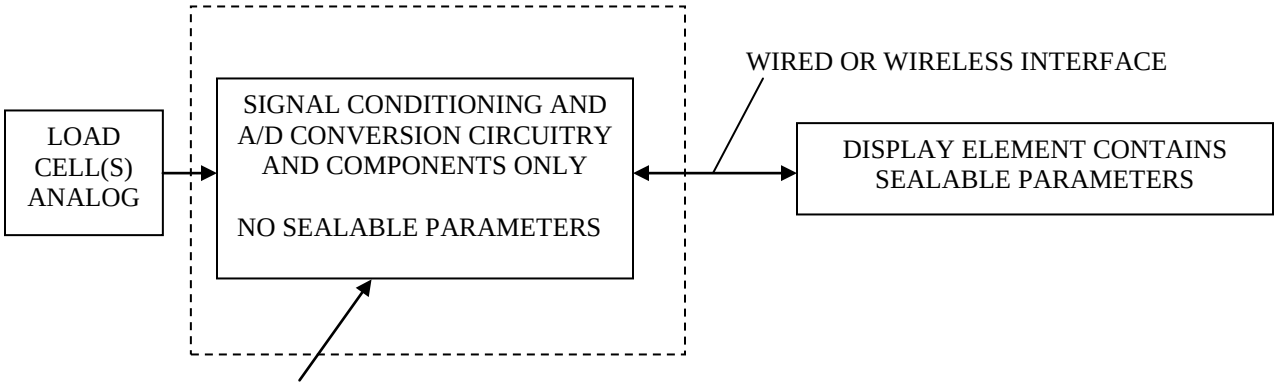
Attachment to agenda Item-6: Sealing/Capabilities of Smart Junction Boxes

National Type Evaluation Program
Digital Controller Element for Load Cells
Checklists and Test Procedures

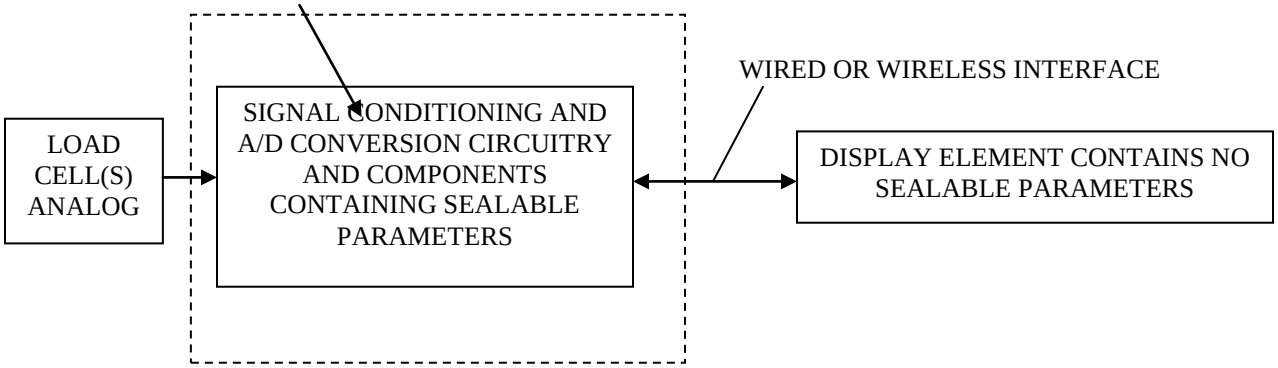
Revision A Dec 28, 2011

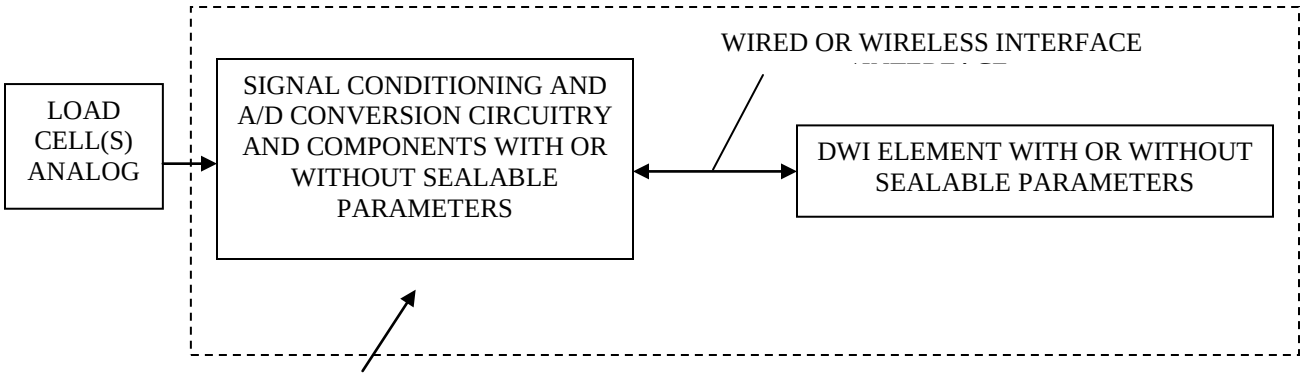
Purpose and Use

This checklist is intended for use when conducting NTEP evaluations of new Digital Controller Elements (DCE) for Load Cells. A DCE for Load Cells is defined as a device that accepts the analog output of one or more cells, converts the load cell output(s) to a single digital value and transmits that value to a display element where it is either displayed or processed further before display. The DCE is typically housed in a separate enclosure and located adjacent to the load cell(s). Calibration of the digital weight signal can take place either within the Digital Controller or within the Digital Weight Indicating (DWI) element. Block diagrams of the three possible types of Load Cell Digital Controller are shown below:

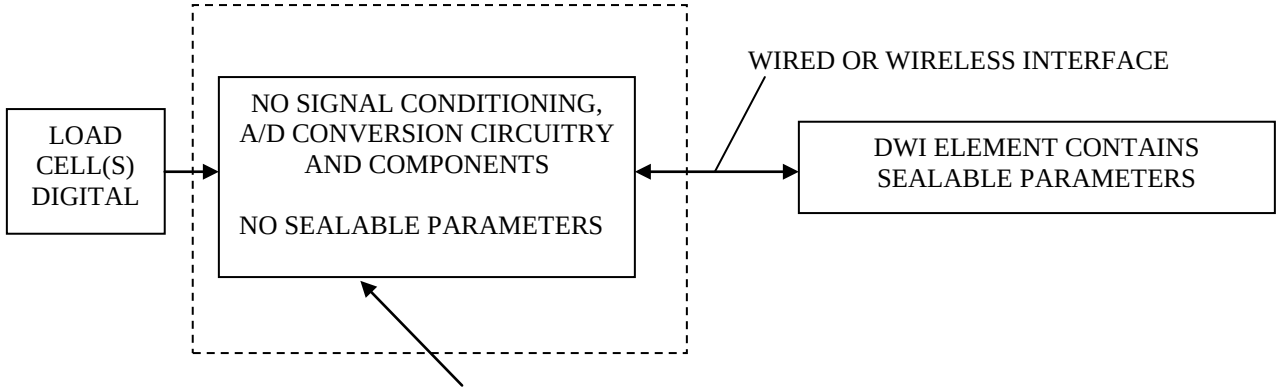


These checklists and test procedures apply if NTEP Certification is ONLY for this portion of the instrument.

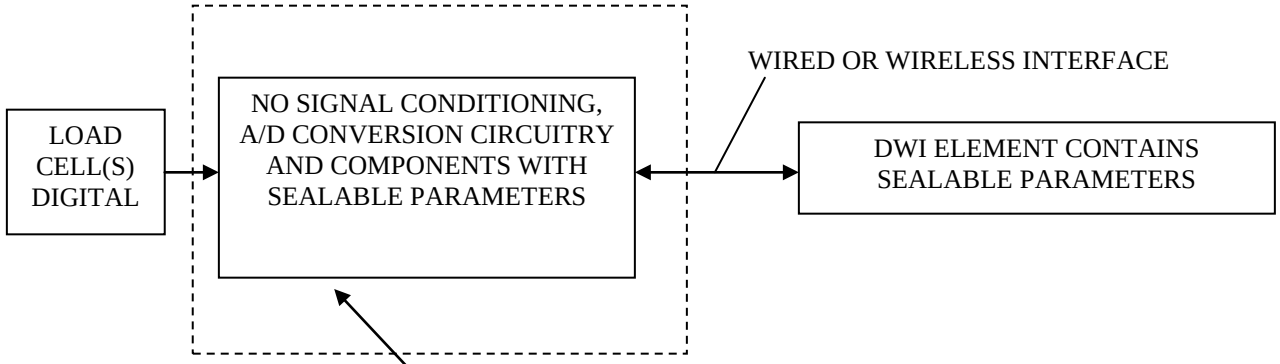




If NTEP Certification is for the signal conditioning element and the DWI element (the whole weight indicating element), use the Digital Electronic Scales (DES) examination procedure.



NTEP Certification is not required for the DCE.



NTEP Certification is required for the DCE.

If both the DCE AND the associated DWI Element are being evaluated as a single component, the test and checklist for Digital Electronic Scales should be used. If only the DCE is being evaluated, use this checklist and test procedure.

The checklist is designed so that the user can determine and record the conformance of the device with the elements of NIST Handbook 44 in a logical sequence. The user should make copies of the checklist to serve as work sheets, preserving the original for reference. In most cases, the results of evaluation for each element can be recorded by checking the appropriate response. In some cases the user is required to record values, results or comments. In those cases, space is provided.

1. Marking Requirements

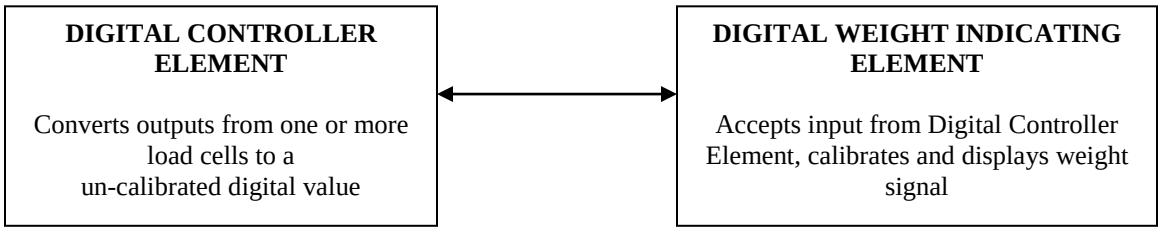
Code Reference: ***To Be Determined***

The minimum information to be marked on the Load Cell Digital Controller Element (DCE) includes the manufacturer's ID, the Model Number and Prefix, the Serial Number and Prefix and the Certificate of Conformity Number (CC). If the DCE is intended to operate accurately over a temperature range that is narrower than –10° C to 40° C (14° F to 104° F) then the operating temperature range must also be marked on the device. If a narrower temperature range is specified, the range must be at least 54° F (30° C). If the DCE contains calibration and setup information to calibrate the weight signal before transmission, it must also contain markings for the accuracy class and n-max. The display element used to display the weight value from this device must contain markings for manufacturer's ID, the Model Number and Prefix, the Serial Number and Prefix, the Certificate of Conformity Number (CC), the temperature range if not –10° C to 40° C (14° F to 104° F), the Nominal Capacity, the Value of the Scale Division "d", and the value of "e" (required only if different than "d").

The lettering must be permanent as described in section 1.

1.1	The Manufacturer's ID, the Model Number and Prefix, the Serial Number and Prefix and Certificate of Conformity Number (CC) must be permanently marked on the device.			
	Manufacturer's ID	Yes	No	N/A
	Model Number and Prefix	Yes	No	N/A
	Serial Number and Prefix	Yes	No	N/A
	Certificate of Conformity	Yes	No	N/A
1.2	The operating temperature range shall be marked if different from –10° C to 40° C (14° F to 104° F).	Yes	No	N/A

Figure 1.
Examples of Marking Requirements for Various Device Configurations

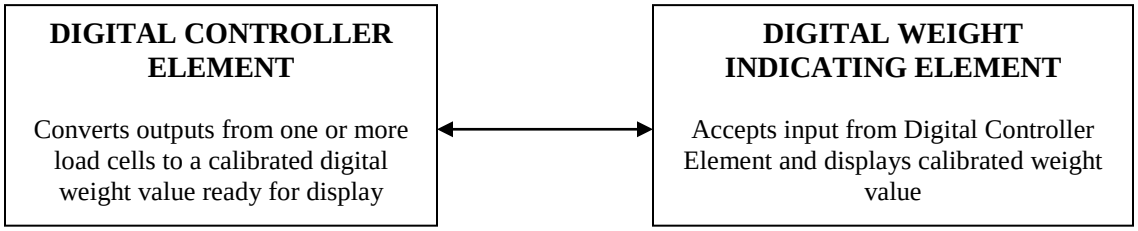


Mark with:
- Manufacturer's ID
- Model Number and Prefix
- Serial Number and Prefix
- Temperature Range if required
- Certificate of Conformity Number

Mark with:
- Manufacturer's ID
- Model Number and Prefix
- Serial Number and Prefix
- Temperature Range if required
- Certificate of Conformity Number
- Accuracy Class
- Nominal Capacity
- n-max
- Scale Division d
- Value of e (if different from d)
- CLC (vehicle, axle load and livestock1)
- Section Capacity (for livestock1 and Railway track scales)
- Special Applications

1 See Footnote 14 in Handbook 44 Scales Code Table S.6.3.b

Marking Requirements for DCEs that Do Not Output a Calibrated Weight Value



Mark with:
- Manufacturer's ID
- Model Number and Prefix
- Serial Number and Prefix
- Temperature Range if required
- Certificate of Conformity Number
- Accuracy Class
- Nominal Capacity
- n_{max}
- Scale Division, d
- Value of e (if different from d)
- CLC (vehicle, axle load and livestock[1])

Mark with:
- Manufacturer's ID
- Model Number and Prefix
- Serial Number and Prefix
- Temperature Range if required
- Certificate of Conformity Number
- Accuracy Class
- Nominal Capacity
- n_{max}
- Scale Division, d
- Value of e (if different from d)
- CLC (vehicle, axle load and livestock1)
- Section Capacity (for livestock[1] and Railway track scales)
- Special Applications

Marking Requirements for DCEs that Output Calibrated Weight Values

1.3	If the device contains calibration data, the Accuracy Class and n-max shall be marked.	Yes	No	N/A
1.4	The lettering for all markings must be permanent.	Yes	No	N/A

2. Provision for Metrological Sealing of Adjustable Components or Audit Trail

Code Reference S.1.11.
All components of a weighing instrument must comply with Section 10 of the Digital Electronic Scale Checklist if they have a metrological effect on the instrument or system. DCE features, not addressed in this checklist, may be covered and shall comply with applicable sections in the Digital Electronics Scales Checklist. (See Appendix A – Philosophy for Sealing, Typical Features and Parameters to be Sealed)

Only those DCEs that contain sealable parameters are required to have a means of sealing the adjustments or contain an Audit Trail feature. Those DCEs that ONLY digitize the load cell signal and do not contain any sealable parameters are not required to have security seals or Audit Trails.

Verify that the Digital Controller Element (DCE) does NOT have sealable parameters and cannot adjust the accuracy of the weighing instrument.

2.1	Does the Digital Controller Element (DCE) have sealable parameters or features? *See table of typical "Scale Features and Parameters" and DES Section 10 Provisions For Metrological Sealing of Adjustable Components or Audit Trail.*	Yes	No	N/A

2.1.1 If yes, does the DCE Comply with the DES checklist Section 10, Provision for Metrological Sealing of Adjustable Components or Audit Trail? Yes No N/A

Category 1
Category 2
Category 3

3. Test Procedures for Influence Factors

Introduction

Influence factors are environmental variables that might affect the performance of the DCE. Section T.N.8 of the Scales Code in NIST Handbook 44 specifies performance requirements for scales and scale components over given ranges. The test equipment (e.g. thermometers, hygrometers, timing devices) must be sufficiently accurate that their errors do not significantly contribute to the measurement results. The environmental chamber used must meet specified conditions as well. In general, good laboratory practices must be followed.

DCEs can be affected by changes in temperature, changes in the power supply voltage, EMC, interruption of weight data transmission media and possibly humidity depending on enclosure design. The manufacturer of the DCE under evaluation must also provide a compatible DWI element that will be used to indicate the output of the DCE. The following tests are appropriate for those DCEs that only digitize and transmit the weight information as well as those who also calibrate the weight signal and output the weight data in a calibrated format ready for display.

Purpose

The purpose of these tests is to determine the performance and operating characteristics of the DCE under test under loss of communication with the DWI element, at different ambient temperatures, and to determine the temperature effect on the no-load indication.

Pre-Test Conditions

3.1 Test Equipment Needed:

- 3.1.1 Environmental Chamber of sufficient capacity and temperature range
- 3.1.2 Load Cell Simulator
- 3.1.3 Calibrated Thermometer and Hygrometers

3.2 Device to be Tested

- 3.2.1 DCE
- 3.2.2 DWI Element
- 3.2.3 Interconnecting Cable (not required if interface is wireless)

3.3 Conditions of Equipment Under Test

- 3.3.1 The DCE shall be connected to the Load Cell Simulator following instructions provided in the manufacturer's documentation. Connect the DCE to the DWI Element following the manufacturer's instructions (unless a wireless interface is used). Connect the DCE and the DWI Element to a power source in accordance with the manufacturer's instructions. If equipped with power switche(es), turn both the DWI Element and DCE on and allow them to remain on for a period of time equal to or greater than the manufacturer's recommendations.
- 3.3.2 Verify that the DCE and DWI Element are operational by observing the weight display in response to changes in the setting of the Load Cell Simulator.
- 3.3.3 Place the DCE and DWI Element within the environmental chamber and set the temperature to 20° C (68° F) or at the mid point of the temperature extremes if a temperature range other than the standard –10° C to 40° C (14° F to 104° F) range is specified by the manufacturer.
- 3.3.4 Prior to beginning the test, verify that the ambient humidity does not exceed 50 percent relative humidity and that the DCE and DWI Element are at thermal equilibrium.

3.4 Communications Interface Interruption

3.4.1 The purpose of this test is to ensure that no erroneous weight information is transmitted when the communications interface between the DCE and DWI Element is interrupted. Increase the setting of the Load Cell Simulator until a reading within the range of 500 to 5000 divisions is displayed by the DWI Element. Record the reading. Remove the primary power from the DCE by unplugging its power cord or, if so equipped, remove the battery. If the DCE receives its power from the DWI, it will be necessary to contact the manufacturer to determine the method to be used to disconnect it from its source of power. Observe the DWI Element. The weight value shown by the DWI Element should, within 2 seconds of interrupting communications, change to either a blank display or error message. It should not be able to display, record or transmit a weight value under these conditions. Restore power to the DCE. Does the DWI Element indicate an error condition or blank display when the communications with the DCE is interrupted?

Yes No N/A

3.4.2 Repeat the test described in 3.4.1 above but rather than disconnecting the DCE from its power source, disconnect the communications cable or block the wireless signal if so equipped. Does the DWI Element indicate an error condition or blank display when the communications with the DCE is interrupted?

Yes No N/A

3.5 Effect of Temperature on Device Output

Code References: T.N.8.1

3.5.1 The purpose of this test is to determine the effect of changes in temperature on the output of the device. Place the DCE and DWI Elements within the environmental chamber. Connect the Load Cell Simulator or Load Receiving Element to the DCE and place the Load Cell Simulator or Load Receiving Element outside of the environmental chamber. Apply power to the DCE and DWI Elements according to the manufacturer's instructions. Set the environmental chamber to a temperature of 20° C if the full temperature range is being used or to the mid point of the temperature extremes if a temperature range other than the standard –10° C to 40° C (14° F to 104° F) range is specified by the manufacturer. If equipped, set the humidity to a setting not greater than 50% relative humidity. Allow the chamber and equipment under test to reach thermal equilibrium. Verify that these conditions are maintained for a minimum of 3 hours.

3.5.2 Using the Load Cell Simulator or Load Receiving Element, conduct at least two increasing and two decreasing load tests with at least five different test loads. If the DCE contains calibration settings and transmits a calibrated weight to the DWI Element, the test points shall include the maximum test loads at each tolerance level. If the DCE does not transmit a calibrated weight value to the DWI Element, it is not necessary to include the maximum test load at each tolerance level.

3.5.3 Record the following information at each test load:

a. Time and date
b. Temperature
c. Relative Humidity
d. Test Load (mV/V or micro-strain) (or weight if a Load Receiving Element is used)
e. Indication
f. Error
g. Performance Notes if appropriate

3.5.4 Increase the temperature of the environmental chamber to the maximum temperature specified by the manufacturer not to exceed 40° C (104° F) and allow the device under test to stabilize for at least 3 hours. Stability is assumed to have been reached when the intended temperature is maintained within ± 1° C (2°F) for a period of 10 minutes.

3.5.5 Record the change in zero, if any, zero if necessary and repeat steps 3.5.2 and 3.5.3.

3.5.6 Reduce the temperature to the minimum specified. After the temperature has stabilized according to the definition in 3.5.4, allow the device under test to stabilize for a minimum of 3 hours.

3.5.7 Record the change in zero, if any, zero if necessary and repeat steps 3.5.2 and 3.5.3.

3.5.8 Increase the temperature to the temperature used in step 3.5.1 and, after the temperature has stabilized, allow the device under test to stabilize for a minimum of 3 hours.

3.5.9 Record the change in zero, if any, zero if necessary and repeat steps 3.5.2 and 3.5.3.

3.5.10 Additional tests at other temperatures within the specified range of temperatures may be conducted if so desired.

3.5.11 If the DCE fails to meet tolerance requirements while conducting the tests in this section of the procedure, the manufacturer has the option of specifying a smaller temperature range. If the DCE failed at only the original specified minimum or maximum temperature, the device need only be tested at the new specified minimum or maximum temperature. It is not required to re-test over the entire newly specified temperature range.

3.5.12 If the DCE fails to meet tolerance requirements while conducting the tests in this section of the procedure, the manufacturer may have the option to have the test data reanalyzed for a larger e-min and a smaller n-max. Reanalyzing the data is only appropriate if the data were collected in an expanded display resolution to a resolution of one tenth of the specified e-min or with error weights if a load-receiving element was used in place of the Load Cell Simulator.

3.5.13 Before the manufacturer requests a smaller e-min and/or a larger n-max based on the performance during an evaluation, they must submit documentation illustrating the changes made to the device or the manufacturing process, in order to improve the metrological performance of the device. NTEP will require the submission of additional devices for temperature testing.

3.5.14 Does the device under test perform over the specified temperature range within tolerance?

Yes No N/A

3.6 Power Voltage Variations

Code References: T.N.8.3.1.
The purpose of varying the power supply voltage is to determine the performance and operating characteristics of the Digital Device Controller that is under test at different voltage levels required by T.N.8.3.1.

If the DCEs provided with an automatic zero tracking device, it may be in operation during the test, in which case the error at zero point shall be determined by recording the error at a test load several intervals above the zero tracking limits.

3.6.1 Test Equipment Needed:
- 3.6.1.1 Variable Power Source
- 3.6.1.2 Voltmeter
- 3.6.1.3 Load Cell Simulator or Load Receiving Element

3.6.2 The test shall be conducted in a normal laboratory environment.

3.6.3 Conditions of Equipment under Test
- 3.6.3.1 Normal power shall be applied to the DCE and DWI Element for a period of time equal to or greater than the warm-up time specified by the manufacturer.
- 3.6.3.2 If applicable, the DCE shall be adjusted as closely as practicable to zero error. If the DCE has no adjustments, disregard this step.
- 3.6.3.3 If equipped with adjustment features, the DCE shall not be adjusted or readjusted at any time during the conduct of this test.

3.6.4 Allowable Variations in Test Conditions:
- 3.6.4.1 ±2% of the power supply
- 3.6.4.2 All other variables shall be held as nearly as practicable to a normal condition. At least one test cycle shall be conducted.

3.6.5 Power Supply Limits
- 3.6.5.1 As specified in Scale Code in NIST Handbook 44 paragraph T.N.8.3.1.

3.6.6 Maximum Allowable Variations
- 3.6.6.1 All available functions must operate correctly
- 3.6.6.2 All indications must remain within the tolerances specified in the Scales Code paragraph T.N.3. Tolerance Values for DCEs that produce a calibrated weight value.

POWER SUPPLY TEST

1. With the power supply and equipment under test in the "on" condition, warm up the equipment for a time interval equal to or greater than the manufacturer's specified minimum warm-up time.
2. Stabilize the power supply output at the nominal voltage ±2%.
3. Conduct increasing and decreasing load tests with at least three different test loads, including the maximum test loads at each tolerance level (only if the DCE produces the calibrated weight value).
4. Record the following data:
   a. Time and Date
   b. Temperature
   c. Relative Humidity
   d. Power Supply Voltage
   e. Test Load (in mV/V or micro-strain) (or units of mass if a Load Receiving Element is used)
   f. Indication
   g. Error
   h. Any applicable notes pertaining to functions or performance
5. Reduce the power supply to the minimum specified in T.N.8.3.1
6. Zero if necessary and repeat steps 3 and 4.
7. Increase the power supply voltage to the maximum specified in T.N.8.3.1.
8. Zero, if necessary, and repeat steps 3 and 4.
9. Reduce the power supply voltage to the nominal value.
10. Zero, if necessary, and repeat steps 3 and 4.

Note: Data can be recorded on the Variation of Voltage Report Form shown at the end of DES section 61.

3.6.7 Are all readings collected during the test within the appropriate tolerance?

Yes No N/A

4. Other Applicable Tests for Digital Controller Elements

4.1 Interchange or Reversal of Parts
Does the device under evaluation comply with Section 7 Interchange or Reversal of Parts? Yes No N/A

4.2 Wireless Communications Test
Does the device under evaluation comply with DES Sections 11.19 through 11.19.6?? Yes No N/A

4.3 Facilitation of Fraud
Does the device under evaluation comply with DES Section 19 Facilitation of Fraud – Appropriate Design? Yes No N/A

4.4 RFI/EMI Environment
Does the device under evaluation comply with Section 24 RFI/EMI Environment? Yes No N/A

4.5 Installation Requirements
Does the device under evaluation comply with Section 25 Installation Requirements? Yes No N/A

4.6 Discrimination and Zone of Uncertainty
Does the device under evaluation comply with Section 44 Discrimination and Zone of Uncertainty? Yes No N/A

4.7 Temperature and Performance Tests (General)
Does the device under evaluation comply with Section 54 Temperature and Performance Tests? Yes No N/A