National Type Evaluation Program Weighing & Belt Conveyor Scale Sector Meeting

August 19, 2025; 9:00 am to 5:00 pm
August 20 9:00 am to 12:00 pm
Lincoln Nebraska

Introduction

The charge of the NTEP Weighing & Belt Conveyor 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, 2.21 Belt-Conveyor Scale Systems, 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 the 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 **boldface print** by ~~**striking out**~~ information to be deleted and **<u>underlining</u>** information to be added. Requirements that are proposed to be non-retroactive are printed in ***boldfaced italics***.

Table A
Table of Contents

Title of Contents — Page

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. Items that were adopted at the 2025 Annual meeting.

1.1 AWS-24.1

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

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

(Added 20XX)

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

(Amended 20XX)

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

(Added 20XX)

(Amended 20XX)

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

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

N.2.1. Non-Automatic Tests. – If the automatic weighing system is designed to operate non-automatically and is used in that manner during normal operation, it shall be tested non-automatically using mass standards. The device shall not be tested non-automatically if it is used only in the automatic mode.

(Amended 2004 **and 20XX**)

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

N.2.2. Automatic Test Procedures.

N.2.2.1. Automatic Tests ~~Non-Automatic~~ for Weigh-Labelers. – ~~If the automatic weighing system is designed to operate non-automatically, and is used in that manner, during normal use operation, it shall be tested non-automatically using mass standards. The device shall not be tested non-automatically if it is used only in the automatic mode.~~The device shall be tested at the normal operating speed using test pucks or packages per N.1.1. Test Pucks and Packages. and N.1.2. Accuracy of Test Pucks or Packages. Each test load should be run a minimum of ten consecutive times.

(Amended 20XX)

N.2.2.2. Automatic Tests for Automatic Checkweighers. – The device shall be tested at the ~~**normal operating speed using packages. Test runs should be conducted using at least two test loads distributed over its normal weighing range (e.g., near the lowest and highest ranges in which the device is typically operated.) Each test load should be run a minimum of ten consecutive times.**~~ **highest speed in each weight range using test pucks or packages per N.1.1. Test Pucks and Packages. and N.1.2. Accuracy of Test Pucks or Packages. The number of consecutive test weighments shall be as specified in Table N.2.2.2. Number of Sample Weights per Test for Automatic Checkweighers.**

(Amended 20XX)

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

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

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

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

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

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

(Amended 20XX)

Recommendation:

This item was adopted by NCWM. There is no change required for Publication 14 since this is for initial verification when placed into service.

Discussion/Conclusion:

1.2 SCL-25.2

Table S.6.3.a. Marking Requirements and Definitions

Table S.6.3.a. Marking Requirements					
To Be Marked With ⇓	Weighing Equipment				
	Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC[1]	Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC	Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC	Load Cell with CC (11)	Other Equipment or Device (10)
Minimum Verification Scale ~~**Division**~~**Interval**(e_{min})			X (19)		

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

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

And,

Amend the Handbook 44 Definitions as follows

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

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

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

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

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

Recommendation:

The NCWM adopted this item. The NTEP administrator recommends changing all references in Publication 14 Digital Electronic Scales from division to interval as an editorial change.

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Discussion/Conclusion:

1.3 SCL-25.4

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

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

(Added 1999) (Amended 2024) **(Amended 20XX)**

S.1.2.2.2.2. Weight Classifiers. – On a weight classifier, such as a postal or shipping scale that rounds up and is marked for special use, the value of "e" shall be equal to ~~**or less than**~~ "d".

(Added 2024) **(Amended 20XX)**

Table S.6.3.b. **Notes for Table S.6.3.a. Marking Requirements**
1. …
2. ...
3. …
4. *Exceptions to Note 3 regarding marking of "e" and "d".* *(a) For an ungraduated scale such as an equal arm scale where the scale graduations do not represent a fixed weight quantity, the nominal capacity shall be shown together with the verification scale interval "e" (e.g. capacity 1,000 g e = 0.1 g, or Max 1,000 g e = 0.1 g). These devices have no "d".* *(b) For a scale where e does not equal d, such as a scale equipped with an auxiliary indication* ~~***or a weight classifier marked for special use***~~*, the nominal capacity shall be shown together with the verification scale interval "e," and the scale division "d" (e.g., capacity 1,000 g e = 0.1 g d = 0.01 g, or Max 1,000 g e = 0.1 g d = 0.01 g).* *[Nonretroactive as of January 1, 1986]* (Amended 2024 **and 20XX**)
Notes 5 through 28 remain unchanged but have been removed for the sake of efficiency.

Appendix D

weight classifier. – A digital scale that rounds weight values up to the next ~~**scale division**~~ **verification scale interval (e)**. ~~**These scales usually have a verification scale interval (e) that is smaller than the displayed scale division (d).**~~ [2.20]

(Added 1987) (Amended 2024 **and 20XX**)

Recommendation:

The NCWM adopted this item. The NTEP administrator recommends reviewing and changing all references in Publication 14 Digital Electronic Scales for weight classifiers that would reference “e” must be equal to “d.” as an editorial change.

Discussion/Conclusion:

1.4 SCL-25.5

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

(Amended 20XX)

Recommendation:

The NCWM adopted this item. The NTEP administrator recommends changing all references in Publication 14 Digital Electronic Scales from division to interval as an editorial change

Discussion/Conclusion:

2. Verifying the Performance Adequacy of a Reference Scale and Recommendations for Amendments to Publication 14 for Belt Conveyor Scales

Source:
NIST OWM's Legal Metrology Devices Group

Background:
During a 2016 meeting of the USNWG on BCS, the USNWG recognized that there has been a difference of opinion in the interpretation of tolerance application among regulatory officials, manufacturers, and users of belt-conveyor scale type systems. The work group confirmed through their discussions that the tolerance prescribed in Handbook 44 Section 2.21. are being applied to the range of test run results by some evaluators as a "plus or minus" tolerance while others are taking a more conservative position and applying the tolerance as an absolute value. This lack of clarity in the Belt-Conveyor Scale Systems Code and the difference in interpretation of how the tolerance is to be applied was identified as a source of inconsistency in the regulation of this type of dynamic weighing systems. Since the USNWG recently amended the Belt-Conveyor Scale Systems Code to recognize systems that operate using multiple rates for the flow of material, this inconsistency was considered to be a significant issue that the work group should address.

The USNWG consulted past records of work group meetings, NTEP Sector meetings, and NCWM conference reports, along with other resources in attempts to determine the correct and intended application of the allowable variation between consecutive test runs when material tests are conducted. The USNWG was unable to arrive at any definitive conclusion on this issue through this research but they agreed it is necessary to amend the Belt-Conveyor Scale Systems Code to clearly identify the proper application of tolerances under specific sets of test conditions.

After lengthy discussion and much deliberation, the USNWG arrived at a consensus and agreed the existing tolerance should be applied as an absolute value when comparing test results performed under practically identical conditions (referring primarily to the flow rate of material). They also concluded that when comparing test results from test 1 runs performed under different conditions, the tolerance should be applied as a plus or minus value to the range of 2 test results.

The changes included in the attached proposal are intended to clarify how the prescribed tolerances are to be applied when comparing totalization operations during material tests on a "belt-conveyor scale system" or a "weigh-belt system." The recommended changes will specify the application of tolerance when material test runs are performed under practically identical conditions, and the proper application of tolerances when those test runs are performed under different conditions.

During deliberations on the issue of how tolerances are to be applied in a comparison of material test results, the USNWG acknowledged that advances in design and technology have resulted in belt-conveyor scale systems and weigh-belt systems capable of performing within more stringent tolerances. The work group also recognized that the international recommendation OIML (R50) incorporates different accuracy classes for these types of systems. It was also noted the Handbook 44 Scales Code (Section 2.20.) incorporates different accuracy classes for weighing devices regulated under that code. The members of the work group agreed there were benefits to introduce different accuracy classes for belt-conveyor scales and weigh-belt systems in Handbook 44 Section 2.21., believing that adding another accuracy class of dynamic weighing systems would provide more alternatives for determining the weight of various products in a wider array of commercial applications.

The additional changes in this proposal recommending the introduction of two different accuracy classes would retain the existing performance requirements (0.25 % relative to the weight of reference material used) and add a second accuracy class for devices/systems capable of complying with more stringent performance requirements (0.1 % relative to the weight of the reference material). In addition to introducing a new accuracy class with a smaller tolerance, other changes are included in this proposal to accommodate the addition of a second accuracy class. This proposal also recommends changes to account for differences in minimum scale division size, marking requirements, minimum test load size, and requirements pertaining to zero-tests (see attached document). These changes to the U.S. standards will harmonize more closely with international recommendation OIML R50 and bring the Belt-Conveyor Scale Systems Code in alignment with certain requirements in the Scales Code in Handbook 44.

There may be opposing arguments from some that do not support allowing a "plus or minus "application of tolerances to the range of results from consecutive material test runs when those runs are performed under different

flow rates.

In proportion to the number of these types of systems in commercial use, there are relatively few systems that are installed in a manner with the intent and/or ability to alter the flow rate of material.

Ensuring compliance with the provisions outlined in Section 3.2. in the Fundamental Considerations of Handbook 44 may prove challenging in some installations, depending upon the available equipment for weighing reference materials and conducting the test of the belt-conveyor scale system or weigh-belt system. The USNWG has received information, however, from a device manufacturer (and member of the USNWG) that has demonstrated that these requirements are achievable.

At the 2019 NCWM Annual Meeting, the NCWM adopted amendments to the Belt-Conveyor Scales Systems (BCSS) Code, including adding a new Accuracy Class 0.1 and accompanying Note paragraph that requires the quantity of material used to conduct a material test on a Class 0.1 BCSS to be weighed on a reference scale to an accuracy within 0.035% (which equates to 0.35 lb/1,000 of test load). The tolerance to be applied to an Accuracy Class 0.1 BCSS is +/- 0.1% of the test load. OWM has some questions regarding the means of verifying the accuracy of some scales using procedures that will ensure when those scales are used to weigh material for a material test of a Class 0.1 BCSS, the actual mass of the material is within the 0.035% specified. Mr. John Barton (NIST OWM) and Mr. Rick Harshman (NIST OWM) will provide an overview of some test procedures being developed by OWM that can hopefully be used to confirm the adequacy of the reference scale (when used as a mass comparator) so that the scale can then be used to weigh reference material to within the 0.035% accuracy specified.

Although the NTEP Belt-Conveyor Scale Sector will be considering recommended changes to the Belt-Conveyor Scale and Weigh-Belt Systems portion of NCWM Publication 14 in the near future, it is thought members of the Weighing Sector might find this topic of interest because reference scales are used in other applications and may need to be tested similarly to determine their adequacy for use in weighing material. For example, reference scales are used to verify the performance of CNG Retail-Motor Fuel Dispensers.

Discussion/Conclusion: Belt Conveyor Scale Sector members in attendance at the October 29, 2019 meeting were notified that changes being recommended for NCWM Publication 14 were posted on the NCWM's website approximately two weeks prior to the meeting. Not all members at the Sector meeting had the opportunity to complete a full review of those recommended changes. Those Sector members agreed they would complete their review and provide any comments regarding edits or other changes by Friday, November 1, 2019. Those comments would be provided to NIST technical advisor who would then incorporate any necessary changes and forward the amended recommendations to the NTEP Administrator prior to the November 15th deadline. No significant changes were recommended by members attending the October 29, 2019 Sector meeting.

During the 2019 Weighing Sector Mr. John Barton (NIST OWM) provided an overview of some of the changes that were adopted at the 2019 NCWM Annual Meeting affecting the Belt-Conveyor Scales Systems (BCSS) Code. Most notably are new requirements intended to address a 0.1 Accuracy Class BCSS. As its accuracy class implies, the tolerance to be applied to a 0.1 Accuracy Class BCSS will be ± 0.1% of the test load, which is the level of accuracy some manufacturers of weigh-belts (a type of belt-conveyor scale system) are claiming their systems can meet. Measurement Canada has evaluated at least one of these systems and found its performance to be within the specified tolerance.

A new Notes paragraph being added to the BCSS Code in 2020 requires the quantity of material used to conduct a material test on a 0.1 Accuracy Class BSCS to be weighed on a reference scale to an accuracy of 0.35 %. This item was added to the Weighing Sector's 2019 agenda to solicit input from members on how best to establish the test loads needed to be able to test these systems in a field environment given the degree of accuracy required of the material. Scales performing to within this level of accuracy (0.035%) may not be available or the procedures typically used to verify the accuracy of some scale types may not be adequate to ensure that when product for a material test is weighed on those scales it will be within the 0.035% specified. For example, a section test on a vehicle scale using 25 000 lb of certified test weight and each section determined to be within 0.035% of the applied test load doesn't ensure axle-loads of vehicles positioned on these same sections weighing 35 000 lb will also be within 0.035% of their true value. Additionally, influences from environmental conditions may result in the need to postpone tests to a time when more favorable conditions exist. Measurement Canada's testing of one of these systems involved using a static railroad scale as a mass comparator and two test cars of known mass; one approximately equal to the weight of an empty railcar, and the other, approximately equal the weight of a railcar filled with material.

NTEP may soon begin receiving applications for type evaluations of these higher accuracy (0.1%) BCSSs. It too will need test procedures for verifying the adequacy of a reference scale used to weigh the material used for testing these higher accuracy systems. Current NCWM Publication 14 BCSS procedures for verifying the adequacy of a reference scale are intended for reference scales used to weigh product for a material test of BCSS having an applicable tolerance of ± 0.25%. These current procedures are inadequate for use in verifying the adequacy of a reference scales used for weighing product for a material test of a BCSS system with a ±0.1% applicable tolerance.

The development of adequate test procedures for the reference scale will be a main focus of an upcoming meeting of the NTEP Belt-Conveyor Scale Sector. The meeting is planned for October 2019.

During the discussion of this item, Mr. Pascal Turgeon (Measurement Canada) and Mr. Zach Tripoulas (MD NTEP evaluator) offered to provide assistance in the development of the procedures.

2020 Weighing Sector Meeting:
During the 2020 WS Meeting, Mr. John Barton (NIST, OWM) updated the participants on the ongoing efforts of addressing the best approach to defining the needs and performance level of a reference scale needed to perform testing on a Class 0.1 Belt Conveyor Scale. Mr. Barton also mentioned his appreciation for the information and documentation sharing offered by Measurement Canada. Mr. Barton reported that he hopes to hold a meeting of the work group in the late September time frame to keep this item moving forward.

2021 Weighing Sector Meeting:
John Barton provided background information related to the need for the development of a test procedure for the use of a reference scale to weigh material that will be used for the evaluation and testing of a belt-conveyor scale designed to perform to the new Class 0.1 tolerance. Peter Sirrico provided an overview of the test procedure used to evaluate this type of instrument. John Barton commented that he is heading up a Work Group charged with researching possible ways to use existing an scale as a reference scale while maintaining confidence that the accuracy of the reference material is held to the required value of 1/3 of the applied tolerance.

John Barton asked if anyone would be willing to participate in the Work Group. Eric Golden (Cardinal Detecto), and Kevin Chesnutwood (NIST Force Group) offered to participate in the Work Group. Pascal Turgeon (Measurement Canada) offered to share the Measurement Canada EPO and any supporting documentation from either him or Ron Peasley (Measurement Canada).

The item remains on the Weighing Sectors Agenda as a Carry Over Item for the 2022 Weighing Sector Meeting.

2022 Weighing Sector Meeting:
The members present agreed that this item is important to the testing of a belt-conveyor scale operating at the 0.1% tolerance level. The members also agreed that the item requires additional work and agreed to keep the item on the Weighing Sector Agenda for the 2023 meeting.

Discussion/Conclusion

Peter J. Sirrico consultant for Thayer Scale was unable to attend this year's meeting this item will remain on the agenda for 2026 and if there is no change it will be removed.

3. Automatic Weighing System, Static vs Dynamic Testing, VCAP

The NCWM/NTEP has been approached with the idea of modifying or removing the need to perform dynamic testing under the influence of temperature. This is a carryover item from the 2023 Weighing Sector meeting to allow any additional information to be brought forward.

Discussion/Conclusion:

2024 Meeting: The ad hoc group Marel/Mettler-Toledo needs to submit form 15 to change NTEP policy to remove the dynamic portion of influence testing from VCAP. Marel thinks a report needs to be generated from the data collected.

2025: No additional information from Marel/Mettler-Toledo item will be removed from the agenda for 2026.

New Items

1. Weighing/Belt Conveyor Sector name change to Weighing Sector.

Source:

NTEP Administrator to provide background of previous sector names.

Discussion/Conclusion

2. Next Meeting

The Weighing Sector Meeting is typically held the second or third week of August. The members are asked to provide suggestions on the dates and locations for the 2026 meeting.

Discussion/Conclusion:

3. Meeting Attendees

The following individuals participated in the 2024 Weighing / Belt-Conveyer Scale Sector meeting.

Name	Company

End of Report