NTETC Belt-Conveyor Scale Sector
Meeting Summary
Feb. 26th 2009, St. Louis, MO.

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Carry-Over Items from 2008:

1. Proposed Update to NCWM Publication 14 Belt-Scale Checklist

Source: Bill Ripka, Sector Chairman

Background: At the February 2008 meeting of the Belt Sector NIST Technical Advisor Steven Cook reviewed recent changes to NIST Handbook 44 Section 2.21. (BeltConveyor Systems) and recommended that the NCWM Publication 14 (Pub 14) Belt-Conveyor Scale Checklist which was based on the 2006 edition of NIST Handbook 44, be reviewed and updated. The Sector members reviewed suggested amendments and no further changes were recommended.

Prior to the 2009 Sector meeting Sector Chairman, Bill Ripka provided the draft Pub 14 Belt-Conveyor Scale Checklist technical policies on the substitutions of Master Weight Totalizers and other minor editorial suggestions for review. Among the suggested changes that were included in this draft were proposed changes for procedures involving testing semi-automatic and automatic zero-setting mechanisms.

Discussion/Conclusion: Comments were heard during the February 2009 Sector meeting regarding the draft proposed changes submitted by Bill Ripka. Manufacturers generally agreed the proposal for evaluation of substitution MWTs is not intended to apply to devices produced by different manufacturers. The Sector also agreed to recommend that this criterion be used to amend existing certificates.

The Sector discussed whether or not a substitute totalizer needs to undergo a permanence test during type-evaluation. Ian Burrel (Control Systems Technology) stated that a totalizer submitted for evaluation should undergo a permanence test during the laboratory portion of the type-evaluation. Steven Cook (NIST) questioned whether or not totalizers from different manufacturers could be evaluated on a one-to-one comparison basis during a field test when different totalizers are used with identical associated equipment/systems.

NTEP Administrator Jim Truex polled the manufacturers present as to whether any among them have an instrument which is developed or being developed and will be submitted for NTEP evaluation. If so, would the manufacturers be willing to submit that device and have the above Pub 14 draft used during the evaluation? Bill Ripka responded that Thermo-Ramsey may have a totalizer which might be available for evaluation by the end of 2009. Jim Truex

stated that NTEP is ready to apply the draft on a trial basis, and that this step is necessary prior to amending Pub 14 by adopting the draft.

Language highlighted in shaded font indicates recommended changes to Pub 14 Belt-Conveyor Scale Checklist as shown below.

** A MWT submitted for approval as a stand-alone device can only be accepted as an addition to an existing CC for a complete Belt Conveyor Scale System.

A. Models to be Submitted for Evaluation

A type is a model or models of the same design, as defined in the NTEP Policy and Procedures. A complete list and description of all models of a type to be included in the Certificate of Conformance (CC) shall be submitted with the request for type evaluation. All options and features to be included on the CC must be submitted for evaluation. If the CC is to include more than one model of the same type, the submitter shall contact the evaluation agency to determine which model or models will be evaluated. A CC will be amended when new models of the same type meeting the specified criteria are applied for by the manufacturer.

The models to be submitted for evaluation shall be those having:

a. Laboratory Test – A master weight totalizer (MWT) or integrator, that as a minimum meets the requirements of the original evaluation, with defined enhancements and additional options indicated. The submitter shall also provide all necessary devices or instruments to represent the load receiving and speed sensing elements.
b. Field Test – The field test shall be performed with a previously "approved for commercial use" weighbridge model by the same manufacturer.

B. Certificate of Conformance Parameters

A Certificate of Conformance (CC) will apply to all models that have:

1. Equivalent hardware and software, and
2. Subsets of standard options and features of the equipment evaluated.

Metrological features not recognized by Handbook 44, but capable of being used as the basis for commercial transactions, shall be capable of being disabled and sealed before the device can receive an NTEP Certificate of Conformance.

C. Replacement Parts

The policy for addressing the conformance of replacement parts with the parts being replaced is:

1. If a Master Weight Totalizer (MWT) has received an NTEP evaluation and an NTEP Certificate of Conformance, it must be repaired with parts that are consistent with the original design or metrologically equivalent parts.

D. Substitution of the Master Weight Totalizer

For a master weight totalizer (MWT) to be considered an appropriate substitute for the MWT tested during the original type evaluation of a belt-conveyor scale system, the following criteria must be satisfied:

1. The MWT must be tested in the laboratory using appropriate load and speed signal simulators capable of being adjusted within the tolerances indicated in the checklists and tables in this document.

2. All MWT laboratory tests must be performed on the replacement MWT, including temperature testing.

3. During the test, the device must be within the acceptance tolerance.

4. A field test will be performed meeting new initial installation testing criteria.

5. A field permanence test will be performed.

6. A separate Certificate of Conformance (CC) will not be issued for the new MWT. Instead, the original CC will be amended to include the new MWT as an option.

7. Application limits such as capacity and speed ranges established during the original type evaluation will not be amended.

E. Checklist and Test Procedures

1. Indicating and Recording Elements

The integrator of a belt conveyor scale normally includes the master weight totalizer (MWT) and a rate of flow indicator and rate of flow alarms. The master weight totalizer must have adequate resolution to be able to establish a valid zero reference value and must have sufficient capacity to totalize loads over a reasonable period of time. The integrator may also have a resettable partial totalizer for indicating the mass of loads conveyed over a limited period of time and may have a supplementary totalizer with a scale interval greater than that of the master weight totalizer that will indicate the mass of loads conveyed over a fairly long period of operation. The partial totalizer is normally used for indicating the values for the zero test, simulated load tests, materials tests, and individual measurements of interest to the scale owner.

The master weight totalizer shall be equipped with provisions for applying a security seal that must be broken or another approved security means before any change that affects the metrological integrity of the device can be made to the master weight totalizer.

1.1	The scale must have a master weight totalizer	Yes ☐	No ☐	N/A ☐
1.2	The MWT shall not be resettable without breaking a security means.	Yes ☐	No ☐	N/A ☐
1.3	A power failure test must be conducted on digital electronic MWT's both in the laboratory and in the field permanence test.	Yes ☐	No ☐	N/A ☐

Test Procedure

1.3.1	Accumulate a measured quantity on the MWT and stop the flow of material. Note the reading.	Yes ☐	No ☐	N/A ☐
1.3.2	Disconnect power to the MWT	Yes ☐	No ☐	N/A ☐
1.3.3	Connect power to the MWT	Yes ☐	No ☐	N/A ☐
1.3.4	The quantity indication shall return to the previously displayed quantity within 1 division	Yes ☐	No ☐	N/A ☐

Laboratory Test: The accumulated measured quantity for the MWT is retained in memory during a power failure of 24 hours and is displayed again when power is returned.

Field Test: The accumulated quantity for the MWT is retained in memory during a power failure of 10 seconds up to 24 hours and is displayed again when power is returned.

1.4 The capacity of the MWT shall be at least 10 hours times the maximum rated Flow rate indicated on the original CC. Yes ☐ No ☐ N/A ☐

1.5 The value of the scale division shall be capable of being established for a value less than or equal to 0.1 percent of the minimum totalized load. Yes ☐ No ☐ N/A ☐

1.6 The MWT shall indicate in one or more of the weight units indicated in table T.1 [check the applicable unit(s)] Yes ☐ No ☐ N/A ☐

The scale division shall be in increments of 1, 2, or 5 times 10k where k is an integer. Yes ☐ No ☐ N/A ☐

Table T.1

Unit	Abbreviation
_____ pounds	Lb or LB
_____ U.S. short ton	Ton or T
_____U.S. long ton	LT
_____ Metric ton	T
_____ kilograms	kg

1.7 The indicated weight value must be expressed without the use of a multiplier. Yes ☐ No ☐ N/A ☐

1.8 The MWT may have a no-flow lockout provided the lockout is limited to not more than 3 percent of the rated belt loading in terms of weight per unit length. The no-flow lockout must be deactivated during the zero test. Yes ☐ No ☐ N/A ☐

1.8.1 During normal operation, the MWT shall advance only when the belt conveyor is in operation and under load. Yes ☐ No ☐ N/A ☐

1.8.2 If a no-flow lockout is provided, verify that it is limited to not more than 3% of the rated belt loading. Yes ☐ No ☐ N/A ☐

1.8.3 It must be possible to deactivate the no-flow lockout during the zero test Yes ☐ No ☐ N/A ☐

2. Recording Element

2.1 The MWT shall incorporate or be capable of interfacing with a recording element. Yes ☐ No ☐ N/A ☐

2.1 The value of the scale division for the recording element shall be the same as for the MWT. Yes ☐ No ☐ N/A ☐

2.3 The recording element shall record the initial indication and the final indication of the MWT, the quantity delivered, the unit of measurement, (i.e., kilograms, tones, pounds, tons, etc.), the date and time. (see Table T.2) This information shall be recorded for each delivery. The indicated and recorded weight values must agree to the nearest scale division. Yes ☐ No ☐ N/A ☐

All weight values shall be recorded as digital values.

Information required on the ticket:

Table T.2	
Date	05 06 2008
Time	15:30
Master Start Total	44113.5 T
Master Stop Total	44300.5 T
Quantity	187.0 T

2.4 If a reset to zero mechanism is incorporated, there must be an interlock to prevent the zeroing of the device between the printing of the initial and final values of the totalized weight. Yes ☐ No ☐ N/A ☐

2.5 The printing of weight values shall be inhibited when the flow rate is greater than either: Yes ☐ No ☐ N/A ☐

- ~ 3 percent of the maximum flow rate, or
- ~ The flow rate at which the MWT is engaged unless the weight value is identified as a subtotal, in process weight, or the equivalent.

2.6 The recorded weight value must be expressed without the use of a multiplier. Yes ☐ No ☐ N/A ☐

2.7 The printer must automatically sequence through a print cycle so that each printed document includes two weight values to represent the initial and final values. Yes ☐ No ☐ N/A ☐

3. Rate of Flow Indicator and Recorder

A rate of flow indicator and recorder are required. The MWT shall incorporate or be capable of interfacing with a rate of flow indicator and recorder. They may express the rate in weight units per hour or as a percent of capacity. The indicator and recorder may be either analog or digital.

3.1 The system must have both a rate of flow indicator and rate of flow recorder. Yes ☐ No ☐ N/A ☐

The rate of flow recorder is:
_____ analog
_____ digital

3.2 If a digital flow rate recorder is provided, the readings must be taken at time intervals not exceeding 10 seconds. Yes ☐ No ☐ N/A ☐

3.3 The rate of flow indicator must indicate from zero to at least 100% of capacity. Yes ☐ No ☐ N/A ☐

3.4 The rate of flow recorder shall record from zero to at least 100% of capacity. Yes ☐ No ☐ N/A ☐

4. Rate of Flow Alarms

The system shall be equipped with a permanent means to provide an audio or visual alarm (signal) when the rate of flow is equal to or less than 20 percent and equal to or greater than 100 percent of

the rated capacity of the scale. The alarm shall be located such that it will be noticed by the operator during normal operation.

The rate of flow alarm is:

_____ both audio and visual _____ audio _____ visual

4.1 The alarm (signal) is located so it will be noticed during normal scale operation. Yes ☐ No ☐ N/A ☐

4.2 Record the values at which the alarm is triggered: Yes ☐ No ☐ N/A ☐

Low alarm:_____

High alarm:_____

4.2.1 The alarm triggered when the rate of flow is equal to or less than 20 percent and equal to or greater than 100 percent of the rated capacity of the scale. Yes ☐ No ☐ N/A ☐

4.3 Access to the parameters for setting the alarm limits shall be through a security means. Yes ☐ No ☐ N/A ☐

5. Zero-Setting Mechanism

The zero-setting mechanism may be either a manual or automatic mechanism. If the zero-load reference is recorded at the beginning and end of a delivery, the range of the zero-setting mechanism shall not be greater than ± 5% of the rated capacity of the scale. Where the zero-load reference is not recorded at the beginning and end of a delivery, the range of the zero-setting mechanism shall be limited to ± 2% of the rated capacity of the scale. If a greater adjustment is needed, the access to the adjustment must be through some security means. An audio or visual signal shall be given when the automatic and semi-automatic zero-setting mechanisms reach the limit of adjustment. The zero-setting mechanism must be constructed such that the zero-setting operation is done only after a whole number of belt revolutions (a minimum of three minutes). The completion of the zero-setting operation must be indicated. The low-flow lockout must be deactivated for this test.

5.1 To verify the ± 5% range of the zero setting mechanism and the zero load reference recording capability: Yes ☐ No ☐ N/A ☐

5.1.1 Verify that the zero-setting range is limited to ±5 percent. Yes ☐ No ☐ N/A ☐

5.1.2 Adjust the load simulating device to represent 8% of the scale capacity. Yes ☐ No ☐ N/A ☐

5.1.3 Zero the scale. Yes ☐ No ☐ N/A ☐

5.1.4 Adjust the load simulating device representative of a 1% of scale capacity decrease; the automatic-zero-setting mechanism shall reset the zero of the scale and the recording element shall indicate the change in zero.. Yes ☐ No ☐ N/A ☐

Adjust for another 1% of scale capacity decrease.

Again, the MWT shall reset the zero and the recording element shall indicate the change.

Continue to decrease the load simulating device in

1percent increments until the automatic-zero-setting mechanism no longer resets the zero.

Record the total amount of adjustment.

Return the load simulating device to the initial zero value. Increase the load simulating device in 1 percent increments, verifying zero corrections and recordings until the MWT will no longer automatically reset the zero.

Record the value where automatic zero correction is restricted.

The total range of the automatic-zero-setting mechanism shall not exceed 10 percent of the scale capacity.

5.1.4 The zero should move a maximum of ± 5 percent either in its automatic-zero setting mode or as manually adjusted. Yes ☐ No ☐ N/A ☐

5.2 To verify the ± 2% range of the zero setting mechanism: Yes ☐ No ☐ N/A ☐

5.2.1 Verify that the zero-setting range is limited to ±2 %. Yes ☐ No ☐ N/A ☐

5.2.2 Adjust the load simulating device to represent 5% of the scale capacity. Yes ☐ No ☐ N/A ☐

5.2.3 Zero the scale.

5.2.4 Adjust the load simulating device representative of a 1% of scale capacity decrease; the automatic-zero-setting mechanism shall reset the zero of the scale. Yes ☐ No ☐ N/A ☐

Adjust for another 1% of scale capacity decrease.

Again, the MWT shall reset the zero.

Continue to decrease the load simulating device in 1 % increments until the automatic-zero-setting mechanism no longer resets the zero.

Record the total amount of adjustment.

Return the load simulating device to the value initial zero value. Increase the load simulating device in 1 % increments, verifying zero corrections, until the MWT will no longer automatically reset the zero.

Record the value where automatic zero correction is restricted.

The total range of the automatic-zero-setting mechanism shall not exceed 4 percent of the scale capacity.

5.2.5 The zero should move a maximum of ± 2 % either in its automatic-zero setting mode or as manually adjusted. Yes ☐ No ☐ N/A ☐

5.3 The zero-setting operation shall be performed only after a whole number of belt revolutions and at least 3 minutes of operation. Yes ☐ No ☐ N/A ☐

5.4 The completion of the automatic zero-setting operation must be Yes ☐ No ☐ N/A ☐

indicated.

5.5 The range of the zero-setting mechanism must be limited to ± 2 percent or ± 5% of the capacity of the scale without breaking a security means. Yes ☐ No ☐ N/A ☐

5.6 An audio or visual signal shall be given when the automatic and semi-automatic Zero-setting mechanisms reach the limit of adjustment. Yes ☐ No ☐ N/A ☐

6. Sensitivity at Zero Load

The purpose of this requirement is to assure that the MWT has sufficient resolution and sensitivity to establish a good zero reference value. The manufacturer may specify an alternate test procedure to demonstrate the required sensitivity. The no-flow lockout must be deactivated for this test.

6.1 Adjust the load simulating device to represent the weight required to determine compliance based on the equation: Yes ☐ No ☐ N/A ☐

$$\frac{2*W_c}{C_m}$$

For example: $\frac{2*500}{1000} = 1 \text{ lb}$

Where: C_m = counts in dynamic weighing scale divisions required for the minimum totalized load

W_c = weight required to reach the static scale capacity of the weighbridge.

Static scale capacity = (maximum weight/foot)(length of weighbridge)

6.2 Operate the scale for a time equal to the time required to deliver the minimum totalized load.

6.2.1 Record the time period: _____ minutes.

6.3 The totalizer shall advance at least one but not more than three divisions. Yes ☐ No ☐ N/A ☐

6.3.1 Record the quantity registered: _____ divisions.

6.4 The MWT has the sensitivity specified at zero. Yes ☐ No ☐ N/A ☐

7. Marking Requirements

7.1 The marking of the MWT shall meet the requirements established during the initial CC evaluation. Yes ☐ No ☐ N/A ☐

8. Provisions for Metrological Sealing of Adjustable Components or Audit Trail

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

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

8.1	The device has the capability for a physical seal	Yes ☐	No ☐	N/A ☐
8.2	The device meets the requirements for Audit Trail	Yes ☐	No ☐	N/A ☐

9. RFI/EMI Environment

The equipment shall be suitable for the environment in which it is intended to be used, including resistance to electromagnetic and radio-frequency interference generated by electromechanical equipment, portable hand-held radio transmitters and citizen's band transmitting equipment (if normally used at the site of installation).

9.1	The instrument meets standard NTEP RFI/EMI influence requirements.	Yes ☐	No ☐	N/A ☐

10. Laboratory Test Procedures

A. Technical Policy

The MWT is to be placed in the environmental chamber to determine performance with respect to influence factors. It is not necessary to re-rest a previously type approved weighbridges, speed sensors or ancillary devices. It is not necessary, nor recommended, that signal simulators for load and speed be located in the chamber. The simulated test loads to be used for the MWT evaluation shall be equal to the signal levels from the actual tests loads used during the initial type evaluation.

B. Initial Tests

1. Determine and record the load simulating device setting for zero and full scale ranges.
2. Calibrate the MWT at 20 ºC.
3. Conduct the sensitivity test at zero load.
4. Verify that the range of the automatic zero setting mechanism(s) do not exceed ±2 percent and ±5 percent of capacity.
5. Test the alarms for flow rates below 20 percent and above 100 percent of rated capacity.

Once the laboratory test is started, after completion of the voltage tests, neither the zero nor the span are to be adjusted. The data should be normalized for the many tests.

The laboratory tests consist of a combination of simulated dynamic tests. These tests require adjusting a load simulating device and a speed simulating device to pre-calculated values and conducting a simulation of belt travel distances, integrating the weight on the MWT.

C. Soak Requirements

The laboratory test is to be run at 20 ºC, the upper temperature limit and the lower temperature limit. The surface temperature of the MWT is to be measured. In consultation with the

manufacturer, place the temperature sensor on the portion of the MWT that is expected to be the last part to reach thermal equilibrium. After the surface temperature has reached the test temperature, allow the equipment to soak for at least an additional two hours, but not more than six hours, before starting the test. For convenience of the test, however, an overnight period may be used for the soak period before running the next temperature test.

1. Stabilize the temperature at 20 ºC.
2. Enable the speed simulating device for a constant signal level.
3. Deactivate the automatic zero setting mechanism and no-flow lock-out.
4. Zero the MWT.

The MWT shall have sufficient resolution (that is a sufficiently small dynamic scale division) to permit this test to be completed in the greater of 20 minutes, or for a time equivalent to the test time required for the test run at 35 percent of the minimum static capacity.

The beginning and ending MWT indications shall not change more than ± 1 scale division.

D. Voltage Tests

Verify the line power source, AC or DC, is set to the manufacturers recommended nominal value (i.e.: 120 VAC or 24 VDC)

1. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
2. Reduce the line power supply to 85% of nominal (i.e.: 100 VAC or 20.4 VDC).
3. Run a zero test.
4. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
5. Increase the line power supply to 110% of nominal (i.e.: 130 VAC or 26.4 VDC).
6. Run a zero test.
7. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
8. Return the line power supply to the nominal value.

E. Temperature Tests

1. Run a zero test
2. Do not reset zero or adjust the span at any time after the start of this test.
3. Adjust the load simulating device to achieve the desired load representations.
4. Test the MWT simulating dynamic operation of the belt conveyor scale system at the following “flow rates” (all percent values represent percent loads of static scale capacity (SSC)):

0 (zero test), 35 percent (SSC_{min}), 35 percent, 70 percent, 98 percent,

Leave the MWT under simulated load for 1 hour, then:

98 percent, 70 percent, 35 percent, 35 percent (SSC_{min}), and 0 (zero test)

Table T.3

Percent of Static Scale Capacity	Nominal Time (Minutes)	Equivalent Belt Travel
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
35% of SSC_{max}	Time to deliver 800d	

70% of SSC_{max}	Time to deliver 800d	
98% of SSC_{max}	Time to deliver 800d	
Leave MWT under simulated load for 1 hour		
98% of SSC_{max}	Time to deliver 800d	
70% of SSC_{max}	Time to deliver 800d	
35% of SSC_{max}	Time to deliver 800d	
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____

The tolerance to be applied for the laboratory test is set at 0.45 times the tolerance for the complete installation times 0.3 (30%). The formula is shown in Table T.4 to illustrate the process. The reference value for a particular accuracy test is the simulated load times the simulated belt travel distance. The values to be used for the laboratory test are shown in the following example:

F. 98% load – Zero load test = difference

Proportion the effect of the zero-load test to the time of the tests for each simulated load. The values for the differences represent the simulated material measured by the MWT and are compared to the reference value for accuracy.

1. Change the temperature to -10 ºC (14 ºF) at a rate no faster than 1º C/min following the "soak requirements".
2. Repeat the simulated dynamic tests.
3. Change the temperature to 40 ºC (104 ºF) at a rate no faster than 1º C/min following the "soak requirements".
4. Repeat the simulated dynamic tests.
5. Change the temperature to 20 ºC (68 ºF) at a rate no faster than 1º C/min following the "soak requirements".
6. Repeat the simulated dynamic tests.

G. Data Analysis

1. The data are evaluated on the Simulated Dynamic MWT Test Work Sheet, Item 14 and 15, for pass or fail.

11. Field Test

A field test is required prior to final type approval. The field test can be performed as a retrofit on a previously approved for commercial use belt-conveyor scale system or in a new application. The Field Test Procedures as defined in paragraph 13 of the initial belt-conveyor scale Type Evaluation section of Publication 14 and as defined in Handbook 44 are to be followed. The results of all tests must be within acceptance tolerances.

12. Permanence Test

A permanence test is conducted to determine the accuracy of the device in use over a period of time. The permanence test shall be conducted after a minimum of 20 days after successful completion of

the initial performance test, and after a minimum volume of material has been transported across the belt-conveyor scale. This minimum volume of material shall be no less than the maximum scale capacity times 8 hours times 20 days. (i.e. A system with a maximum scale capacity of 1000 TPH requires a minimum volume of 160,000 tons [1000 * 8 * 20] to have been transported prior to the permanence test.). The results of all tests must be within acceptance tolerances.

The permanence test shall include:

1. initial stable zero tests
2. at least two test loads at normal use capacity
3. simulated load tests
4. verification of audit trail recorded events

13. Data Sheet and Laboratory Test Procedure

Temperature Testing: Belt-Conveyor Scale Systems Code paragraphs T.3.1., T.3.1.1., T.3.1.2. The accuracy of the MWT is to be adjusted at 70% of the static scale capacity (SSC). A weight display of 0.01 percent (1 part in 10,000) is required for the laboratory tests. The allowable error is adjusted to 30 percent of the allowable error for the entire system type approval. If tests are run for a time greater than that needed for the minimum test load (MTL), substitute the totalized load (TL) for the MTL in the tolerance calculation in Test Conditions, step 3 (Table T.4).

Table T.4

Device Parameters	Abbrev.	Maximum	Minimum	Dim
1. Load per unit length from existing Certificate of Conformance; corresponds to the largest capacity and the lowest capacity rating	BL			lb/ft
2. Length of the weighbridge (inches) from existing Certificate of Conformance				In
3. Belt Speed from existing Certificate of Conformance	SP			ft/min
4. Determine scale capacity in units per hour SC=SP*BL*60/2000 (must correspond to existing Certificate of Conformance)	SC			ton/hr
5. Record the static scale capacity in units of weight SSC=(maximum weight per foot)(length of weighbridge)	SSC			lb
6. Allowable zero error for temperature change of 10 ºC (18 ºF) AZE=(.003)(0.0007)(SC_{min})(time)/60 where "time" is the time of the zero test in minutes	AZE			ton
7. Size of scale division required for zero	SD			ton
8. Determine the minimum and maximum totalized loads	MTL			ton
Test Conditions	**Abbrev.**			

1. Determine the time in minutes to acquire MTL with the test load to be simulated in the laboratory	Test load, pound/foot			lb/ft
	Test load, total			lb
	Time (minutes) to deliver MTL (at least 10 minutes)	Time		min
2. Determine number of belt travel sensor revolutions required for the above time. Manufacturer to provide revolutions per foot or pulses per foot as appropriate to determine 3 belt revolutions and a delivery of 800d.		BTR		revolutions
3. Allowable weighing error (units of weight) for simulated dynamic tests which will be divisions on master weight totalizer. AWE = (0.003)(0.45)(0.005)(TL)	AWE			ton

Table T.5
Initial Tests
1. Set up the unit at 20 ºC (68 ºF), zero the MWT, and adjust the span following the manufacturer's procedure.
2. Conduct the sensitivity test at zero load.
3. Verify that the range of the automatic zero setting mechanism(s) do not exceed ±2% and ±5% of capacity.
4. Test the alarms for flow rates below 20% and over 100% of scale capacity.

Table T.6
Laboratory Tests
1. Stabilize the temperature at 20 ºC.
2. Enable the speed simulator to represent 100% speed.
3. Deactivate the automatic zero setting mechanism and zero the MWT.
4. Run a zero test.
Voltage tests
5. Run an accuracy test at 98% of scale capacity for the time to deliver 800d.
6. Reduce the live voltage to 85% of nominal.
7. Run a zero test.
8. Run an accuracy test at 98% of scale capacity for the time to deliver 800d.
9. Increase the line voltage to 110% of nominal.
10. Run a zero test.
11. Run an accuracy test at 98% of scale capacity for the time to deliver 800d.
12. Return the live supply to nominal.

Temperature Tests
13. Run a zero test. Do not reset zero or adjust the span at any time after the start of this test.
14. Adjust the load simulating device to represent normal loading of the scale (70% of scale capacity).
15. At 20 ºC, test the MWT dynamically with simulation of the load and speed. Test the MWT at the following "flow rates" (all percent values represent percent loads of static scale capacity): 0 (zero test); 35 percent(SSC_{min}); 35 percent; 70 percent; 98 percent. Then leave the MWT at full load for 1 hour and test at the following flowrates: 98 percent; 70 percent; 35 percent; 35 percent((SSC_{min}); and 0 (zero test).

Table T.7

Percent of Static Scale Capacity	Time (Minutes)	Totalaized Load TL (ton)	Tolerance AWE= (0.003)(0.45)(0.005)(TL)
0	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		
35% of SSC_{min}	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		
35% of SSC_{max}	Time to deliver 800d		
70% of SSC_{max}	Time to deliver 800d		
98% of SSC_{max}	Time to deliver 800d		
Leave MWT under simulated load for 1 hour			
98% of SSC_{max}	Time to deliver 800d		
70% of SSC_{max}	Time to deliver 800d		
35% of SSC_{max}	Time to deliver 800d		
35% of SSC_{min}	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		
0	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		

Table T.8
Laboratory Tests *continued*
16. Change the temperature to -10 ºC (14 ºF) at a rate no faster than 1 ºC/min. Follow soak requirements.
17. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
18. Change the temperature to 40 ºC (104 ºF) at a rate no faster than 1 ºC/min. Follow soak

requirements.
19. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
20. Change the temperature to 20 ºC (68 ºF) at a rate no faster than 1 ºC/min. Follow soak requirements
21. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
Data Analysis
1. The data are evaluated on the following Simulated Dynamic MWT Test Work Sheets for pass or fail
2. Approval is for addition of MWT to existing Certificate of Conformance without changes to minimum and maximum ranges.

14. Dynamic MWT Test Work Sheet and Laboratory Test Procedure No. 1

The calibration point is the 70 percent load for the initial room temperature (20 ºC) test. Because the weight indication when in the test mode may not be at zero and may not be adjusted to indicate n weight values (e.g., the quantity indication may be voltage output or "counts", the table provides for calculations to convert indications into weight units). The scale indication shall not be zeroed during the test process. Corrections for the change in zero tests are to be done by calculation.

Places to record information needed for the test and the formulae needed to compute table entries are given below.

Static Scale Capacity, SSC = (maximum weight per foot)(length of weighbridge) = _____ lb.

Test load for 70 percent SSC = _____ lb.

Weight/foot = (static scale load)/(length of weighbridge) = Static scale capacity)/(length of weighbridge)

Start and end readings are in divisions and must be converted to weight values.

Conversion factor for divisions to weight = (change in static weight indication from zero to 70% SSC load) / (70% SSC load in pounds)

Change in zero = (Total change of zero during zero test) {(time of test for applied load)/(time of zero test)}

Indication corrected for change of zero = (Indicated change) – (Change of zero)

Scale indication in lb = (Indication corrected for change of zero) / (Conversion factor)

Actual weight = {(Applied load)/(length of weighbridge)}(speed)(time)

Note: Speed and time must use the same units of time (e.g., feet per minute and minutes)

Error = Scale indication – actual weight

Tolerance is from the Belt-Conveyor Scale Data Sheet and Laboratory Test Procedure, step 3.

15. Dynamic MWT Test Work Sheet and Laboratory Test Procedure No. 2

Scale indication at zero load (static scale indication) = _____ divisions

(Not required if MWT can display static weight)

Scale indication at 70 percent SSC (static scale indication) = _____ divisions (Not required if MWT can display static weight)

Conversion factor = (change in static weight indication from zero to 70% SSC load) / (70% AAC load in pounds) = divisions/lb

Temperature_____ ºC

Type of Tests_____ Signature_____

Table T.9											
Test Load (lb)	Applied load (lb)	Time of test in minutes	Reading in counts		Indicated Change = End – Start	Change in Zero	Indication corrected for change in zero	Scale Indication (lb)	Actual Weight	Error (lb)	Tolerance (lb)
			End	Start							
Zero test	0										
35% SSC_{min}											
35% SSC_{max}											
70% SSC_{max}											
98% SSC_{max}											
Leave scale under simulated load for 1 hour											
98% SSC_{max}											
70% SSC_{max}											
35% SSC_{max}											
35% SSC_{min}											
Zero test	0										

16. Zero Change with Respect to Temperature

Table T.10							
	Low Temperature		**High Temperature**		**20 ºC**		**Performance limit for temperature effect on zero test, AZE, per 10 ºC**
Previous Temperature T_P	**20 ºC**						
Current Temperature T_C					**20 ºC**		
Change in Temperature (T_C – T_P)							
	Divisions	**lb**	**Divisions**	**lb**	**Divisions**	**lb**	
Zero load indication at T_P							
Zero load indication at T_C							

Change in zero							
Change in zero per 5 ºC (9 ºF)							

Date: _____

Indicator Model Number:_____ **Indicator Serial Number:**_____

_____ _____

Signature **Title**

2. Develop a List of Sealable Parameters for BCS Systems

Background: During the Sector's February 2008 meeting, members were asked to develop a list of programmable parameters within belt-conveyor scale systems which should have access restricted by means of some form of security seal. In developing this list, members were asked to consider all instruments which would have any metrological effect to the system. Paul Chase agreed to poll those manufacturers which currently hold NTEP certificates in order to develop a list of parameters that would be inclusive of the different design types. The resulting list was intended to be incorporated in NCWM Publication 14 and used in the type evaluation process.

A copy of the "Requirements for Metrological Audit Trails" from NCWM Publication 14 was provided to Sector members prior to the meeting for a review and discussion and recommendations.

Discussion: During the February 2009 Sector meeting, Paul Chase indicated that he did not receive replies from all the manufacturers polled. Some members stated during the 2009 meeting that not all manufacturers give similar parameters within their particular devices the same name or terminology as do other manufactures do. Also pointed out during discussion were situations where several (if not all) programmable parameters could have access limited through the use of one security seal, and what consequence this type of situation has on the development of a list that is useful to an NTEP evaluator. Ian Burrell stated that an adjustable parameter (such as span adjustment) may, in some systems, involve more than one component or module, and thereby, require the use of more than just one seal to limit access to a single parameter.

Jim Truex, NTEP Administrator, stated that NTEP evaluators require some foundation to base the test procedures on when various devices go through the type approval process. There was discussion among the members about various specific features (e.g.: coarse zero adjustment; high/low flow alarm settings; etc.) that may be found on a device and whether or not to require a security seal to limit access.

Conclusion: The following table was initially developed showing what parameters should be protected by limiting access to them through a security seal or other security means. The Sector agreed that this table is simply a generic basis for the evaluator to use as a starting point, and the need to seal additional features would be assessed on a case-by-case basis for each manufacturer during the application for type evaluation.

Jim Truex stated that NTEP evaluators will employ this table on a trial basis and note and comment on any changes that are deemed necessary.

Belt-Conveyor Scale Features and Parameters

Typical Features to be Sealed	Typical Features and Parameters Not Required to be Sealed
• Official verification zero reference • Official verification span/calibration reference • Linearity correction values • Allowable range of zero (if adjustable) • Selection of measurement units • Division value, d • Range of over capacity indications (if it can be set to extend beyond regulatory limits) • Alarm limits for flow rate (high/low) • Automatic zero-setting mechanism (on/off) • Automatic zero-setting mechanism (range of a single step) • Configuration (speed, capacity, calibrated test weight value if applicable, pulses per belt revolution, load cell configuration,)	• Display update rate • Baud rate for electronic data transfer • Communications (Configuration of input, output signal to peripheral devices)

NOTE: *The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive, and there may be parameters other than those listed which affect the metrological performance of the device and must, therefore, be sealed. If listed parameters or other parameters which may affect the metrological function of the device are not sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device (i.e., all settings comply with the most stringent requirements of Handbook 44 for the applications for which the device is to be used).*

Attendees

Steve Cook	NIST	(301) 975-4003	steven.cook@nist.gov
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Jim Truex	NCWM	(740) 919-4350	jim.truex@ncwm.net
Paul Chase	Chase Technology	(218)-545-2356	mjc@emily.net
Al Page	Montana Dept. of Agric.	(406) 841-2058	awp88bb@gmail.com
Bill Ripka	Thermo Ramsey	(612) 783-2664	billripka@thermofisher.com
Art Amsler	Arcadia Controls	(412) 841-2700	artarcadia@aol.com
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Peter Sirrico	Thayer Scale	(781) 826-8101	psirrico@thayerscale.com
Todd Deitrich	Kaskaskia Valley Scale Co.	(618) 295-3331	todd@kvsco.com
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NTETC Belt-Conveyor Scale Sector
February 25, 2010
Meeting Summary

A. NCWM Publication 14 Updates

1. HB-44, UR.3.2 (S&T Committee agenda item 321-1)

Background: At the 2009 NCWM Annual Meeting, the Conference adopted an amendment to paragraph UR.3.2. to clarify that zero-load and material or simulated-load tests are required to be performed between official testing at intervals determined by the statutory authority or by the manufacturer. Full details of the amendments to NIST Handbook 44 may be found in the S&T Committee 2009 Interim Report.

Discussion/Conclusion: The Sector members agreed that this is a NIST Handbook 44 User Requirement and not intended for use during type evaluation. No changes are recommended in Publication 14.

2. HB-44, S.1.3.1 (S&T Committee agenda item 321-3)

Background: At the 2009 NCWM Annual Meeting, the Conference adopted an amendment to paragraph S.1.3.1. to reconcile the value of the minimum scale division (0.1 % of the minimum totalized load) with the value of the minimum test load (800 divisions) listed in paragraph N.2.3.(a).

Recommendation: NTETC Belt-Conveyor Sector Technical Advisor recommended the amendment to NCWM publication 14 section 1.8 as shown below to reflect changes in NIST Handbook 44 BCS Code, design specification S.1.3.1.

1.8. *(S.1.2. and S.1.3.1.) The scale division shall be in increments of 1, 2, or 5 times 10k where k is an integer* ***and shall not be greater than 0.125 % (1/800) of the minimum totalized load****.* Yes ☐ No ☐ N/A ☐

1.8.1. *What is the scale division?*

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

1.8.2. Verify that the value of the scale division is protected by an acceptable security means (e.g., physical seal or audit trail).

Discussion/Conclusion: Sector members agreed to recommend the proposed change to Publication 14 BCS section 1.8., and add a new section 1.8.2. to verify that the value of the scale division should be a sealable parameter which is protected by a security means as shown above.

3. HB-44 N.2., N.2.1. (S&T Committee agenda item 321-5) (Number of Tests during Initial Verification)

Background: At the 2009 NCWM Annual Meeting, the Conference adopted an amendment to paragraph N.2.1. to provide clarification of how many test runs are required during an official test. Portions of the wording changes in N.2.1. relate to testing a belt-conveyor scale at a single flowrate (using a minimum of four test runs) if it can be verified that the system is operated using a single flowrate and that rate does not vary in either direction by an amount more than 10 % of the normal flow rate that can be developed at the installation for at least 80 % of the time.

These changes are applicable to specific installations that operate exclusively (within parameters) at one flowrate and would therefore not impact procedures used during type evaluation testing.

Other changes to N.2.1. will impact testing procedures regardless of the specifics of an installation and should therefore result in changes to Publication 14.

Recommendation: To reflect changes in the 2010 edition of NIST Handbook 44, the technical advisor recommends that Publication 14 page BCS-15 be amended as follows:

13. Field Test Procedure

Field Performance Test of the Belt-Conveyor Scale

~~**N.2.1. Initial Verification.** - A belt-conveyor scale system shall be tested at the normal use flow rate, 35 % of the maximum rated capacity, and an intermediate flow rate between these two points. The system may also be tested at any other rate of flow that may be used at the installation.~~
~~(Added 2004)~~

N.2.1. Initial Verification. – A belt-conveyor scale system shall be verified with a minimum of two test runs at each of the following flow rates:

(a) normal use flow rate,
(b) 35 % of the maximum rated capacity, and
(c) an intermediate flow rate between these two points.

Discussion/Conclusion: The sector agreed to recommend the proposed amendments to Publication 14 BCS section 13. In addition the members also recommend that a note (as shown below) for section 13 be **added** to clarify that the site identified for conducting the field permanence test portion of the type evaluation shall be capable of providing tests at various flowrates.

Note: The test site selected for permanence testing shall be capable of testing over a range of flow rates. Any site where the belt-conveyor scale system is limited to a single flow rate will not be considered acceptable.

4. HB-44, T.1.1 (S&T Committee agenda item 321-6)

Background: At the 2009 NCWM Annual Meeting, the Conference adopted and amendment to paragraph T.1.1. Tolerance Values. to clarify the allowable change in zero during an official test. Background information on the amendments to Handbook 44 may be found in the S&T Committee 2009 Interim report.

***Recommendation*:** The technical advisor recommended that no action is necessary because the amendments to Handbook 44 requirements shown above are applicable to subsequent field examinations, are not referenced explicitly in Pub 14, and do not apply to type approval test procedures,.

Discussion/Conclusion: Sector members agreed with the technical advisor's recommendation that no further actions are required.

5. HB-44, Sections N.3.1.2., N.3.1.3., and S.3.3.1

Background: At the 2009 NCWM Annual Meeting, the Conference adopted amendments to paragraphs N.3.1.2., N.3.1.3., N.3.1.4., and to add new paragraph S.3.1.1. in order to :

- Consolidate the requirements in N.3.1.2 and N.3.1.3,
- Clarify the testing guidelines in N.3.1.3.,
- Renumber the impacted paragraphs, and
- Add a new paragraph to state that the zero balance condition shall not be obscured by the automatic zero-setting mechanism.

Recommendation: The technical advisor recommended that references in Publication 14, pages BCS-16 be amended to reflect the consolidation and renumbering of the paragraphs as shown below:

13 Field Test Procedure

~~**N.3.1.2. Initial Stable Zero.** - The conveyor system shall be run to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out until three consecutive zero-load tests each indicate an error which does not exceed ± 0.06 % of the totalized load at full scale capacity for the duration of the test. No adjustments can be made during the three consecutive zero-load test readings.~~
~~(Added 2002) (Amended 2004)~~

N.3.1.~~3~~2. Test of Zero Stability. - The conveyor system shall be operated to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out **before weighing material** immediately before the simulated or materials test until the three consecutive zero-load tests each indicate an error which does not exceed ± 0.06 % of the totalized load at full scale capacity for the duration of test. No adjustments can be made during the three consecutive zero-load test readings.
(Added 2002) (Amended 2004 **and 2009**)

N.3.1.4~~3~~. Check For Consistency of the Conveyor Belt Along Its Entire Length. - After a zero-load test with flow rate filtering disabled, the totalizer shall not change

more than plus or minus (± 3 d) 3.0 scale divisions from its initial indication during one complete belt revolution.
(Added 2002) (Amended 2004)

The technical advisor also recommended adding the following language to Publication 14 page BCS-7:

6. Zero-Setting Mechanism

Code Reference: S.3.1. **and S.3.1.1.**

6.3.	The completion of the automatic zero-setting operation must be indicated.	Yes ☐ No ☐ N/A ☐
6.3.1	**Verify that any changes in the zero reference are indicated and/or recorded**	**Yes ☐ No ☐ N/A ☐**

Discussion/*Conclusion:* The sector members agreed with the proposed changes and recommended that NCWM Publication 14 be amended as shown above.

B. Proposed Update to NCWM Publication 14 Belt-Scale Checklist

Background: During the February 2009 BCS sector meeting, a draft Publication 14 checklist was developed and offered for use on a trial basis by NTEP labs that would evaluate manufacturer's replacement instruments. During the meeting, Sector Chairman, Bill Ripka of Thermo-Fisher stated that Thermo-Fisher would possibly have an instrument that would be submitted in the near future to undergo the NTEP process. This checklist could then be used on this instrument as a trial basis. The results/comments would then be returned to NTEP Administrator and Sector WG for review and further development. The entire draft checklist may be found in the 2009 NTETC Belt-Conveyor Scale Sector meeting summary.

Discussion: Based on information provided by NTEP Administrator Jim Truex, the sector members were informed that NTEP had not received an instrument from any manufacturer to use as a trial for the checklist that has been drafted. Lars Marmsater indicated that Merrick Industries will be submitting an indicator to update its NTEP Certificate of Conformance.

Conclusion: NTEP Administrator Jim Truex indicated that the California NTEP Lab would perform the evaluation when the device is submitted and that the sector will be provided with a report from the NTEP lab for any recommendations to approve or amend the proposed checklist. Sector members agreed that no further work is needed to the checklist at this time, pending a report from NTEP after applying the draft to the evaluation of an instrument. This item will be carried over and placed on the next meeting agenda of the NTETC BCS sector.

C. Develop a List of Sealable Parameters for BCS Systems

Background: The list shown below was developed during the 2009 NTETC BCS Sector meeting and was to be forwarded to NTEP laboratories for use on a trial basis after which comments and recommended amendments would be forwarded to the Sector WG for further development. The technical advisor reported to the members that no manufacturers' devices have been submitted for NTEP approval and therefore the list has not been used during any evaluations.

Discussion/Conclusion: Sector members agreed that no further amendments to the table are needed at this time, and that the table should be incorporated in the 2011 edition of Publication 14.

Belt-Conveyor Scale Features and Parameters

Typical Features to be Sealed	Typical Features and Parameters Not Required to be Sealed
Official verification zero reference	Display update rate
Official verification span/calibration reference	Baud rate for electronic data transfer
Linearity correction values	Communications (Configuration of input, output signal to peripheral devices)
Allowable range of zero (if adjustable)	
Selection of measurement units	
Division value, d	
Range of over capacity indications (if it can be set to extend beyond regulatory limits)	
Alarm limits for flow rate (high/low)	
Automatic zero-setting mechanism (on/off)	
Automatic zero-setting mechanism (range of a single step)	
Configuration (speed, capacity, calibrated test weight value if applicable, pulses per belt revolution, load cell configuration,)	

NOTE: *The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive, and there may be parameters other than those listed which affect the metrological performance of the device and must, therefore, be sealed. If listed parameters or other parameters which may affect the metrological function of the device are not sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device (i.e., all settings comply with the most stringent requirements of Handbook 44 for the applications for which the device is to be used).*

D. New Business

1. Revisit parameters used to categorize "Family" groups

Steve Cook, NIST recommended that the Sector review and revise if necessary the criteria used to base the grouping of instruments submitted for type evaluation as a Family or Type of devices. This topic is recommended to be included on the next NTETC Belt-Conveyor Scale Sector meeting agenda.

E. Attendance

2010 NTETC Belt-Conveyor Scale Sector Meeting Attendance

Name	Company	Mailing Address	Telephone	Email
John Barton	NIST	100 Bureau Dr. Mailstop 2600 Gaithersburg, MD 20899	301 975-4002	john.barton@nist.gov
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Steven Cook	NIST	100 Bureau Dr. Mailstop 2600 Gaithersburg, MD 20899	301 975-4003	stevenc@nist.gov
James Hale	Southern Co.	366 Three Oaks Subdivision Rd. Langley, KY 41645	606 285-3635	jahale@southernco.com
Richard Harshman	NIST	100 Bureau Dr. Mailstop 2600 Gaithersburg, MD 20899	301 975-8107	richard.harshman@nist.gov
Ken Jones	CA. Division of Measurement Services	6790 Florin Perkins Rd., Suite 100 Sacramento, CA. 95828	916 229-3052	kjones@cdfa.ca.gov
Lars Marmsater	Merrick Industries, Inc.	10 Arthur Dr. Lynn Haven, FL 32444	850 271-7829	lars@merrick-inc.com
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James Truex	NCWM	88 Carryback Drive Pataskala, OH 43062	740 919-4350	jim.truex@ncwm.net
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Appendix A

National Type Evaluation Technical Committee (NTETC) Belt-Conveyor Scale (BCS) Sector Meeting Summary

February 23-24, 2011 / St. Louis, Missouri

INTRODUCTION

The charge of the BCS 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 and 2.21. BCS Systems. The sector's recommendations are 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 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
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Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
BCS	Belt-Conveyor Scale	NTETC	National Type Evaluation Technical Committee
CC	Certificate of Conformance	OIML	International Organization of Legal Metrology
NCWM	National Conference on Weights and Measures	OWM	Office of Weights and Measures
NIST	National Institute of Standards and Technology	R	Recommendation
NTEP	National Type Evaluation Program	USNWG	U.S. National Work Group

Details of All Items
(In order by Reference Key)

CARRY-OVER ITEMS

1. Report from the 2011 NTEP Committee on Changes to NCWM Publication 14

Review of changes adopted in 2011 edition of *NCWM Publication 14, Weighing Devices.*

Background / Discussion:
Several changes to *NCWM Publication 14, Weighing Devices, Belt-Conveyor Scales* were recommended by the sector during the February 2010 NTETC BCS Sector Meeting and are noted in the 2010 Sector Meeting Summary. These amendments were recommended to reflect changes to the 2010 edition of *NIST Handbook 44* requirements in the BCS Scale Code (2.21.) and subsequently adopted into the following sections in *NCWM Publication 14, Weighing Devices, Belt-Conveyor Scales.*

- **Section 1, paragraph 1.8.**
  The change to this section was made to reflect the amendments to *NIST Handbook 44*, 2.21. paragraph S.1.3.1. Value of the Scale Division in 2009 and paragraph N.2.3.Minimum Test Load in 2008.

  Code Reference: S.1.2., S.1.3.1.

  1.8. The scale division shall be in increments of 1, 2, or 5 times 10k where k is an integer **and shall not be greater than 0.125 % (1/800) of the minimum totalized load.**

  1.8.1. Verify that the value of the scale division is protected by an acceptable security means (e.g., physical seal or audit trail).

- **Section 13, Field Test Procedure**
  These changes provided clarification on the minimum required number of test runs to be performed during an official test. Although exceptions for the required number of test runs are permitted for routine field testing on systems that operate at one flow rate only, the note added to the 2011 edition of *NCWM Publication 14* specifies that those sites which operate at only a single rate of flow are not appropriate for use in conducting a type evaluation.

  Field Performance Test of the Belt-Conveyor Scale

  N.2.1. Initial Verification

  A belt-conveyor scale system shall be ~~**tested at the normal use flow rate, 35% of the maximum rated capacity, and an intermediate flow rate between these two points. The system may also be tested at any other flow rate that may be used at the installation. (Added 2004)**~~ **verified with a minimum of two test runs at each of the following flow rates:**

  a. Normal use flow rate.

  b. 35 % of the maximum rated capacity. AND

  c. An intermediate flow rate between these two points.

  Note: The test site selected for permanence testing shall be capable of testing over a range of flow rates. Any site where the belt-conveyor scale system is limited to a single flow rate will not be considered acceptable.

- **Section 13, Field Test Procedure**
  These changes in *NIST Handbook 44*, 2.21 are editorial in nature and were made primarily to reflect the consolidation of the paragraphs previously numbered as N.3.1.2. Initial Stable Zero and N.3.1.3. Test of Zero Stability into one paragraph now numbered N.3.1.2. Test of Zero Stability within the 2010 edition of *NIST Handbook 44*. The consolidation was recommended to eliminate redundancy within these paragraphs and was accomplished with only minor wording changes. These changes also resulted in the paragraph previously numbered N.3.1.4. Check for Consistency of the Conveyor Belt along Its Entire Length to be renumbered as N.3.1.3.

  N.3.1.~~3~~2. Test of Zero Stability
  The conveyor system shall be run to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out **immediately before conducting the simulated-load or materials test** until three consecutive zero-load tests each indicate an error which does not exceed ± 0.06 % of the totalized load at full scale capacity for the duration of the test. No adjustments can be made during the three consecutive zero-load test readings.

  (Added 2002) (Amended 2004 **and 2009**)

  N.3.1.~~4~~3. Check For Consistency of the Conveyor Belt Along Its Entire Length
  After a zero-load test with flow rate filtering disabled, the totalizer shall not change more than plus or minus 3.0 scale divisions (± 3 d) from its initial indication during one complete belt revolution.

  (Added 2002) (Amended 2004)

- **Section 6, Zero-Setting Mechanism**
  This change was made to reflect the addition of new paragraph S.3.1.1. in *NIST Handbook 44*, 2.21.

  Code Reference: S.3.1. <u>and S.3.1.1.</u>
  The zero-setting mechanism may be either a manual or automatic mechanism. In either case, the range of the zero-setting mechanism is limited to ± 2% of the rated capacity of the scale. If a greater adjustment is needed, the access to the adjustment must be through some security means. An audio or visual signal shall be given when the automatic and semi-automatic zero-setting mechanisms reach the limit of adjustment of the zero-setting mechanism. The zero-setting mechanism must be constructed such that the zero-setting operation is done only after a whole number of belt revolutions (a minimum of 3 revolutions or a time period equivalent to the time required to deliver 1000 d of load.) The completion of the zero-setting operation must be indicated. The low-flow lockout must be deactivated for this test.

  For systems that record the zero load reference at the beginning and end of a delivery, the range of zero-setting mechanism shall not be greater than ± 5% without breaking the security means.

  6.4. The completion of the automatic zero-setting operation must be indicated.

  <u>6.4.1. Verify that any changes in the zero reference are indicated and/or recorded.</u>

Conclusion:
Mr. Truex, NTEP Administrator, reviewed these amendments to update sector members on changes to *NCWM Publication 14*. No further discussion took place.

2. Update to NCWM Publication 14 Belt-Conveyor Scale Checklist

Status report on draft proposal for amending *NCWM Publication 14 BCS Checklist*.

Background / Discussion:
Prior to the February 2009 sector meeting, Mr. Ripka, Chair, provided a draft *NCWM Publication 14 BCS Checklist* with technical policies on the substitution of Master Weight Totalizers along with other minor editorial suggestions for review. Among the suggested changes that were included in this draft were proposed amendments to the procedures involving testing semi-automatic and automatic zero-setting mechanisms. The sector members suggested that it be used on a trial basis by NTEP laboratories when evaluating manufacturer's replacement instruments scheduled to undergo NTEP evaluation. This trial-use would serve to evaluate the checklist and to identify any gaps or necessary changes. During the meeting Mr. Ripka, Thermo-Fisher Scientific, stated that his company would possibly have an instrument that could be submitted in the near future for NTEP evaluation, allowing this checklist to be used on a trial basis.

At the February 2010 sector meeting the members were informed that there had been no instruments submitted to date for NTEP evaluation that would serve to demonstrate the usefulness of the checklist. Mr. Marmsater, Merrick Industries, Inc., indicated that his company is also expecting to have a device ready to submit for type evaluation soon. The possible use of the checklist during an evaluation on this instrument would be discussed at the 2011 sector meeting.

Conclusion:
At the 2011 NTETC BCS Sector Meeting the members were informed that to this point, there still have not been any applications submitted that would allow the use of the checklist. Mr. Marmsater, Merrick Industries, Inc., indicated that his company still expects to have an instrument ready to submit in the near future for type evaluation. No additional comments or actions were discussed at this time.

3. Develop a List of Sealable Parameters for BCS Systems

Status report on the adoption of list of sealable parameters to be included for use in NTEP evaluations of belt-conveyor scales.

Background / Discussion:
A list of device features and parameters which were identified by the sector as items that should be protected by some form of security seal was developed during the 2009 NTETC BCS Sector Meeting. This list was to be forwarded to NTEP laboratories for use on a trial basis. Comments and recommended amendments from the NTEP evaluators would then be forwarded to the sector work group for further development. The listing could then be amended if needed and a recommendation be made to the NTEP Committee for its adoption into *NCWM Publication 14*.

Conclusion:
The implementation of this list of sealable parameters is subject to the review by NTEP evaluators, as listed under the previous agenda (update of the amended NTEP evaluation checklist). Since no manufacturer's instruments have been made available at this time for the trial use of the proposed checklist or the list of sealable parameters, no further actions or discussion were justified at this time. The sector was informed that a trial application and review of both items will be performed when the opportunity arises.

NEW BUSINESS

Note: Discussion of the following item may be related to a similar agenda item addressed during the February 23-24 2011 meeting of the U.S. National Work Group (USNWG) for BCS that preceded the NTETC BCS Sector Meeting. Additional background information may be found in the USNWG 2011 Meeting Summary.

4. Linearization Feature for BCS

Draft new test procedures for the evaluation of linearization correction features.

Background / Discussion:
Manufacturers and service agents of BCS have voiced support for the use of electronic instruments equipped with a linearity correction feature (i.e. multiple point calibrations) to reduce span errors that deviate from a linear pattern. This contrasts with reported prohibition of this type feature by certain weights and measures regulatory authorities. Some sector members have asked for clarification from the National Institute of Standards and Technology (NIST), Office of Weights and Measures (OWM) on the use of this type of feature and whether it is (or should be) permitted within current U.S. standards.

The NIST Technical Advisor informed the sector during the February 2011 NTETC BCS Sector Meeting that there is no basis for excluding the use of a linearity correction within *NIST Handbook 44* that would serve as justification to prohibit its use. In addition there are numerous NTEP Certificates of Conformance (CC) for weighing devices that include this type of feature under the listing of standard features and options for that device. The sector members were asked if they favored the development of testing procedures to evaluate linearization correction features for inclusion in *NCWM Publication 14*. Sector members were also asked whether or not the ability to enable/disable the feature should be a sealable parameter. Initial discussion among the sector revealed the majority favored the development of test procedures to assist evaluators in the examination of BCS equipped with linearization correction features.

Sector member Mr. Burrell, Control Systems Technology Pty, Ltd., raised concerns however regarding the nature of any test procedures that would be published, thus revealing proprietary information about a specific feature included in the device's programming. Other sector members raised the question of whether or not it would be sufficient to

simply require that the ability to enable or disable any linearization feature to be a sealable parameter and that the manufacturer would need to work closely with the NTEP laboratories and evaluators to ensure that this type of feature would be examined properly. Mr. Barton, NIST Technical Advisor added that it would seem appropriate to develop testing procedures that would, at a minimum ensure that the existence of this feature within a device would not allow the device to be used in a fraudulent manner.

Mr. Truex, NTEP Administrator, stated that the NTEP evaluator must be informed by the device manufacturer of any feature that has metrological significance so that feature may be evaluated. Mr. Truex added that he believes this type of feature should be tested in a laboratory environment and probably not in a field environment.

The possibility of developing test procedures of a generic nature so as to avoid revealing sensitive technical, proprietary details about any particular instrument was discussed among the sector. Those members who represent manufacturers at the meeting agreed that draft test procedures could be developed. They stated that the procedures could be drafted to be sufficient enough to provide an evaluator with instructions on thoroughly testing a device, but not extensive enough to expose sensitive information about the device if these test procedures are published.

Another point raised by Mr. Burrell, Control Systems Technology Pty, Ltd., was whether or not devices that are currently covered under an active CC that includes linearization correction features would need to be revaluated if and when testing procedures relative to a linearization feature are developed and published in *NCWM Publication 14*. Other manufacturers within the group expressed their belief that it would be necessary for devices equipped with this feature to undergo at least a partial revaluation if and when the test procedures were adopted into *NCWM Publication 14*.

Conclusion:
Manufacturers attending the NTETC BCS Sector Meeting agreed to participate in a sub-group formed to develop a draft of test procedures for recommendation to the NTEP Committee. This sub-group will also consider the scope for the application of any newly developed test procedures (i.e. whether the test procedures will be applied retroactively to devices that have already received NTEP approval). The sub-group includes the following members:

- Mr. Bill Ripka, Thermo Fisher Scientific
- Mr. Peter Sirrico, Thayer Scale / Hyer Industries
- Mr. Lars Marmsater, Merrick Industries, Inc.
- Mr. Ian Burrell, Control Systems Technology Pty, Ltd.

The sub-group will continue work on developing test procedures through correspondence and will offer the first draft for review by the entire USNWG by April 30, 2011.

5. Conveyor Belt Profiling

Draft new *NCWM Publication 14* procedures for evaluation of belt profiling (belt mapping) feature.

Note: Discussion of the following item may be related to a similar agenda item addressed during the February 23-24 NTETC BCS Sector Meeting of the USNWG for BCS that preceded the NTETC BCS Sector meeting. Additional background information may be found in the USNWG 2011 Meeting Summary.

Background / Discussion:
This method of establishing a zero-condition for a totalization operation enables the belt-conveyor scale to synchronize the application of an individual tare weight values associated with distinct segments of the belt to the movement of those belt segments over the scale portion of the conveyor. If this alternative to averaging the weight of segments of the belt carcass is used there may be a need to establish a procedure to evaluate its effectiveness, to ensure that it functions as intended, and is maintained during operation of the BCS.

NIST, OWM has received inquiries seeking guidance on whether this type of feature is permitted under U.S. standards. It is also being reported by some members of the USNWG on BCS that some regulatory field officials will not issue an approval for devices equipped with this feature when it is not listed as a standard feature or option on the NTEP CC.

Current *NIST Handbook 44* and International Organization of Legal Metrology (OIML) Recommendation (R) 50 [Continuous totalizing automatic weighing instruments (belt weighers)] requirements were developed for systems that average the weight of belt segments by continuously weighing the belt as it passes over the scale portion of the conveyor. The draft revision of OIML R 50 however, does include terminology that explicitly recognizes the belt profiling feature as a means of establishing and maintaining a zero condition. The current draft of R 50 also addresses the need to verify the performance of the synchronization of belt segment weights with the travel of belt segments over the weighing device.

At the February 2011 NTETC BCS Sector Meeting, the sector was asked to determine the need for including this feature within U.S. standards and procedures (*NIST Handbook 44* and *NCWM Publication 14*) as well.

During the February 2011 NTETC BCS Sector Meeting the members were asked to consider if there is there is a need for procedures to evaluate the effectiveness of belt profiling and to ensure that correct operation is maintained during totalization. A majority of sector members voiced their opinion that this feature should receive some level of evaluation, and that at a minimum the ability to enable or disable the belt profiling feature should be protected by some form of security seal.

Mr. Chase, Chase Technologies, Inc., stated that profiling should not be viewed as an independent function but that it is more appropriately classified as a subset of Automatic Zero Tracking. Automatic Zero Tracking features are already required to be protected through a type of security seal.

Mr. Barton, NIST Technical Advisor, asked the sector members if the need exists to develop type evaluation test procedures to verify that the function of the belt profiling feature will be effective throughout a range of changing conditions that the belt-conveyor scale system may be subject to. The members generally acknowledged that its performance could be a concern and that changes in environmental conditions affecting characteristics of the belt (i.e., elasticity, length) must be compensated for.

Mr. Ripka, Chair stated that clarification is needed to provide direction for the use of the proposed *NIST Handbook 44* requirement pertaining to conveyor belt consistency (N.3.1.3) in association with the belt profiling feature. The proposed draft of N.3.1.3. will require that the condition of the conveyor belt be maintained so that excessive deviation from an established zero condition is controlled. Mr. Ripka asked the sector members for their position on whether the requirement pertaining to belt consistency would be applied to the system before or after a belt profiling feature is placed in operation. While there were no definitive responses, it was acknowledged that the use of both types of zero maintenance controls may be redundant and further consideration is needed.

Conclusion:
While there was no consensus reached within the sector on whether test procedures are needed to evaluate this feature while the device is under type evaluation, it was agreed that belt profiling is a metrologically significant feature. In addition, the sector members felt that at a minimum, the activation of this feature should be required to be protected by a form of security seal.

Mr. Barton, NIST Technical Advisor suggested that the belt profiling is a matter that is best understood and applied by belt-conveyor scale manufacturers. For that reason, it may be preferable to have the analysis and necessary action(s) for the consideration of belt profiling features taken on by the same sub-group formed under the previous agenda item. That sub-group's members agreed to work outside of the time constraints of the sector meeting to develop a draft for test procedures deemed necessary to evaluate a belt profiling feature in use with a device submitted for type evaluation. The sub-group includes the following members:

- Mr. Bill Ripka, Thermo Fisher Scientific
- Mr. Peter Sirrico, Thayer Scale / Hyer Industries
- Mr. Lars Marmsater, Merrick Industries, Inc.
- Mr. Ian Burrell, Control Systems Technology Pty, Ltd.

A draft of test procedures developed by the sub-group is expected to be made available for review by the entire membership of the sector by April 30, 2011.

6. Provision for Sealing

Should *NCWM Publication 14 BCS Checklist and Test Procedures*, Section 1.1 include *NIST Handbook 44*, G-S.8 as a code reference for sealing a device?

Background / Discussion:
The first paragraph of *NIST Handbook 44* General Code requirement G-S.8. Provision for Sealing Electronic Adjustable Components is nearly identical to that of *NIST Handbook 44* BCS Code paragraph S.5. Provisions for Sealing.

Paragraph S.5 differs however, in that it does not include references for automatic or semi-automatic calibrations mechanisms whereas G-S.8 includes a second paragraph in the requirement addressing automatic or semi-automatic calibrations. Since automatic or semi-automatic calibrations mechanisms are incorporated into belt-conveyor scale systems the sector should address this inconsistency.

The work group had no initial comments regarding this item. Mr. Barton, NIST Technical Advisor suggested that a draft amendment for *NIST Handbook 44* Belt-Conveyor Scale Code, paragraph S.5, be developed and then circulated among the members of the USNWG on BCS by way of email. The work group members can then review the draft and respond with comments electronically. If the recommendation is favored, the need to protect access to an automatic/semi-automatic calibration feature will need to be included as part of type evaluation procedures in *NCWM Publication 14*. The sector members agreed to review the draft recommendation and provide any comments on it.

Conclusion:
Mr. Barton, NIST Technical Advisor, will draft language for the inclusion of a second paragraph amending *NIST Handbook 44*, 2.21 paragraph S.5 to recognize the need to protect access to automatic/semi-automatic calibration feature by way of a security seal. This draft will be circulated among members of the USNWG on BCS and the NTETC BCS Sector for their review. The draft will be circulated by April 30, 2011. A final draft will be developed based on comments received and submitted for approval by the Specifications and Tolerances Committee.

7. Clarification of Guidelines Used for the Selection of Instruments for Type Evaluation

Parameters used for classification of devices as part of a type or "family" of manufacturer's model design.

Background / Discussion:
During the February 2010 NTETC BCS Sector Meeting the sector members acknowledged that the existing language in *NCWM Publication 14* BCS Sections A through G is vague and that it would be useful for criteria used in the selection of instruments to undergo evaluation as representative of a certain type or family to be further defined.

The existing language categorizes devices by the number of weigh idlers used for the weighing portion of the belt-conveyor and, a 10:1 ratio based on the size, loading and speed of the belt/weighbridge.

Mr. Barton, NIST Technical Advisor, offered some examples of additional requirements for a suitable representative device:

- One that includes all possible interfaces (communication ports, remote calibration, etc.);
- Similar or the same type of load cell or load receptors (should there be a limited capacity range for substitution load cells or for load cells listed on the CC?);
- Single speed or variable speed operation;
- Method of zero calibration and maintenance; and
- Other metrological features such as those found listed in the sector's proposed table of "Belt-Conveyor Scale Features and Parameters" (See 1.b. above) such as:
  - Selection of measurement units;
  - Division value, d; and
  - Range of over capacity indications.

Mr. Burrell, Control Systems Technology Pty, Ltd., questioned the usefulness of categorizing instruments in families and supported this view by stating that most if not all devices that are sold by his company are designed and constructed specifically to suit the needs of each individual customer.

Mr. Ripka, Thermo Fisher Scientific, informed the sector that the options which are programmable through an electronic control instrument that limit the range of operation are not a significant consideration for this classification process. Mr. Ripka stated that it is the design structure of the system components rather than programmable options which will be most meaningful in providing a means to categorize BCS systems. The justification for his belief is that it is the design and construction of the structural elements of the system that will determine loading capacity and capability of a BCS.

Mr. Burrell, Control Systems Technology Pty, Ltd., also stated that it is his belief that a 10:1 ratio currently used to classify devices as types or families is simply an arbitrary figure and that there should be more latitude allowed. Mr. Truex, NTEP Administrator, stated that the 10:1 ratio was selected out of the necessity to establish a basis for criteria and that the same ratio is used for many other type of devices.

Mr. Barton, NIST Technical Advisor, suggested that if the design and construction is the prime consideration, then perhaps the BCS manufacturers would be the most logical sources for drafting specific criteria to be used to show commonality between devices and therefore considered as belonging to the same type or family.

Conclusion:
Burrell, Control Systems Technology Pty, Ltd., and Mr. Ripka, Thermo Fisher Scientific, agreed to work on developing additional specific criteria and that they would have a draft to offer the Sector by August 1, 2011 for review. Mr. Burrell also recommended that Mr. Chase, Chase Technologies, Inc., be included in the development of the draft. Mr. Chase agreed to participate in developing this draft.

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National Type Evaluation Technical Committee (NTETC)
Belt-Conveyor Scale (BCS) Sector Meeting Summary

February 23, 2012 / St. Louis, Missouri

INTRODUCTION

The charge of the BCS 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 and 2.21. Belt-Conveyor Scale Systems. The sector's recommendations are presented to the 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 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 **underlining** information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***.

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Table B
Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
BCS	Belt-Conveyor Scale	NTEP	National Type Evaluation Program
MTL	Minimum Test Load	NTETC	National Type Evaluation Technical Committee
NCWM	National Conference on Weights and Measures	OWM	Office of Weights and Measures
NIST	National Institute of Standards and Technology	USNWG	U.S. National Work Group

Details of All Items
(In order by Title of Content)

CARRY-OVER ITEMS

1. Belt-Conveyor Scale NTEP Checklist

Source:
NIST, OWM

Background / Discussion:
Prior to the 2009 NTETC BCS Sector Meeting, Mr. Ripka, Chair submitted a draft of an amended *NCWM Publication 14* Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures to the sector members for review. The changes in this draft related primarily to Master Weight Totalizers intended to be installed as substitutions within a BCS system in addition to a number of other minor editorial changes. Among the suggested changes that were included in this draft were proposed changes involving procedures used when evaluating semi-automatic and automatic zero-setting mechanisms.

This proposed draft has not been sufficiently vetted yet. That draft was offered for use on a trial basis by NTEP laboratories when evaluating manufacturer's replacement instruments that are scheduled to undergo NTEP evaluation. Some manufacturers within the sector have indicated that they may have instruments ready to be submitted to NTEP for evaluation.

NTEP laboratories have agreed to use the amended checklist in order to identify gaps or necessary changes within the draft. Feedback from evaluators who have used this amended checklist is needed so that the sector can determine if the proposed changes need further development. Any input and additional comments that are available will be discussed.

NTEP evaluator Mr. Jones, California Division of Measurement Standards, informed the sector that there have not been any submissions of BCS Totalizers from manufacturers that could serve as a model unit to apply this amended checklist to on a trial basis.

Belt-conveyor scale manufacturer representatives from Thermo Fisher Scientific and Merrick Industries, Inc. informed the sector that they anticipate submitting devices to NTEP for evaluation in the near future. These manufacturers stated that their devices should be appropriate models to be used to evaluate the draft procedures.

Conclusion:
The sector agreed that upon the application of the new draft test procedures, a report would be made to the sector by the NTEP evaluator(s) detailing any gaps in the procedures and further amendments if necessary. The amended checklist will be applied to these instruments when they become available.

2. Sealable Parameters List for NTEP Evaluation

Source:
NIST, OWM

Background / Discussion:
A list of BCS features and parameters which were identified by the sector as those that should be protected by a form of security seal had been developed during the 2009 NTETC BCS Sector Meeting. The list has been forwarded to NTEP laboratories who have agreed to use this list during NTEP evaluation of BCS to determine if the list is sufficiently comprehensive. Feedback from NTEP evaluators using this amended checklist is requested so that sector members are able to determine if the list is sufficient. Any additional input and comments available from manufacturers and NTEP evaluators on the proposed changes will be discussed.

The sector was informed that although the sealable parameters list developed during the 2009 NTETC BCS Sector Meeting is in the current *NCWM Publication 14*, there have not been any instruments submitted for evaluation under NTEP that provide the opportunity to compare this list to.

Conclusion:
The sector agreed that the list as developed at the 2009 NTETC BCS Sector Meeting will remain in *NCWM Publication 14* in its current form, and will be updated as needed based on any gaps identified by NTEP evaluators.

3. Linearization Feature for BCS

Source:
NIST, OWM

Background / Discussion:
Manufacturers and service agents of belt-conveyor scales have voiced support for the use of electronic instruments equipped with a linearity correction feature (i.e. multiple point calibrations) to reduce span errors that deviate from a linear pattern. It has been reported by some sector members that this practice may be in conflict with the prohibition of this type of feature by certain weights and measures regulatory authorities. Some sector members have asked for clarification from the National Institute of Standards and Technology (NIST), Office of Weights and Measures (OWM) on the use of this type of feature and whether it is (or should be) permitted in existing U.S. standards. The U.S. National Work Group (USNWG) on BCS has deliberated on the use of a linearization feature for enhancing the performance of belt-conveyor scale systems and considered whether there is a need to develop requirements within *NIST Handbook 44* to address its use. Test procedures (including those used for type evaluation) are to be analyzed and further developed or amended as needed in order to verify that this feature will comply with the current *NIST Handbook 44.* Manufacturers at the 2011 NTETC BCS Sector Meeting agreed to participate in a work group formed to develop a draft of test procedures that could be submitted to the NTEP Committee as proposed changes within *NCWM Publication 14*. This work group will also consider the scope for the application of any newly developed test procedures (i.e. whether the test procedures will be applied retroactively to devices that have already received NTEP approval). The work group includes the following members:

- Mr. Bill Ripka, Thermo Fisher Scientific
- Mr. Peter Sirrico, Thayer Scale / Hyer Industries
- Mr. Lars Marmsater, Merrick Industries, Inc.
- Mr. Ian Burrell, Control Systems Technology Pty Ltd.

The work group agreed to continue work on developing test procedures through correspondence and offer a draft for review by the sector. An update on any progress that has been made in this effort will be provided to the sector.

The sector recognizes that linearization correction features may at this time be in use in some manufacturer's devices. The sector also understands that manufacturers may take different approaches in the design of such features and that it would be impractical to write a single set of procedures to follow during type evaluation of different manufacturer's devices.

Mr. Barton, NIST Technical Advisor suggested that a simple, generic statement may be all that is needed to provide the evaluator with the information necessary (e.g., a statement that would direct the evaluator to follow procedures that are provided by the manufacturer).

Mr. Marmsater, Merrick Industries, Inc. noted that many electronic components used in the construction of belt-conveyor scale systems become obsolete very rapidly and this causes the manufacturer to redesign the instruments to accommodate necessary changes in design. He questioned whether this will require that a revaluation be performed at the time of these redesigns. Mr. Truex, NTEP Administrator acknowledged that this could be a potential problem and that NTEP and if necessary, NTEP Committee would properly address this issue.

Conclusion:
The sector agreed that the same work group that originally took on the linearization feature project during the 2011 NTETC BCS Sector Meeting will regroup and continue the work to produce a rough draft of procedures to be followed when evaluating the instruments ability to compensate for non-linear performance. This rough draft is to be completed by May 31, 2012 and then circulated to the sector for review and comment.

4. Conveyor Belt Profiling

Source:
NIST, OWM

Background / Discussion:
This method of establishing a zero-condition for a totalization operation enables the belt-conveyor scale to synchronize the application of an individual "tare" weight values associated with distinct segments of the belt to the movement of those belt segments over the scale portion of the conveyor. If this alternative to averaging the weight of segments of the belt carcass is used there is a potential need to establish a procedure to evaluate its effectiveness, to ensure that it functions as intended, and is maintained during operation of the BCS.

NIST OWM has received inquiries seeking guidance on whether this type of feature is permitted under U.S. standards. It is also being reported by some members of the USNWG BCS that some regulatory field officials will not issue an approval for devices equipped with this feature when it is not listed as a standard feature or an option on the NTEP Certificate of Conformance.

During the 2011 NTETC BCS Sector Meeting the sector was asked to consider if there is a need for procedures to evaluate the effectiveness of belt profiling and to ensure that correct operation is maintained during totalization. A majority of sector members voiced their opinion that this feature should receive some level of evaluation, and that at a minimum the ability to enable or disable any belt profiling feature should be protected by some form of security seal.

The sector also concluded that it may be preferable to have the analysis and necessary action(s) for the consideration of belt profiling features taken on by the same work group formed under the previous agenda item. The work group is comprised of the same members as the work group formed under the previous agenda item and includes:

- Mr. Bill Ripka, Thermo Fisher Scientific
- Mr. Peter Sirrico, Thayer Scale / Hyer Industries
- Mr. Lars Marmsater, Merrick Industries, Inc.
- Mr. Ian Burrell, Control Systems Technology Pty Ltd.

A draft of test procedures is expected to be made available for review by the sector. An update on any progress made by the work group will be provided to the sector.

At the 2011 NTETC BCS Sector Meeting, the work group reported that no progress has been made on developing a draft for test procedures to evaluate belt profiling features.

Conclusion:
The sector agreed that there is merit to incorporating guidance for NTEP evaluators by providing procedures for testing this feature. They agreed that the same group that originally took on the project will regroup and continue the work to produce a rough draft of procedures to be followed when evaluating a belt-profiling type of feature. This rough draft will be completed by May 31, 2012 and will be circulated to other sector members for review and comment.

NEW ITEMS

5. 2012 NIST Handbook 44 Changes

Source:
NIST, OWM

Background / Discussion:
The proposed amendments were presented to the sector members and an explanation was provided for necessary changes that are being recommended.

Conclusion:
The 2012 edition of *NIST Handbook 44* BCS code contains an amended paragraph N.3.1.3. After a review of the suggested changes, there were no opposing comments from the sector. It is recommended that *NCWM Publication 14* be changed to reflect this amendment as shown below:

13. Field Test Procedure (page BCS-18)

Field Performance Test of the Belt-Conveyor Scale

N.3.1.3. Check for Consistency of the Conveyor Belt Along Its Entire Length. – During a zero-load test with all operational ~~**no**~~ **low**-flow lockout disabled, the total change indicated in the totalizer during ~~**one**~~ **any complete** revolution of the belt shall not exceed **the absolute value of** 0.12 % of the minimum ~~**test**~~ **totalized** load. ~~**The end value of the zero-load test must meet the ± 0.06 % requirement (Test for Zero Stability).After a zero-load test with flow rate filtering disabled, the totalizer shall not change more than plus or minus (± 3 d) 3.0 scale divisions from its initial indication during one complete belt revolution.**~~

Note: The end value of the zero-load test must meet the ± 0.06 % requirement referenced in the "Test for Zero Stability."

(Added 2002) (Amended 2004 **and 2011**)

6. Recommended Changes to Existing Language in NCWM Publication 14

6.a. 9. Installation Requirements - paragraph numbering (page BCS-11)

Source:
NIST, OWM

Background / Discussion:
The proposed amendments were presented to the sector and an explanation was provided for necessary changes that are being recommended.

Conclusion:
The sector was asked to consider that the paragraph numbers within *NCWM Publication 14* be changed to correspond with the previous renumbering of paragraphs in Section 9. There were no opposing comments. Suggested amendments are shown below:

Code Reference: UR.2.2.1.

9.7.3.	Pulleys, if used, must be properly protected from material build-up.	☐ Yes	☐ No	☐ N/A
9.7.4.	If the tail pulley rides on a carriage, the guides must be protected against material build-up.	☐ Yes	☐ No	☐ N/A
9.7.5.	If the arrangements in ~~(3)~~ **(9.7.3.)** and ~~(4)~~ **(9.7.4.)** are used, then the bridle attaching the cable to the carriage must be designed such that the carriage will not become cocked in its guides or tracks.	☐ Yes	☐ No	☐ N/A

6.b. Minimum Test Load (MTL) References

Source:
NIST, OWM

Background / Discussion:
When the value for MTL in *NIST Handbook 44* [2.21], paragraph N.2.3. (a) was changed from 1000 scale divisions to 800 scale divisions in the 2005 edition of *NIST Handbook 44*, not all corresponding values in *NCWM Publication 14* were changed.

Conclusion:
The proposed amendments were presented to the sector and explanations were provided for necessary changes that are being recommended. There were no opposing comments. To reconcile these *NCWM Publication 14* references with current *NIST Handbook 44* requirements, it is recommended that MTL references in *NCWM Publication 14* Belt-Conveyor Scales Checklist be changed as shown, from 1000 d to 800 d in the following locations:

a. 6. Zero-Setting Mechanism (page BCS-7)

Code Reference: S.3.1. and S.3.1.1.
The zero-setting mechanism may be either a manual or automatic mechanism. In either case, the range of the zero-setting mechanism is limited to ± 2% of the rated capacity of the scale. If a greater adjustment is needed, the access to the adjustment must be through some security means. An audio or visual signal shall be given when the automatic and semi-automatic zero-setting mechanisms reach the limit of adjustment of the zero-setting mechanism. The zero-setting mechanism must be constructed such that the zero-setting operation is done only after a whole number of belt revolutions (a minimum of 3 revolutions or a time period equivalent to the time required to deliver ~~**1000**~~ **800** d of load.) The completion of the zero-setting operation must be indicated. The low-flow lockout must be deactivated for this test.

b. 6. Zero-Setting Mechanism (page BCS-8)

6.3. The zero-setting operation shall be performed only after at least 3 belt revolutions or a time period equivalent to the time required to deliver ~~**1000**~~ **800** d of load. ☐ Yes ☐ No ☐ N/A

c. 7. Sensitivity at Zero Load (page BCS-8)

Test Procedure
Apply a load equal to the weight required to determine compliance with the Belt-Conveyor Scale Code paragraph S.3.2. based upon the equation:

$$\frac{2 * W_c}{C_m}$$

For Example: $\frac{2 * \text{~~500~~ 400 lb}}{\text{~~1000~~ 800 d}} = 1$ lb

d. 12. Laboratory Test Procedures (page BCS-14 and 15)

Voltage Tests
5. Run an accuracy test at 98% of scale capacity for the time to deliver ~~**1000**~~ **800** d.
6. Change the voltage of the power supply to 100 V.
7. Run a zero test.
8. Run an accuracy test at 98% of scale capacity for the time to deliver ~~**1000**~~ **800** d.
9. Change the voltage of the power supply to 130 V.
10. Run a zero test.
11. Run an accuracy test at 98% of scale capacity for the time to deliver ~~**1000**~~ **800** d.
12. Return the voltage of the power supply to a nominal value.

Percent of Static Scale Capacity	Nominal Time (minutes)	Equivalent Belt Travel[1]
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$ (belt speed for test)][1] whichever is greater	
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$ (belt speed for test)], whichever is greater	
35% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
70% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
98% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
Leave the scale under load for 1 hour.		
98% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
70% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
35% of SSC_{max}	Time to deliver ~~**1000**~~ **800** d	
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$ (belt speed for test)], whichever is greater	
0	20 minutes, or $MTL_{min}/([0.35)(BL_{min})$ (belt speed for test)][2] whichever is greater	

e. 15. Data Sheet and Laboratory Test Procedure (page BCS-20 and 21)

Device Parameters		Abbreviations	Maximum	Minimum	Dim.
Load per unit length (from manufacturer) corresponds to the largest capacity and the lowest capacity rating.		BL			lb/ft
Length of the weighbridge (inches.)					in
Belt speed (from manufacturer.)		SP			ft/min
Determine scale capacity in units per hour SC=SPxBLx60/2000		SC			ton/hr
Record the static scale capacity in units of weight. SSC = (maximum weight per foot) (length of weighbridge)		SSC			lb
Allowable zero error for temperature change of 10 °C (18 °F) AZE = (0.0007) (SC_{min}) (time)/60 where "time" is the time of the zero test in minutes.		AZE			ton
Size of scale division required for zero.		SD			ton
Determine the minimum and maximum totalized loads.		MTL			ton
Test Conditions		**Abbreviations**	**Maximum**	**Minimum**	**Dim.**
Determine the time in minutes to acquire MTL with the test load to be applied in laboratory testing.	Test load, pound/foot.				lb/ft
	Test load, total.				lb
	Time (minutes) to deliver MTL (at least 10 minutes.)	time			min
Determine number of belt travel sensor revolutions required for the above time. Manufacturer to provide revolutions per foot or pulses per foot as appropriate to determine 3 belt revolutions and a delivery of ~~**1000**~~ **800** d (from manufacturer.)		BTR			Revolutions
Allowable weighing error (units of weight) for dynamic tests which will be divisions on master weight totalizer (MWT.) AWE = 0.45(0.005)(TL)		AWE			ton

Percent of Static Scale Capacity	Time (minutes)	Totalized Load TL (ton)	Tolerance AWE = 0.45 (.005) (TL)
0	20 minutes, or MTL_{min}/[(0.35) (BL_{min}) (belt speed for test)], whichever is greater		
35% of SSC_{min}	20 minutes, or MTL_{min}/[(0.35) (BL_{min}) (belt speed for test)], whichever is greater		
35% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
70% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
98% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
Leave the scale under load for 1 hour.			
98% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
70% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
35% of SSC_{max}	*Time to deliver ~~**1000**~~ **800** d		
35% of SSC_{min}	20 minutes, or MTL_{min}/[(0.35) (BL_{min}) (belt speed for test)], whichever is greater		
0	20 minutes, or MTL_{min}/[(0.35) (BL_{min}) (belt speed for test)], whichever is greater		

7. Field Test Procedures for Reference Scales

7.a. Hopper Scales – 13. Field Test Procedure(page BCS – 17)

Source:
NIST, OWM

Background / Discussion:
The required minimum test weights of 10% of scale capacity as stated in *NCWM Publication 14* does not correspond with the minimum test weight required in *NIST Handbook 44* [2.20], Table 4 of 12.5%. The sector is asked if these values should be reconciled.

Sector members agreed that the minimum test weight amount of 10% of scale capacity is in conflict with *NIST Handbook 44* Scales Code, Table 4 where it is required that, for scales of greater than 3000 lb capacity the minimum test weight required is 12.5% of scale capacity. The origin of the established value of 10% is uncertain at this time. Mr. Barton, NIST Technical Advisor offered that the possible source for this value may have been from the stated value for minimum test weight in the *NIST Handbook 44* Automatic Bulk Weighing Systems code where that type of device is required to be tested using 10% of scale capacity as the minimum test weight.

The sector originally agreed that this reference to 10% minimum test weight required should be amended to coincide with the minimum test weight required under Table 4 – *NIST Handbook 44* Scales Code (e.g., 12% of scale capacity). Further discussion by the sector disclosed that no requirement is present in *NIST Handbook 44* BCS code to specify the capacity of a reference scale used and that the only specific requirement is that the scale used must produce weighments within 0.1% accuracy.

Conclusion:
The amendments shown below were agreed upon by the sector which specify that no more than three substitutions can be used during the testing of a hopper scale used a reference scale, and that the hopper scale be tested according to *NIST Handbook 44* procedures. The sector recommends the changes as shown below be made in *NCWM Publication 14*.

13. Field Test Procedure (page BCS-17)

Test of the Reference Scale

Hopper Scales
Hopper scales must be tested to the used capacity using **a maximum of three** substitution tests **according to NIST Handbook 44 procedures**. ~~**Test weights equal to a minimum of 10% of scale capacity are needed; more test weight is recommended.**~~ The scale must be accurate to 0.1% and adjusted if necessary.

Notice: After the 2012 NTETC BCS Sector Meeting, Mr. Barton, NIST Technical Advisor received feedback regarding concerns about this item and decision reached by the sector. These concerns were specifically related to the deletion of a stated minimum required test weight and the apprehension that this type of scale may be tested using test weight in amounts that are smaller than what has been established as minimum. Mr. Ripka, Chair and Mr. Truex, NTEP Administrator were consulted, with a decision reached that since this is not a critical issue currently preventing a manufacturer from completing an NTEP evaluation, it would be best to hold as a carry-over item to be re-addressed at the next sector meeting.

7.b. Railway Track Scales – 13. Field Test Procedure (page BCS-17)

Source:
NIST, OWM

Background / Discussion:
The sector was asked to provide input regarding a recommendation that uncoupled in-motion railway scales used to establish reference weights for material tests be required to be tested in the mode (in-motion or statically) that will be used to determine the reference weights.

As written, this procedure does not prohibit weighing rail cars, uncoupled in-motion, to obtain reference weights for use during a material test when the railway scale's accuracy has only been verified through static testing. Considering the substantial time and effort involved in testing an uncoupled in-motion railway scale, it is questionable whether the scale will be properly tested as an in-motion scale (when used as such) or if it will only have its accuracy verified through a statically performed test.

The sector was asked if the railway track scale is not tested as an in-motion scale, should it be accepted that the scale will be capable of producing reference weights of 0.1% accuracy when the scale is used as an in-motion scale. Several sector members expressed their belief that reference weights can be obtained on an in-motion scale that has had its accuracy verified however; the weights should be obtained by static weighing only. This notion was based on the uncertainty whether in-motion weighing can consistently produce 0.1% accuracy for all weighments.

Mr. Burrell, Control Systems Technology Pty Ltd. pointed out that to exclude the use of in-motion weighing from acceptable methods to obtain reference weights would be placing unfair limitations on technological advancements. He further stated that static type scales cannot be absolutely relied on to accurately produce weighments without error. Other sector members expressed the view that they are not aware of any tests being performed where reference weights are obtained by in-motion weighing.

Conclusion:
The sector agreed that no action be taken on this recommendation, and that the current language in *NCWM Publication 14* should not be amended.

13. Field Test Procedure (page BCS-17)

Test of the Reference Scale

Railway Track Scales
Because of the difficulties of obtaining adequate test weights or test cars to test railway track scales, the American Association of Railroads Committee simply recommends that the scales be tested the best way that can be arranged. The scale must be accurate to 0.1% and adjusted if necessary.

Split-draft static-weighing is acceptable. ~~**Uncoupled in-motion weighing is permitted if it is done as a single draft.**~~

8. Time and Date Information Required on Recorded Indications

Source:
NIST, OWM

Background / Discussion:
The 2012 USNWG on BCS Meeting included discussion regarding paragraph S.1.4. in *NIST Handbook 44* BCS code which requires that recorded indications include the date and time in addition to the initial and final totalizer reading and the unit of measurement.

The statement of date and time however is non-specific in that there is no association made for the date and time record with the stage that the totalization process is in.

This issue has also been included in the agenda for the NTETC BCS Sector Meeting due to the reference to this *NIST Handbook 44* requirement in *NCWM Publication 14*. The example of a recorded indication provided in *NCWM Publication 14* (shown below) indicates a single, unspecified date and time. It may be reasonable to assume that because the total quantity is also provided on the recorded indication, that the date and time shown are associated with the final MWT reading.

2. Recording Element (page BCS-5)

Code Reference S.1.4. and G-S.5.2.2.:

2.3. The value of the scale division of the recording element shall be the same as that of the indicating element. The belt-conveyor scale system shall record the initial indication and the final indication on the MWT, the quantity delivered, the unit of measurement, (e.g., kilograms, tonnes, pounds, tons, etc.), the date, and time. This information shall be recorded for each delivery. The indicated and recorded weight values must agree to the nearest scale division. ☐ Yes ☐ No ☐ N/A

2.4. All weight values shall be recorded as digital values. ☐ Yes ☐ No ☐ N/A

2.5. Information required on the ticket. ☐ Yes ☐ No ☐ N/A

	~~05 06 92~~ ~~15:30~~
MASTER START TOTAL	44113.5 T
MASTER STOP TOTAL	44300.5 T
QUANTITY	187.0 T

The sector is asked to consider whether or not it is useful to include a time and date for the recorded indications of both the initial MWT reading and the final MWT reading. Additionally, is there justification for providing enough information on the recorded indications to establish a span of time for the delivery of the total amount of material?

If it is determined that an amendment is needed to the *NIST Handbook 44* requirement, it is recommended that the sector draft the appropriate necessary changes to *NCWM Publication 14*.

The sector generally agreed that there is some justification for providing sufficient information on recorded indications to be able to determine the amount of time that has passed during a totalization of material and that this amount of time could easily be obtained by referencing a time and date indication on both the beginning and final totalization recorded indication. Some sector members noted however, that recorded information that is already required to be indicated on flow chart recorders will provide that information. Other sector members agreed and added that it has been their experience that the flow chart recordings are always available for inspection as required.

Conclusion:
Considering the limited amount of space on many typical printed tickets that is available for the required recorded (printed) information, the sector agreed not to support that additional information be required on the printed/recorded indications and that no changes to *NCWM Publication 14* should be recommended with regard to this issue.

9. Short Conveyor Belt (Weigh-Belts) Systems

Source:
NIST, OWM

Background / Discussion:
The 2012 USNWG BCS Meeting Agenda include the reintroduction of language in *NIST Handbook 44* under UR.2. regarding shorter belt systems that are designed and furnished by the manufacturer. This proposal would place language back into *NIST Handbook 44* that had been stricken in 2001.

Although this language is not in the current edition of *NIST Handbook 44*, reference to *NIST Handbook 44* in the current *NCWM Publication 14* still includes this deleted wording. The sector is asked to consider how to reconcile *NCWM Publication 14* with references to requirements in *NIST Handbook 44*.

Conclusion:
The sector acknowledged there is on-going work regarding this issue being done by a sub-group of the U.S. National Work Group on belt-conveyor scales which may result in changes to future editions of *NIST Handbook 44*. The sector agreed however, that any references made in *NCWM Publication 14* to requirements contained in *NIST Handbook 44* should mirror the existing language in those requirements. They also agreed to recommend that the following amendments be made to *NCWM Publication 14* to reflect existing language in *NIST Handbook 44*.

9. Installation Requirements (page BCS-11)

Code Reference: UR.2.2.1.

9.7. ~~**Unless the scale is installed in a short conveyor designed and furnished by the scale manufacturer or built to the scale manufacturer's specifications, the conveyor shall comply with the following minimum requirements:**~~ **The design and installation of the conveyor leading to and from the belt-conveyor scale is critical with respect to scale performance. The conveyor can be horizontal or inclined, but if inclined, the angle shall be such that slippage of material along the belt does not occur. Installation shall be in accordance with the scale manufacturer's instructions and the following:** ~~☐ Yes ☐ No ☐ N/A~~

9.7.1. If the belt length is such that a take-up device is required, this device shall be of the counter-weighted type for either vertical or horizontal travel. ☐ Yes ☐ No ☐ N/A

9.7.1.1. Indicate the Type: ☐ Vertical ☐ Horizontal

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National Type Evaluation Program (NTEP)
Belt-Conveyor Scale (BCS) Sector Meeting Summary

February 20, 2014 / Pittsburgh, PA

Introduction

The charge of the BCS 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 and 2.21. BCS Systems. The sector's recommendations are 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 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 **underlining** information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***.

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Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
BCS	Belt-Conveyor Scale	NTEP	National Type Evaluation Program
MTL	Minimum Test Load	NTETC	National Type Evaluation Technical Committee
NCWM	National Conference on Weights and Measures	OWM	Office of Weights and Measures
NIST	National Institute of Standards and Technology	USNWG	U.S. National Work Group

Details of All Items
(In order by Reference Key)

I. Carry-over Items

A. Belt-Conveyor Scale NTEP Checklist

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Amend *NCWM Publication 14 Belt-Conveyor Scales* by incorporating recommended changes that primarily were intended to allow for the evaluation of master weight totalizers (MWT) as a component of a belt-conveyor scale system. This was intended to facilitate the certification of MWT's as replacement instruments and would not necessarily include testing on the entire belt-conveyor scale system.

Background:

Prior to the 2009 BCS Sector meeting, Mr. Bill Ripka, Chair submitted a draft of an amended *NCWM Publication 14* Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures to the sector members for review. The proposed changes in this draft related primarily to Master Weight Totalizers intended to be installed as substitutions within a BCS system in addition to a number of other minor editorial changes. Among the recommended changes that were included in this draft were changes involving procedures used when evaluating semi-automatic and automatic zero-setting mechanisms.

This proposed draft has been offered to be used on a trial basis by NTEP labs when evaluating manufacturer's replacement instruments (Master Weight Totalizers) that are scheduled to undergo NTEP evaluation. Some device manufacturers within the sector have indicated that they may have instruments ready to be submitted to NTEP for evaluation.

The NTEP program has been provided with the draft of proposed changes to *NCWM Publication 14* Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures and the NTEP laboratories have agreed to use the amended checklist in order to identify gaps or necessary changes within the draft. Feedback from

evaluators who have used this amended checklist is needed so that sector members are able to determine the need for further development of the proposed changes.

During the 2012 NTEP Belt-Conveyor Scale Sector meeting, the members agreed to request that a report be provided to the sector by NTEP evaluator(s) that have used the draft of proposed changes that would detail any gaps in the draft and recommend further amendments if necessary. Any input and additional comments from NTEP evaluators that are available will be discussed.

Discussion/Conclusion:

At the 2014 BCS Sector meeting, it was reported by the NTEP officials that there has not been any devices submitted for type approval that could appropriately evaluated using the proposed amended checklist. The NIST Technical Advisor accepted the task of reviewing the draft for an amended checklist to ensure that any references to requirements in *NIST Handbook 44* were current with the most recent edition of that publication. This review is to be completed by April 30, 2014 and any updates that are necessary will be forwarded to the NTEP Administrator for distribution to the NTEP labs.

Since there has been no applications for type approval of devices that would serve as candidates for a trial of the proposed amended checklist, the Sector had no further comment on this issue.

NIST Technical Advisor's note:

Following the February 2014 Sector meeting, the NTEP Belt-Conveyor Scale Sector members were contacted by the Sector Chair, Mr. Bill Ripka and were asked to participate in teleconference scheduled for June 16, 2014. This teleconference was arranged for the Sector to deliberate on possible further changes to the proposed amendments of *NCWM Publication 14 Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures* as stated above in this item. The Sector was asked to consider additional changes to the proposal that were intended to expedite the evaluation of Master Weight Totalizers (MWT) installed as a retrofit or substitute instrument within an existing BCS system.

The primary focus of this teleconference was for the members to consider a change that would eliminate a required field permanence test as part of a type evaluation for a MWT being placed into service as a replacement device. These changes would not eliminate any type of testing performed under laboratory conditions but would remove the requirement for a field permanence test once the substitute instrument had been installed in a previously evaluated conveyor system.

The Sector agreed that a permanence test is needed for the proper evaluation of an entire belt-conveyor scale system when installed however, the suggested revision of this proposal is based on the notion that a permanence test is not warranted for a MWT that is installed as an upgrade or replacement instrument for an existing system.

Following the teleconference and follow-up email exchanges among the Sector members, the Sector was asked to respond via a ballot which would indicate whether or not this revision to the original proposal was supported.

The balloting was conducted through email where the results indicated that all active members of the Sector supported these latest recommended changes. The Sector agreed that in addition to the removal of a required permanence testing during a type evaluation for a MWT, several minor editorial changes were also approved. The Sector Chair agreed to forward the revised proposal to the NTEP Administrator for NTEP Committee consideration for Pub 14. The proposed addition is included in Attachment A..

B. Linearization Feature for BCS:

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Develop recommended test procedures for *NCWM Publication 14 Belt-Conveyor Scales* to evaluate the use of any linearity correction feature when used in a belt-conveyor scale system.

Background:

Manufacturers and service agents of belt-conveyor scales have voiced support for the use of electronic instruments equipped with a linearity correction feature (i.e. multiple point calibrations) to reduce span errors that deviate from a linear pattern. It has been reported by some sector members that this practice may be considered as non-compliant in some jurisdictions with established weights and measures requirements. Some members of the Sector have asked for clarification from the National Institute of Standards and Technology (NIST), Office of Weights and Measures (OWM) on the use of this type of feature and question whether it is (or should be) permitted under existing U.S. standards.

The U.S. National Work Group (USNWG) on BCS has deliberated on the use of a linearization feature for enhancing the performance of belt-conveyor scale systems and considered whether there is a need to develop additional requirements in *NIST Handbook 44* to address its use. At the 2011 BCS Sector Meeting, some members agreed to participate in a sub-group to develop a draft of recommended test procedures that would be submitted to the NTEP Committee as proposed changes within *NCWM Publication 14*. This group was to also consider the scope for the application of any newly developed test procedures (i.e. whether the test procedures will be applied retroactively to devices that has already received NTEP approval).

Following the February 2012 NTEP Sector meeting the sub group met via teleconference. During this conference (conducted on June 7, 2012) the sub-group agreed that any testing of a linearity correction feature could be performed either in controlled laboratory conditions or in a field installation. The group agreed that if the function of this feature was verified under controlled conditions during type evaluation, it should then be clearly noted on the Certificate of Conformance (CC) for the device. The sub-group also concluded that verification of this feature during field testing, could be accomplished through material tests such as those typically performed during routine official examinations.

In addition, the sub-group agreed that this feature would need to be a sealable function within the instrument. Other points regarding this issue that were discussed at the sub-group's teleconference in June 2012 included:

- The correction factor (linearization factor) must be applied at a minimum of three points or flow rates.
- It is to be determined if there is to be a limitation on the amount of correction permitted. If there is to be a limit established, the sub-group suggests that a limit of +/- 0.4% of scale capacity may be appropriate.
- The group determined that lab testing should be performed at pre-specified percentages of device capacity to ensure the feature is capable of performing correctly throughout the operating range of the device.
- The group recommended that testing be performed using predetermined correction factors. For instance:
    - flow rates equal to 25%, 50%, 75% and 90% of full scale;
    - tests for loading of +/- 0.5%, +/-1%, +/-1.5% and +/-2% of full scale at each flow rate.

Discussion:

At the 2014 BCS Sector meeting, the members discussed the advantages and disadvantages of conducting a test both in the field and in the laboratory to verify the function of a linearity correction. Sector Chair, Mr. Bill

Ripka stated that to perform this test in the field would be simplified due to the fact that practically every installation of belt-conveyor scale systems will have a certain amount of non-linear performance. This is attributed to various unaccounted influences from the installation and operational details. The test of a linearization correction could therefore be conducted in the field simply by observing the operation of the system while this feature is disabled and then again when the correction has been enabled and comparing these results. If the system is evaluated under controlled conditions in a laboratory environment, a non-linear performance may have to be artificially induced through the use of error weights placed on or removed from the weighing elements while the system is operated.

Also discussed was a limit placed on the amount of correction that would be allowed by a linearization correction feature. It had been suggested by the sub-group that a limit of +/- 0.4% of scale capacity would be an appropriate value. Some members agreed in general with this limit, however others suggested that this restriction is arbitrary and that it may be overly prescriptive to place any limitation on the amount of correction allowed to the linearity.

While considering a preliminary draft for a test procedure, the sector could not agree on certain other points regarding all points of the procedure including what tolerance should be applied to the output of a system when linearization is being corrected through the use of this feature.

Conclusion:

The BCS Sector agreed that this item needs to be further developed. The original sub-group formed to develop this item agreed to continue work on this item and to produce a draft test procedure that would be circulated for review by the Sector. This draft is scheduled to be available by April 30, 2014 and will then be sent via email to the Sector members.

C. Conveyor Belt Profiling:

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Develop recommended test procedures for *NCWM Publication 14 Belt-Conveyor Scales* to evaluate the use of a belt profiling feature to provide a zero-load reference when used in a belt-conveyor scale system.

Background:

This method of establishing a zero-condition for a totalization operation enables the belt-conveyor scale to synchronize the application of an individual "tare" weight values associated with distinct segments of the belt to the movement of those belt segments over the scale portion of the conveyor. If this alternative to averaging the weight of segments of the belt carcass is used there is a potential need to establish a procedure to evaluate its effectiveness, to ensure that it functions as intended, and is maintained during operation of the BCS.

NISTOWM has received inquiries seeking guidance on whether this type of feature is permitted under U.S. standards. It is also being reported by some members of the USNWG BCS that some regulatory field officials will not issue an approval for devices equipped with this feature when it is not listed as a standard feature or an option on the NTEP Certificate of Conformance.

During the February 2011 meeting the sector members were asked to consider if there is there is a need for procedures to evaluate the effectiveness of belt profiling and to ensure that correct operation is maintained during totalization. A majority of sector members voiced their opinion that this feature should receive some

level of evaluation, and that at a minimum the ability to enable or disable any belt profiling feature should be protected by some form of security seal.

Members at the 2011 BCS Sector meeting also concluded that it may be preferable to have the analysis and necessary action(s) for the consideration of belt profiling features taken on by the same work group formed under the previous agenda item.

Discussion:

During the 2014 meeting, the BCS Sector was informed that the same sub-group which was assigned to develop procedures for verifying the operation of a linearization correction had also been assigned to develop a procedure for testing the function of belt profiling. No draft procedures have been developed at the time of the 2014 BCS Sector meeting.

Similar to the previous item (linearization correction), the sector members acknowledged that this feature could readily be tested in the field and would most likely be more costly to test in a laboratory setting. All of the sector members agreed that this feature must be one protected by a type of security seal.

Conclusion:

The sector agreed to ask the sub-group originally tasked with developing test procedures for the evaluation of this type of feature to continue work on this and to have a draft available by April 30, 2014. This draft will then be shared with sector members who hold (or have held) regulatory positions for their review and comment. The regulatory-background members will review and prepare their comments by August 1, 2014 at which time the sub-group responsible for developing the draft procedures base the need for further development on those and any other comments provided by Sector members. A final draft will be presented to the sector at its next meeting for review.

D. Field Test Procedures for Reference Scales

Source:

NIST/OWM

Proposal:

To amend test procedures outlined in *NCWM Publication 14 Belt-Conveyor Scales* with regard to minimum test weights required to certify hopper scales as a reference scale to be used in a materials test. And to align the values provided for minimum test weights with those values as stated in *NIST Handbook 44 Scales Code.*

Background:

Procedures listed in *NCWM Publication 14* for conducting evaluations of belt-conveyor scale systems using material tests, include the following statements:

13. Field Test Procedure

Test of the Reference Scale

Hopper Scales
Hopper scales must be tested to the used capacity using substitution tests. Test weights equal to a minimum of 10% of scale capacity are needed; more test weight is recommended. The scale must be accurate to 0.1% and adjusted if necessary.

During the 2012 BCS Sector meeting, it was noted that the minimum test weight amount of 10% of scale capacity as stated in *NCWM Publication 14* is in conflict with *NIST Handbook 44* Scales Code, Table 4 where it

is required that, for scales of greater than 3000 lb capacity the minimum test weight required is 12.5% of scale capacity. The sector was asked to consider whether these values should be reconciled. The sector originally agreed that the statement of 10% minimum test weight required in *NCWM Publication 14* should be amended to coincide with the minimum test weight required under Table 4 – *NIST Handbook 44* Scales Code (e.g., 12% of scale capacity).

Further deliberation on this item at the 2012 meeting addressed the fact that *NIST Handbook 44* contains no requirement to specify a minimum capacity for a reference scale used and that the only specific requirement related to the reference scale is that the scale used must produce weighments within 0.1% accuracy. Consequently, the members agreed to recommend that *NCWM Publication 14* be amended to delete the reference to a 10% minimum test weight and simply specify that no more than three substitutions can be used during the testing of a hopper scale used a reference scale, and that the hopper scale be tested according to *NIST Handbook 44* procedures. These recommended changes are shown below.

13. Field Test Procedure (page BCS-17)

Test of the Reference Scale

Hopper Scales

Hopper scales must be tested to the used capacity using **a maximum of three** substitution tests **according to NIST Handbook 44 procedures**. ~~**Test weights equal to a minimum of 10% of scale capacity are needed; more test weight is recommended.**~~ The scale must be accurate to 0.1% and adjusted if necessary.

After the 2012 NTEP BCS Sector Meeting, the NIST Technical Advisor received comments from the former technical advisor to the sector regarding concerns about this item and the conclusions of the sector. These comments were related to the proposed deletion of a stated minimum required test weight and expressed concern that this type of scale may be tested using test weight in amounts that are smaller than what has been established as minimum. Mr. Ripka, BCS Sector Chair and Mr. Truex, NTEP Administrator were consulted with regard to the concerns expressed, and a decision was reached that these concerns have merit and that since this item is not a critical issue currently preventing a manufacturer from completing an NTEP evaluation, it would be best to table this issue as a carry-over item to be further addressed at the next sector meeting.

Discussion:

At the 2014 meeting, the BCS Sector was asked to re-evaluate the conclusions made during the 2012 meeting and to consider concerns expressed over the proposal to eliminate any statement of required minimum test weights needed.

There was a general discussion regarding variations between the minimum test weight requirement in this particular section of *NCWM Publication 14* and the minimum test weight required on hopper-type scales of a capacity and division size that would be commonly used as a reference scale in a material test on BCS systems. Additional points made were that during an NTEP test of this type of weighing device, a minimum test weight of 25% of scale capacity is required.

Other comments made during the 2014 meeting pointed out the disparity of applying a minimum of 10% of scale capacity and the confidence in test results when the scale is used much closer to its nominal capacity, even when substitution testing is performed on this type of device.

Conclusion:

The BCS Sector agreed that a statement regarding the minimum amount of test weight required for a test on a hopper scale used as a reference scale to test BCS systems should be retained. It was also agreed that the minimum test weight required in this section of *NCWM Publication 14* should be aligned with the minimum test

weight requirements (12.5% of nominal scale capacity) as stated in *NIST Handbook 44* for this type of weighing device. The following revised draft will be forwarded to the NTEP Administrator as a recommendation from the Sector for a change in the appropriate location in *NCWM Publication 14*.

13. Field Test Procedure (page BCS-17)

Test of the Reference Scale

Hopper Scales

Hopper scales must be tested to the used capacity using **a maximum of three** substitution tests **according to NIST Handbook 44 procedures**. Test weights equal to a minimum of ~~**10%**~~ **12.5%** of **nominal** scale capacity are needed; more test weight is recommended. The scale must be accurate to 0.1% and adjusted if necessary.

II. New items

A. 2014 NIST Handbook 44 Changes

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Amend *NCWM Publication 14 Belt-Conveyor Scales* to correspond with changes that have occurred in the most recent edition of *NIST Handbook 44*.

Background:

The following items involve changes that were adopted through the NCWM and are now incorporated into the 2014 edition of *NIST Handbook 44*. The content of *NCWM Publication 14 for BCS* Checklists and Test Procedures for BCS Systems should reflect any relevant changes occurring in the current edition of *NIST Handbook 44*. The BCS Sector was asked to review and comment on the recommended changes to *NCWM Publication 14* that would align these publications. The proposed changes to *NCWM Publication 14* are shown in the following two items listed under II.A.1). and II.A.2). in this summary.

1) Appendix C – Units of Mass (ton)

Source:
Mr. Paul Lewis, Rice Lake Weighing Systems, Inc./NTEP Weighing Sector

Background:

Adopted changes to the 2014 edition of *NIST Handbook 44* include the results of efforts to standardize abbreviations used for the term “short ton.” These changes affected the Units of Mass Table appearing on pages C-19 and C-20 of Appendix C. This change resulted in the elimination of abbreviations for the term “short ton” other than “tn” when used on equipment manufactured after the effective date of January 1, 2014. Equipment manufactured between January 1, 2008 and December 31, 2013 may use an abbreviation other than “tn.”

The amendment also included the addition of a footnote to the Table mentioned above intended to clarify that abbreviations for "net" or "short" ton other than "tn" are considered appropriate for use with older equipment as follows:

Units of Mass	
1 ton, metric (t)	2204.623 pounds 0.984 gross ton 1.102 net tons
1 ton, net or short (**tn**)[21]	2000 pounds (exactly) 0.893 gross ton 0.907 metric ton

[21]As of January 1, 2014, "tn" is the required abbreviation for short ton. Devices manufactured between January 1, 2008 and December 31, 2013 may use an abbreviation other than "tn" to specify short ton.

An additional change associated with this item was made in NIST Handbook 44 in the Avoirdupois Units of Mass heading on page C-6 of Appendix C as shown below.

Avoirdupois Units of Mass

[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)[6]
20 hundredweights	= 1 ton ~~(t)~~**(tn)**[x]
	= 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[7]

[6] When necessary to distinguish…
[7] When the terms "hundredweight" and……

[x]As of January 1, 2014, "tn" is the required abbreviation for short ton. Devices manufactured between January 1, 2008 and December 31, 2013 may use an abbreviation other than "tn" to specify short ton.

To align *NCWM Publication 14* for *Belt-Conveyor Scales* (BCS) with the changes above, it is recommended that sections 1.8 and 2.5 in the *NCWM Publication 14 for BCS* Checklists and Test Procedures be amended as follows.

1 Indicating and Recording Elements

…

.

1.8 The scale division shall be in increments of 1, 2, or 5 times 10k where k is an integer and shall not be greater than 0.125 % (1/800) of the minimum totalized load.
What is a scale division? ☐ Yes ☐ No ☐ N/A

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

2 Recording Element

.
.
.

2.5 Information required on the ticket ☐ Yes ☐ No ☐ N/A

MASTER START TOTAL	05 06 92
MASTER STOP TOTAL	15:30
QUANTITY	44113.5 ~~T~~**tn**
	44300.5 ~~T~~**tn**
	187.0 ~~T~~**tn**

While considering this item at their 2013 meeting, the NTEP Weighing Sector reviewed the list of acceptable abbreviations/symbols found in Appendix C of Publication 14 - Digital Electronic Scales (DES). The Weighing Sector proposed changes to this document and forwarded those proposed changes to the Belt-Conveyor Scale Sector for additional input recognizing that these proposed changes might impact BCS manufactures more significantly than manufacturers of other types of scales.

The Weighing Sector has recommended changes to the *NCWM Publication 14 for DES* Appendix C – Acceptable Abbreviations/Symbols as follows:

From NCWM Publication 14 for DES:
[Note: the following excerpt from NCWM Publication 14 has been edited to include only the portions relevant to this agenda item.]

In addition the Weighing Sector considered the appropriate use of the entire word “ton” under this item. It is now being recognized that the word “ton,” when used by itself should be used only in conjunction with the unit “short ton” and should not be intended, nor should it be permitted, to represent any other version of the ton unit (e.g. long ton, metric ton).

Appendix C
Acceptable Abbreviations/Symbols
This list does not standardize the abbreviations/symbols that must be used, rather, it identifies abbreviations/symbols that are routinely acceptable. This list is not limiting or all-inclusive; other abbreviations/symbols may be acceptable.
Additionally, the following lists of abbreviations and symbols should be used as a guide; style differences are acceptable (e.g. shapes of arrows,)

Device Application	**Term**	**Acceptable**	**NOT Acceptable**
General	value of scale division (displayed)	d	
	value of verification scale division	e	
	number of scale divisions	n	
	gross	gross, G, GR	
	Semi-automatic (push-button) tare	tare, T, TA	
	Keyboard, Programmable and Stored tare	tare, T, TA, PT	
	net	net, N, NT	
	pieces	pieces pc, pcs	
	count	count cnt or pc(s) *is encouraged or ct symbol for pieces ct is acceptable NIST Handbook 130*	C
	carat or carat troy – 200 mg	c *NIST Handbook 44 and NIST Guide for the Use of International System of Units (SI)*	ct *not permitted if used as the abbreviation for carat and count on a scale with an enable count feature*
	short ton	**ton or tn**	
*Exceptions to General Tables of *NIST Handbook 44*	carat or carat troy – 200 mg	ct *common jewelry industry abbreviation and is the only acceptable abbreviation in Canada*	ct *not permitted if used as the abbreviation for carat and count on a scale with an enable count feature*
	U.S. short ton	~~**ton,**~~ TN~~**, or tn**~~ - *for belt-conveyor scales the abbreviation "T" is acceptable*	
	U.S. long ton	LT	
	Grain	grain, GRN, grn, GN	
Belt-Conveyor Scales	U.S. short ton (different from "General" application)	T	

Discussion:

During the BCS Sector meeting in February 2014, the members acknowledged the changes that occurred in *NIST Handbook 44* and that the use of multiple abbreviations to identify the term "short ton" can lead to misunderstandings. It was also pointed out that the use of the upper case "T" as an abbreviation for this unit could be confused with the use of that abbreviation in connection with the term "tare" on certain indicating or recording elements. At the 2014 meeting, sector members also considered the changes to *NCWM Publication 14 (DES)* recommended by the Weighing Sector.

The BCS Sector had few additional comments on this item however, the importance for the alignment of *NCWM Publication 14* and *NIST Handbook 44* was recognized by the members.

Conclusion:

At the 2014 meeting, the BCS Sector members indicated their support for the proposal to amend sections 1.8 and 2.5 in the *NCWM Publication 14 for BCS* Checklists and Test Procedures as shown above. They also agreed with the Weighing Sector and supported the changes to Appendix C of *NCWM Publication 14 - Digital Electronic Scales (DES)* as noted above.

2) Deletion of required maximum/minimum conveyor lengths

Source: USNWG on Belt-Conveyor Scales

The 2014 edition of *NIST Handbook 44* BCS code has been amended by the deletion of paragraph UR.1.2.(h). This amendment eliminated the sub-paragraph that previously provided the allowable limits for maximum and minimum conveyor length in commercial BCS systems. To reflect this change, it is recommended that section 9.7.1 in *NCWM Publication 14 for BCS* be changed as shown below:

Code Reference: UR.2.2.1.

9.7. The design and installation of the conveyor leading to and from the belt-conveyor scale …

⋮

~~**9.7.1. The conveyor shall be no longer than 1000 ft (300 m) or shorter than 40 ft (12 m) from head to tail pulley. [Nonretroactive as of January 1, 1986]**~~ ☐ ~~**Yes**~~ ☐ ~~**No**~~ ☐ ~~**N/A**~~

Discussion/Conclusion:

During the 2014 meeting, the BCS Sector had no additional comments on this item. The members agreed to support the recommended changes to *NCWM Publication 14 for BCS* as shown above.

B. Proposals recommended by the NTEP Software Sector

Source:

NTEP Software Sector

Proposal:

Amend *NCWM Publication 14* to address perceived gaps in the identification, protection/security, and the maintenance of software used in electronic weighing systems.

Background:

The NTEP Software Sector has made three proposals regarding the regulation of software used in electronic weighing devices. These proposals have been circulated to the other NTEP Sectors for review and comment. The three proposals are listed individually below and were considered as separate items during the 2014 BCS Sector meeting.

[Technical Advisor's note: The discussions and conclusions regarding each of the three items are shown below under "Discussion" and "Conclusion" in the order that the items were presented to the Sector at its 2014 meeting]

1) Identification of Certified Software

This item originated as response to the question "How does the field inspector know that the software running in the device is the same software evaluated and approved by the lab?" It has been recognized that the international community has already addressed this issue (i.e., through WELMEC and OIML).

There was a discussion at the 2012 NTEP Software Sector Meeting, focusing on where the terminology regarding inextricably linking the software version or revision to the software itself belonged. The Software Sector recommended adding the following to *NCWM Publication 14* and forward to NTEP Weighing, Measuring, and Grain Analyzer Sectors for feedback:

Identification of Certified Software:

Note: Manufacturers may choose to separate metrologically significant software from non-metrologically significant software. Separation would allow the revision of the non-metrological portion without the need for further evaluation. In addition, non-metrologically significant software may be updated on devices without breaking a seal, if so designed. Separation of software requires that all software modules (programs, subroutines, objects, etc.) that perform metrologically significant functions or that contain metrologically significant data domains form the metrologically significant software part of a measuring instrument (device or sub-assembly). If the separation of the software is not possible or needed, then the software is metrologically significant as a whole. The conformity requirement applies to all parts and parts shall be marked according to Section G-S-X.X.

The manufacturer must describe and possibly demonstrate how the version or revision identifier is directly and inseparably linked to the metrologically significant software. Where the version revision identifier is comprised of more than one part, the manufacturer shall describe which portion represents the metrological significant software and which does not.

The BCS Sector is being asked to review and comment on a proposal developed by the NTEP Software Sector. This proposal recommends that marking requirements be established for software-based electronic equipment that will enable field verification of the appropriate version or revision for metrological software. This proposal would include changes to language in *NIST Handbook 44* so that U.S. standards would be more closely aligned with international requirements found in standards published by WELMEC (European Cooperation in Legal Metrology) and OIML (International Organization of Legal Metrology).

The Software Sector recognized a number of points during the development of this proposal including:

- It is the opinion of the Software Sector that a specific method of identification of software version or revision should not be defined but rather that the manufacturer should utilize a method and demonstrate the selected identification mechanism is suitable for the purpose.
- A category III or some comparable means of providing a seal for metrological software would provide an indication to the weights and measures inspector that any changes have been made to the software.

The Software Sector has requested that the other NTEP Sectors review this proposal and provide feedback.

2) Software Protection / Security

The Software Sector is proposing that the existing audit trail and physical seal provisions used in the U.S. to provide security of the software used in software-based devices needs to be enhanced. To accomplish this, the Software Sector has referenced the international WELMEC Document as shown below:

Protection against accidental or unintentional changes
Metrologically significant software and measurement data shall be protected against accidental or unintentional changes.

Specifying Notes:
Possible reasons for accidental changes and faults are: unpredictable physical influences, effects caused by user functions and residual defects of the software even though state of the art of development techniques have been applied.

This requirement includes consideration of:

a) Physical influences: Stored measurement data shall be protected against corruption or deletion when a fault occurs or, alternatively, the fault shall be detectable.

b) User functions: Confirmation shall be demanded before deleting or changing data.

c) Software defects: Appropriate measures shall be taken to protect data from unintentional changes that could occur through incorrect program design or programming errors, e.g. plausibility checks.

Required Documentation:
The documentation should show the measures that have been taken to protect the software and data against unintentional changes.

Example of an Acceptable Solution:

- The accidental modification of software and measurement data may be checked by calculating a checksum over the relevant parts, comparing it with the nominal value and stopping if anything has been modified.
- Measurement data are not deleted without prior authorization, e.g. a dialogue statement or window asking for confirmation of deletion.
- For fault detection see also Extension I.

The Software Sector is in the process of developing a checklist for inclusion in NCWM Publication 14. This checklist is based roughly on a checklist contained in the international standard for non-automatic weighing instruments, OIML R 76 – 2. The information requested by this checklist is currently voluntary, however, it is recommended that NTEP applicants comply with these requests or provide specific information as to why they may not be able to comply. Based on this information, the checklist may be amended to better fit with NTEP's need for information and the applicant's ability to comply.
The California, Maryland and Ohio laboratories agreed to use this check list (shown below) on one of the next devices they have in the lab and report back to the sector on what the problems may be. North Carolina's laboratory was also given a copy of the check list to try.

1. **Devices with ~~Embedded~~ Software ~~TYPE P (aka built for purpose)~~**

1.1. Declaration of the manufacturer that the software is used in a fixed hardware and software environment. **AND** ☐ Yes ☐ No ☐ N/A

1.2. Cannot be modified or uploaded by any means after securing/verification. ☐ Yes ☐ No ☐ N/A

Note: It is acceptable to break the "seal" and load new software, audit trail is also a sufficient seal.

1.3. The software documentation contains:

1.3.1. Description of all functions, designating those that are considered metrologically significant. ☐ Yes ☐ No ☐ N/A

1.3.2. Description of the securing means (evidence of an intervention). ☐ Yes ☐ No ☐ N/A

1.3.3. Software Identification**, including version / revision** ☐ Yes ☐ No ☐ N/A

1.3.4. Description how to check the actual software identification. ☐ Yes ☐ No ☐ N/A

1.4. The software identification is:

1.4.1. Clearly assigned to the metrologically significant software and functions. ☐ Yes ☐ No ☐ N/A

1.4.2. Description how to check the actual software identification. ☐ Yes ☐ No ☐ N/A

1.4.3. Provided by the device as documented. ☐ Yes ☐ No ☐ N/A

1.4.4. Directly linked to the software itself. ☐ Yes ☐ No ☐ N/A

2. **~~Personal Computers, Instruments with PC Components, and Other Instruments, Devices, Modules, and Elements with Programmable or~~ Loadable Metrologically Significant Software ~~TYPE U (aka not built for purpose)~~**

2.1. The metrologically significant software is:

2.1.1. Documented with all relevant (see below for list of documents) information. ☐ Yes ☐ No ☐ N/A

2.1.2. Protected against accidental or intentional changes. ☐ Yes ☐ No ☐ N/A

2.1.3. Evidence of intervention (such as, changes, uploads, circumvention) is available until the next verification / inspection (e.g., physical seal, Checksum, **Cyclical Redundancy Check (**CRC**)**, audit trail, etc. means of ☐ Yes ☐ No ☐ N/A

security).

3. **Software with ~~Closed Shell (~~no access to the operating system and/or programs possible for the user~~)~~**

3.1. Check whether there is a complete set of commands (e.g., function keys or commands via external interfaces) supplied and accompanied by short descriptions. ☐ Yes ☐ No ☐ N/A

3.2. Check whether the manufacturer has submitted a written declaration of the completeness of the set of commands. ☐ Yes ☐ No ☐ N/A

4. **Operating System and / or Program(s) Accessible for the User**

4.1. Check whether a checksum or equivalent signature is generated over the machine code of the metrologically significant software (program module(s) subject to legal control Weights and Measures jurisdiction and type-specific parameters). ☐ Yes ☐ No ☐ N/A

4.2. Check whether the metrologically significant software will detect and act upon any unauthorized alteration of the metrologically significant software using simple software tools (e.g., text editor). ☐ Yes ☐ No ☐ N/A

5. **Software Interface(s)**

5.1. Verify the manufacturer has documented:

5.1.1. The program modules of the metrologically significant software are defined and separated. ☐ Yes ☐ No ☐ N/A

5.1.2. The protective software interface itself is part of the metrologically significant software. ☐ Yes ☐ No ☐ N/A

5.1.3. The functions of the metrologically significant software that can be accessed via the protective software interface. ☐ Yes ☐ No ☐ N/A

5.1.4. The parameters that may be exchanged via the protective software interface are defined. ☐ Yes ☐ No ☐ N/A

5.1.5. The description of the functions and parameters are conclusive and complete. ☐ Yes ☐ No ☐ N/A

5.1.6. There are software interface instructions for the third party (external) application programmer. ☐ Yes ☐ No ☐ N/A

The NTEP laboratories have used the above checklist on a limited basis and already have provided some feedback to the Software Sector. Work is ongoing on this item with the intent that it eventually will be incorporated as a checklist in NCWM Publication 14; again the laboratories are requested to try utilizing

this checklist for any evaluations on software-based electronic devices. The revised checklist will be distributed to the laboratories for additional review.
The other NTEP Sectors are being asked to review and provide additional feedback.

3) Software Maintenance and Reconfiguration

The Software Sector has requested that the other NTEP Sectors review the recommended changes to *NCWM Publication 14* with regard to the means used by device manufacturers to insure the integrity of the software in their devices.

The Software Sector asked the question: "What do the software-based device manufacturers use to secure their software?" The following items were reviewed by the sector and passed to the other sectors for review.

1. Verification that the update process is documented (OK)

2. For traced updates, installed Software is authenticated and checked for integrity

   Technical means shall be employed to guarantee the authenticity of the loaded software (i.e. that it originates from the owner of the type approval certificate). This can be accomplished (e.g. by cryptographic means like signing). The signature is checked during loading. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software **or become inoperative**.

   Technical means shall be employed to guarantee the integrity of the loaded software i.e. that it has not been inadmissibly changed before loading. This can be accomplished e.g. by adding a checksum or hash code of the loaded software and verifying it during the loading procedure. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software **or become inoperative**.

   Examples are not limiting or exclusive.

3. Verify that the sealing requirements are met

   The sector asked, "What sealing requirements are we talking about?"

   This item is **only** addressing the **software update**, it can be either verified or traced. It is possible that there are two different security means, one for protecting software updates (software log) and one for protecting the other metrological parameters (Category I II or III method of sealing). Some examples provided by the sector members include but are not limited to:

   - Physical Seal, software log
   - Category III method of sealing can contain both means of security

4. Verify that if the upgrade process fails, the device is inoperable or the original software is restored

   The question before the group is, Can this be made mandatory?

   The manufacturer shall ensure by appropriate technical means (e.g. an audit trail) that traced updates of metrologically significant software are adequately traceable within the instrument for

subsequent verification and surveillance or inspection. This requirement enables inspection authorities, which are responsible for the metrological surveillance of legally controlled instruments, to back-trace traced updates of metrologically significant software over an adequate period of time (that depends on national legislation). The statement in italics will need to be reworded to comply with US weights and measures requirements.

The sector **agreed** that the two definitions below for Verified update and Traced update were acceptable.

Verified Update
A verified update is the process of installing new software where the security is broken and the device must be re-verified. Checking for authenticity and integrity is the responsibility of the owner/user.

Traced Update
A traced update is the process of installing new software where the software is automatically checked for authenticity and integrity, and the update is recorded in a software update log or audit trail.

Note: It's possible that the Philosophy of Sealing section of NCWM Publication 14 may already address the above IF the definitions of Verified and Traced Updates (and the statement below) were to be added. The contrary argument was that it may be better to be explicit).

Use of a Category 3 audit trail is required for a Traced Update. A log entry representing a traced software update shall include the software identification of the newly installed version.

The sector recommended consolidating the definitions with the above statement thus:

Verified Update
A verified update is the process of installing new software where the security is broken and the device must be re-verified. Checking for authenticity and integrity is the responsibility of the owner/user.

Traced Update
A traced update is the process of installing new software where the software is automatically checked for authenticity and integrity, and the update is recorded in a ~~**software update log or**~~ Category 3 audit trail. The audit trail entry shall include the software identification of the newly installed version.

In 2012, the Sector recommended that as a first step, the following be added to *NCWM Publication 14*:

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

Though the Software Sector is currently considering only that the single sentence (shown above) be incorporated into *NCWM Publication 14* there may be additional changes proposed in the future.

Discussion:

II,B.1. Identification of Certified Software:

During the 2014 meeting the BCS Sector was provided with background information and explanation of these three items by NTEP Administrator, Mr. Jim Truex. Each of the three items was considered by the

BCS Sector members separately and the discussion and conclusions from the BCS Sector members regarding each item are listed in the same sequence as they appear in the above background information.

The sector members were informed that language that had been drafted regarding the identification of certified software represented a recommendation to notify software developers/providers that it may be beneficial to separate software developed for use with commercial weighing and measuring devices into two components. One of the components would be associated with the general function of the equipment and the other component would consist of any software affecting metrological features of a device. This separation would facilitate the ability to provide a means for sealing (physical or electronic) the metrological significant functions while allowing the general-purpose functions and features to remain with unrestricted access. This separation of different parts of software may have more significance if and when software programs that are associated with legal metrology devices are type evaluated under NTEP.

Some sector members who are device manufacturers indicated that this approach may be of no consequence to their operation due to the fact that the software used in the devices they produce is developed for the sole purpose of operating their weighing equipment. Therefore, all portions of the software will have metrological effect and will need to be protected by means of a security seal. None of the sector members however, objected to including this language as a general statement to provide an indication of what is anticipated to be incorporated as regulation in the future.

II.B.2. Software Protection / Security:

At their 2014 meeting the BCS Sector members were informed by Mr. Truex that this proposal from the Software Sector provides a checklist to be used in type evaluation of software used in association with commercial weighing and measuring devices. This checklist has been derived from principles found in the WELMEC Document 2.3 and details in OIML R76 and is being proposed to be included in *NCWM Publication 14*.

Also at the 2014 meeting, the sector was informed that this checklist has been used on a trial basis by NTEP laboratories in the U.S. The trial implementation of the checklist in these NTEP laboratories has reportedly identified some problems as well as a certain amount of usefulness. Also noted was that some portions of the checklist were not clearly understood by the evaluators. The sector was also provided with a number of objections to this checklist that were identified by the Weighing Sector during their review of this proposal. These objections are as follows:

- ~~2~~ This proposal would seem to apply to all devices and is not applied in a non-retroactive fashion;
- ~~3~~ The distinction between software that has, and that which does not have metrological effects is not clear in the proposal – particularly regarding the need to break security seals when loading software;
- ~~4~~ All elements of this checklist are not supported by requirements currently found in *NIST Handbook 44;* and
- ~~5~~ Some terms used in the proposed checklist are not defined or clearly understood.

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II.B.3. Software maintenance and reconfiguration:

The Sector was in general agreement with the notion that software updates should be recorded as changes within an electronic sealing means (i.e., audit trail). The members however expressed concern over their lack of understanding for the meaning of the portion of this proposed language that states: "…including software that checks the authenticity and integrity of the updates." Some Sector members questioned whether software that has been installed in the system to only validate updates to metrologically significant software would actually be considered as a parameter to be tracked in an audit trail. The Sector generally agreed that this wording is not clear in the proposal and suggested that this point be clarified.

Another point discussed by the Sector members was whether this proposal would apply to all devices retroactively. They agreed that this would be problematic if devices already in service would need to be reprogrammed to comply with this proposal.

Conclusions:

II.B.1 Identification of Certified Software:

The BCS Sector agreed to support the inclusion of the information as shown under "Identification of Certified Software" in to *NCWM Publication 14*. The members did however recommend that the last sentence of the first paragraph ("The conformity requirement applies to all parts and parts shall be marked according to Section G-S-X.X.") be omitted. This recommendation is in support of the recommendation made by the Weighing Sector in their review of this item.

II.B.2 Software Protection / Security:

The BCS Sector members agree with the conclusions of the Weighing Sector and do not support the proposed inclusion of the checklist within *NCWM Publication 14*.

II.B.3 Software Maintenance and Recognition:

The BCS Sector members had questions regarding this proposal and do not believe that it has been sufficiently developed. The meaning of the last portion of the proposed additional language "…including software that checks the authenticity and integrity of the updates, shall be considered a sealable event" is unclear. The BCS Sector agrees largely with the conclusions of the Weighing Sector and does not support the proposed inclusion of the checklist within *NCWM Publication 14* at this time.

C. Review of NCWM Publication 14 List of Sealable Parameters for BCS Systems

Source:

USNWG on Belt-Conveyor Scales.

Proposal:

To review and further develop (if necessary) a list of features associated with a belt-conveyor scale system (and weigh-belt systems) that will categorize those features as either sealable or non-sealable.

Background:

The list shown below was developed during the 2009-2010 NTETC BCS Sector meetings. The table was then incorporated in the 2011 edition of Publication 14. NTEP laboratories were asked to report back to the sector with comments and recommended amendments for improvement. Since there has not been any responses received by the sector at this point, it is not known if any manufacturers' devices have been submitted for NTEP approval to apply this list to during any evaluations.

Belt-Conveyor Scale Features and Parameters	
Typical Features to be Sealed	**Typical Features and Parameters Not Required to be Sealed**
Official verification zero reference	Display update rate
Official verification span/calibration reference	Baud rate for electronic data transfer
Linearity correction values	Communications (Configuration of input, output signal to peripheral devices)
Allowable range of zero (if adjustable)	
Selection of measurement units	
Division value, d	
Range of over capacity indications (if it can be set to extend beyond regulatory limits)	
Alarm limits for flow rate (high/low)	
Automatic zero-setting mechanism (on/off)	
Automatic zero-setting mechanism (range of a single step)	
Configuration (speed, capacity, calibrated test weight value if applicable, pulses per belt revolution, load cell configuration,)	
NOTE: *The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive, and there may be parameters other than those listed which affect the metrological performance of the device and must, therefore, be sealed. If listed parameters or other parameters which may affect the metrological function of the device are not sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device (i.e., all settings comply with the most stringent requirements of Handbook 44 for the applications for which the device is to be used).*	

Discussion:

In view of the proposals submitted by the NTEP Software Sector that are included in this agenda, it was recommended by Mr. Ripka, (Chair) that the sector members review this table for completeness.

During the 2014 BCS Sector meeting, it was recommended that belt-profiling should be added as a sealable parameter in the table. No objections were heard regarding this suggested amendment.

There were a variety of other features discussed that in certain circumstances could be considered as sealable features in a BCS system. Mr. Peter Sirrico suggested that communications should not be located under the non-sealable parameters as it currently appears in the table but should rather be listed as a sealable parameter due to the ability in some devices to input changes to metrological features of the device through the communications portal. Additionally, it was suggested that baud-rate should also be relocated from the non-sealable parameters column to the sealable parameters column. Most members conceded that if the communications portal offered a means of input to change metrological features, then the

communications (i.e., configuration of connection to metrologically significant peripheral devices) should appear in the sealable column. Not all members were in support of the similar change suggested regarding the baud rate.

There was additional discussion regarding the effects that the various features or functions in this table have on metrological aspects of a BCS system which led the Sector members to conclude that an argument could be made to place practically all features/functions under the sealable parameters column in the table.

Conclusion:

There was no consensus among sector members to finalize any revision to the existing table in *NCWM Publication 14* and it was agreed that the table should undergo a trial usage by NTEP evaluators when possible and that any necessary changes would be addressed by the BCS Sector afterwards. The discussion for the amendment of this table will be placed on the agenda of the next sector meeting.

III. Attendance:

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Attachment A – BCS Pub 14 Checklist for Master Weight Totalizers (MWT)

Recommended change / addition to NCWM Publication 14 Belt Conveyor Scales

July 10, 2008

Revised 6-16-2014

For Providing MWT testing as a stand-alone device

*Technical Advisor's note: This draft was originally developed largely upon existing NCWM Publication 14 content. This document is intended as an appendix to the existing Pub 14 for the evaluation of master weight totalizers (MWT) to be used as replacement instruments for retrofit in existing belt-conveyor scale systems. This revision of the original (July 2008) document contains those changes considered by NTEP Belt-Conveyor Scale Sector members via e-mail correspondence and teleconference in June 2014. The new changes that are now recommended by the Sector are shown below in **bold type**. Deleted language is shown in **~~strikethrough font~~** and newly added language is **underlined**.*

Appendix C

Evaluation of stand-alone master weight totalizers

(A MWT submitted for approval as a stand-alone device can only be accepted as an addition to an existing CoC for a complete Belt Conveyor Scale System.)

A. Models to be Submitted for Evaluation

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A type is a model or models of the same design, as defined in the NTEP Policy and Procedures. A complete list and description of all models of a type to be included in the Certificate of Conformance (CC) shall be submitted with the request for type evaluation. All options and features to be included on the CC must be submitted for evaluation. If the CC is to include ore than one model of the same type, the submitter shall contact the evaluation agency to determine which model or models will be evaluated. A CC will be amended when new models of the same type meeting the specified criteria, are applied for by the manufacturer.

The models to be submitted for evaluation shall be those having:

a. Laboratory Test – A master weight totalizer (MWT) or integrator that, at a minimum meets the requirements of the original evaluation, with defined enhancements and additional options indicated. The submitter shall also provide all necessary devices or instruments to represent the load receiving and speed sensing elements.

b. Field Test – The field test shall be performed with a previously "approved for commercial use" weighbridge model by the same manufacturer.

B. Certificate of Conformance Parameters

A Certificate of Conformance (CC) will apply to all models that have:

- Equivalent hardware and software
- Subsets of standard options and features of the equipment evaluated.

Metrological features not recognized by Handbook 44, but capable of being used as the basis for commercial transactions, shall be capable of being disabled and sealed before the device can receive an NTEP Certificate of Conformance.

C. Replacement Parts

The policy for addressing the conformance of replacement parts with the parts being replaced is:

1. If a Master Weight Totalizer (MWT) has received an NTEP evaluation and an NTEP Certificate of Conformance, it must be repaired with parts that are consistent with the design or metrologically equivalent parts.

D. Substitution of the Master Weight Totalizer

For a master weight totalizer (MWT) to be considered an appropriate substitute for the MWT tested during the original type evaluation of a belt-conveyor scale system, **each of** the following criteria must be satisfied:

1. The MWT must be tested in the laboratory using appropriate load and speed signal simulators capable of being adjusted within the tolerances indicated in the checklists and tables in this document;
2. All MWT laboratory tests must be performed on the replacement MWT, including temperature testing;
3. During the test, the device must be within the acceptance tolerance;
4. A field test will be performed meeting ~~**new initial installation**~~ **NIST Handbook 44, Belt-Conveyor Scales Systems Code sections N.2., N.3.1. and N.3.2,** testing criteria;

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~~5. A field permanence test will be performed, and~~

~~5~~6 A separate Certificate of Conformance (CC) will not be issued for the new MWT. Instead, the original CC will be amended to include the new MWT as an option; and

~~6~~7 Application limits such as capacity and speed ranges established during the original type evaluation will not be amended.

E. Checklist and Test Procedures

1. Indicating and Recording Elements

The integrator of a belt conveyor scale normally includes the master weight totalizer (MWT) and a rate of flow indicator and rate of flow alarms. The master weight totalizer must have adequate resolution to be able to establish a valid zero reference value and must have sufficient capacity to totalize loads over a reasonable period of time. The integrator may also have a resettable partial totalizer for indicating the mass of loads conveyed over a limited period of time and may have a supplementary totalizer with a scale interval greater than that of the master weight totalizer that will indicate the mass of loads conveyed over a fairly long period of operation. The partial totalizer is normally used for indicting the values for the zero test, simulated load tests, materials tests, and individual measurements of interest to the scale owner.

The master weight totalizer shall be equipped with provisions for applying a security seal that must be broken or another approved security means before any change that affects the metrological integrity of the device can be made to the master weight totalizer.

1.1 The scale must have a master weight totalizer yes ☐ No ☐ N/A ☐

1.2 The MWT shall not be resettable without breaking a security means. yes ☐ No ☐ N/A ☐

1.3 A power failure test must be conducted on digital electronic MWT's both in the laboratory and in the field permanence test. yes ☐ No ☐ N/A ☐

Test Procedure

1.3.1 Accumulate a measured quantity on the MWT and stop the flow of material. Note the reading. yes ☐ No ☐ N/A ☐

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1.3.2 Disconnect power to the MWT yes ☐ No ☐ N/A ☐

1.3.3 Connect Power to the MWT yes ☐ No ☐ N/A ☐

1.3.4 The quantity indication shall return to the previously displayed quantity within 1 division. yes ☐ No ☐ N/A ☐

Laboratory Test: The accumulated measured quantity for the MWT is retained in memory during a power failure of 24 hours and is displayed again when power is returned.

~~**Field Test: The accumulated quantity for the MWT is retained in memory during a power failure of 10 seconds up to 24 hours and is displayed again when power is returned.**~~

1.4 The capacity of the MWT shall be at least 10 hours times the maximum rated Flow rate indicated on the original CC. yes ☐ No ☐ N/A ☐

1.5 The value of the scale division shall be capable of being established for a value less than or equal to 0.1 percent of the minimum totalized load. yes ☐ No ☐ N/A ☐

1.6 The MWT shall indicate in one or more of the weight units indicated in table T.1 [check the applicable unit(s)]. yes ☐ No ☐ N/A ☐

1.7 The scale division shall be in increments of 1, 2, or 5 times 10k where k is an integer. yes ☐ No ☐ N/A ☐

Table T.1	
Unit	**Abbreviation**
______ pounds	Lb or LB

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U.S. short ton	Ton or ~~T~~tn
U.S. long ton	LT
Metric ton	~~T~~tn
kilograms	kg

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1.8 The indicated weight value must be expressed without the use of a multiplier. yes ☐ No ☐ N/A ☐

1.9 The MWT may have a no-flow lockout provided the lockout is limited to not more than 3 percent of the rated belt loading in terms of weight per unit length. The no-flow lockout must be deactivated during the zero test. yes ☐ No ☐ N/A ☐

1.9.1 During normal operation, the MWT shall advance only when the belt conveyor is in operation and under load. yes ☐ No ☐ N/A ☐

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1.9.2 If a no-flow lockout is provided, verify that it is limited to not more than 3% of the rated belt loading. yes ☐ No ☐ N/A ☐

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1.9.3 It must be possible to deactivate the no-flow lockout during the zero test. yes ☐ No ☐ N/A ☐

2. Recording Element

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2.1 The MWT shall incorporate or be capable of interfacing with a recording element. yes ☐ No ☐ N/A ☐

2.2 The value of the scale division for the recording element shall be the same as for the MWT. yes ☐ No ☐ N/A ☐

2.3 The recording element shall record the initial indication and the final indication of the MWT, the quantity delivered, the unit of measurement, (i.e., kilograms, tones, pounds, tons, etc.), the date and time. (see Table T.2) This information shall be recorded for each delivery. The indicated and recorded weight values must agree to the nearest scale division. yes ☐ No ☐ N/A ☐

2.4 All weight values shall be recorded as digital values. yes ☐ No ☐ N/A ☐

Information required on the ticket: yes ☐ No ☐ N/A ☐

Table T.2

Date	05 06 2008
Time	15:30
Master Start Total	44113.5 ~~Ton~~
Master Stop Total	44300.5 ~~Ton~~
Quantity	187.0 ~~Ton~~

2.5 If a reset to zero mechanism is incorporated, there must be an interlock to Prevent the zeroing of the device between the printing of the initial and final values of the totalized weight. yes ☐ No ☐ N/A ☐

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2.6 The printing of weight values shall be inhibited when the flow rate is greater than either:

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2.6.1 3 percent of the maximum flow rate, or yes ☐ No ☐ N/A ☐

2.6.2 The flow rate at which the MWT is engaged unless the weight value is identified as a subtotal, in process weight, or the equivalent. yes ☐ No ☐ N/A ☐

2.7 The recorded weight value must be expressed without the use of a multiplier. yes ☐ No ☐ N/A ☐

2.8 The printer must automatically sequence through a print cycle so that each printed document includes two weight values to represent the initial and final values. yes ☐ No ☐ N/A ☐

3. Rate of Flow Indicator and Recorder

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A rate of flow indicator and recorder are required. The MWT shall incorporate or be capable of interfacing with a rate of flow indicator and recorder. They may express the rate in weight units per hour or as a percent of capacity. The indicator and recorder may be either analog or digital.

3.1 The system must have both a rate of flow indicator and rate of flow recorder. yes ☐ No ☐ N/A ☐

The rate of flow recorder is:

_____ analog

_____ digital

3.2 If a digital flow rate recorder is provided, the readings must be taken at time intervals not exceeding 10 seconds. yes ☐ No ☐ N/A ☐

3.3 The rate of flow indicator must indicate from zero to at least 100% of capacity. yes ☐ No ☐ N/A ☐

3.4 The rate of flow recorder shall record from zero to at least 100% of capacity. yes ☐ No ☐ N/A ☐

4. Rate of Flow Alarms

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The system shall be equipped with a permanent means to provide an audio or visual alarm (signal) when the rate of flow is equal to or less than 20 percent and equal to or greater than 100 percent of the rated capacity of the scale. The alarm shall be located such that it will be noticed by the operator during normal operation.

The rate of flow alarm is:

_____ both audio and visual _____ audio _____ visual

4.1 The alarm (signal) is located so it will be noticed during normal scale operation. yes ☐ No ☐ N/A ☐

4.2 Record the values at which the alarm is triggered:

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Low alarm: _____

High alarm _____

4.2.1 Is the alarm triggered when the rate of flow is equal to or less than 20 percent and equal to or greater than 100 percent of the rated capacity of the scale? yes ☐ No ☐ N/A ☐

4.3 Access to the parameters for setting the alarm limits shall be through a security means. yes ☐ No ☐ N/A ☐

5. Zero-Setting Mechanism

The zero-setting mechanism may be either a manual or automatic mechanism. If the zero-load reference is recorded at the beginning and end of a delivery, the range of the zero-setting mechanism shall not be greater than ± 5% of the rated capacity of the scale. Where the zero-load reference is not recorded at the beginning and end of a delivery, the range of the zero-setting mechanism shall be limited to ± 2% of the rated capacity of the scale. If a greater adjustment is needed, the access to the adjustment must be through some security means. An audio or visual signal shall be given when the automatic and semi-automatic zero-setting mechanisms reach the limit of adjustment. The zero-setting mechanism must be constructed such that the zero-setting operation is done only after a whole number of belt revolutions (a minimum of three minutes). The completion of the zero-setting operation must be indicated. The low-flow lockout must be deactivated for this test.

5.1 To verify the ± 5% range of the zero setting mechanism and the zero load reference recording capability:

5.1.1 Verify that the zero-setting range is limited to ±5 percent. yes ☐ No ☐ N/A ☐

5.1.2 Adjust the load simulating device to represent 8% of the scale capacity. yes ☐ No ☐ N/A ☐

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5.1.3 Zero the scale. yes ☐ No ☐ N/A ☐

5.1.4 Adjust the load simulating device representative of a 1% of scale capacity decrease; the automatic-zero-setting mechanism shall reset the zero of the scale and the recording element shall indicate the change in zero.. Adjust for another 1% of scale capacity decrease. Again, the MWT shall reset the zero and the recording element shall indicate the change. Continue to decrease the load simulating device in 1percent increments until the automatic-zero-setting mechanism no longer resets the zero. Record the total amount of adjustment. Return the load simulating device to the value initial zero value. Increase the load simulating device in 1 percent increments, verifying zero corrections and recordings until the MWT will no longer automatically reset the zero. Record the value where automatic zero correction is restricted. The total range of the automatic-zero-setting mechanism shall not exceed 10 percent of the scale capacity. yes ☐ No ☐ N/A ☐

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5.1.5 The zero should move a maximum of ± 5 percent either in its Automatic-zero setting mode or as manually adjusted. yes ☐ No ☐ N/A ☐

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5.2 To verify the ± 2% range of the zero setting mechanism:

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5.2.1 Verify that the zero-setting range is limited to ±2 percent. yes ☐ No ☐ N/A ☐

5.2.2 Adjust the load simulating device to represent 5% of the scale capacity. yes ☐ No ☐ N/A ☐

5.2.3 Zero the scale. yes ☐ No ☐ N/A ☐

5.2.4 Adjust the load simulating device representative of a 1% of scale capacity decrease; the automatic-zero-setting mechanism shall reset the zero of the scale. Adjust for another 1% of scale capacity decrease. Again, the MWT shall reset the zero. Continue to decrease the load simulating device in 1percent increments until the automatic-zero-setting mechanism no longer resets the zero. Record the total amount of adjustment. Return the load simulating device to the value initial zero value. Increase the load simulating device in 1 percent increments, verifying zero corrections, until the MWT will no longer automatically reset the zero. Record the value where automatic zero correction is restricted. The total range of the automatic-zero-setting mechanism shall not exceed 4 percent of the scale capacity. yes ☐ No ☐ N/A ☐

5.2.5 The zero should move a maximum of ± 2 percent either in its Automatic-zero setting mode or as manually adjusted. yes ☐ No ☐ N/A ☐

5.3 The zero-setting operation shall be performed only after a whole number of belt revolutions and at least 3 minutes of operation. yes ☐ No ☐ N/A ☐

5.4 The completion of the automatic zero-setting operation must be indicated. yes ☐ No ☐ N/A ☐

5.5 The range of the zero-setting mechanism must be limited to ± 2 percent or ± 5% of the capacity of the scale without breaking a security means. yes ☐ No ☐ N/A ☐

5.6 An audio or visual signal shall be given when the automatic and semi-automatic Zero-setting mechanisms reach the limit of adjustment. yes ☐ No ☐ N/A ☐

5.7 A belt-conveyor scale shall be equipped with a zero-ready indicator that produces an audio or visual signal when the zero balance is within ± 0.12 % of the rated capacity of the scale during an unloaded belt condition. yes ☐ No ☐ N/A ☐

6. Sensitivity at Zero Load

The purpose of this requirement is to assure that the MWT has sufficient resolution and sensitivity to establish a good zero reference value. The manufacturer may specify an alternate test procedure to demonstrate the required sensitivity. The no-flow lockout must be deactivated for this test.

6.1 Adjust the load simulating device to represent the weight required to determine compliance based on the equation:

$$\frac{2 * W_C}{C_m}$$

Example: $\frac{2 * 500 \text{ lb}}{1000} = 1 \text{ lb}$

Where: C_m = counts in dynamic weighing scale divisions required for the minimum totalized load

W_C = weight required to reach the static scale capacity of the weighbridge.

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Static scale capacity = (maximum weight/foot)(length of weighbridge)

6.2 Operate the scale for a time equal to the time required to deliver the minimum totalized load.

6.2.1 Record the time period: _____ minutes.

6.3 The totalizer shall advance at least one but not more than three divisions. yes ☐ No ☐ N/A ☐

6.3.1 Record the quantity registered: _____ divisions.

6.4 The MWT has the sensitivity specified at zero. yes ☐ No ☐ N/A ☐

7. Marking Requirements

The marking of the MWT shall meet the requirements established during the initial CC evaluation.

8. Provisions for Metrological Sealing of Adjustable Components or Audit Trail

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

For additional information on the proper design and operatin of the different forms of audit trail, see the Appendis for Audit Trail

8.1 The device has the capability for a physical seal yes ☐ No ☐ N/A ☐

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8.2 The device meets the requirements for Audit Trail yes ☐ No ☐ N/A ☐

9. RFI/EMI Environment

The equipment shall be suitable for the environment in which it is intended to be used, including resistance to electromagnetic and radio-frequency interference generated by electromechanical equipment, portable hand-held radio transmitters and citizen's band transmitting equipment (if normally used at the site of installation).

9.1 The instrument meets standard NTEP RFI/EMI influence requirements. yes ☐ No ☐ N/A ☐

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10. Laboratory Test Procedures

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Technical Policy

The MWT is to be placed in the environmental chamber to determine performance with respect to influence factors. It is not necessary to re-rest a previously type approved weighbridges, speed sensors or ancillary devices. It is not necessary, nor recommended, that signal simulators for load and speed be located in the chamber. The simulated test loads to be used for the MWT evaluation shall be equal to the signal levels from the actual tests loads used during the initial type evaluation.

Initial Tests

1. Determine and record the load simulating device setting for zero and full scale ranges.

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2. Calibrate the MWT at 20 ºC.
3. Conduct the sensitivity test at zero load.
4. Verify that the range of the automatic zero setting mechanism(s) do not exceed ±2 percent and ±5 percent of capacity.
5. Test the alarms for flow rates below 20 percent and above 100 percent of rated capacity.

Once the laboratory test is started, after completion of the voltage tests, neither the zero nor the span are to be adjusted. The data should be normalized for the many tests.

The laboratory tests consist of a combination of simulated dynamic tests. These tests require adjusting a load simulating device and a speed simulating device to pre-calculated values and conducting a simulation of belt travel distances, integrating the weight on the MWT.

Soak Requirements

The laboratory test is to be run at 20 ºC, the upper temperature limit and the lower temperature limit. The surface temperature of the MWT is to be measured. In consultation with the manufacturer, place the temperature sensor on the portion of the MWT that is expected to be the last part to reach thermal equilibrium. After the surface temperature has reached the test temperature, allow the equipment to soak for at least an additional two hours, but not more than six hours, before starting the test. For convenience of the test, however, an overnight period may be used for the soak period before running the next temperature test.

1. Stabilize the temperature at 20 ºC.
2. Enable the speed simulating device for a constant signal level.
3. Deactivate the automatic zero setting mechanism and no-flow lock-out.
4. Zero the MWT.

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The MWT shall have sufficient resolution (that is a sufficiently small dynamic scale division) to permit this test to be completed in the greater of 20 minutes, or for a time equivalent to the test time required for the test run at 35 percent of the minimum static capacity.

The beginning and ending MWT indications shall not change more than ± 1 scale division.

Voltage Tests

Verify the line power source, AC or DC, is set to the manufacturers recommended nominal value (i.e.: 120 VAC or 24 VDC)

1. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
2. Reduce the line power supply to 85% of nominal (i.e.: 100 VAC or 20.4 VDC).
3. Run a zero test.
4. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
5. Increase the line power supply to 110% of nominal (i.e.: 130 VAC or 26.4 VDC).
6. Run a zero test.
7. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.
8. Return the line power supply to the nominal value.

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Temperature Tests

1. Run a zero test
2. Do not reset zero or adjust the span at any time after the start of this test.
3. Adjust the load simulating device to achieve the desired load representations.
4. Test the MWT simulating dynamic operation of the belt conveyor scale system at the following "flow rates" (all percent values represent percent loads of static scale capacity (SSC)):

   0 (zero test), 35 percent (SSC_{min}), 35 percent, 70 percent, 98 percent,

   Leave the MWT under simulated load for 1 hour, then:

   98 percent, 70 percent, 35 percent, 35 percent (SSC_{min}), and 0 (zero test)

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Table T.3

Percent of Static Scale Capacity	Nominal Time (Minutes)	Equivalent Belt Travel
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
35% of SSC_{max}	Time to deliver 800d	
70% of SSC_{max}	Time to deliver 800d	
98% of SSC_{max}	Time to deliver 800d	

Leave MWT under simulated load for 1 hour		
98% of SSC_{max}	Time to deliver 800d	
70% of SSC_{max}	Time to deliver 800d	
35% of SSC_{max}	Time to deliver 800d	
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater	_____

The tolerance to be applied for the laboratory test is set at 0.45 times the tolerance for the complete installation times 0.3 (30%). The formula is shown in Table T.4 to illustrate the process. The reference value for a particular accuracy test is the simulated load times the simulated belt travel distance. The values to be used for the laboratory test are shown in the following example:

98% load – Zero load test = difference

Proportion the effect of the zero-load test to the time of the tests for each simulated load. The values for the differences represent the simulated material measured by the MWT and is compared to the reference value for accuracy.

1. Change the temperature to -10 ºC (14 ºF) at a rate no faster than 1º C/min following the "soak requirements".
2. Repeat the simulated dynamic tests.
3. Change the temperature to 40 ºC (104 ºF) at a rate no faster than 1º C/min following the "soak requirements".
4. Repeat the simulated dynamic tests.
5. Change the temperature to 20 ºC (68 ºF) at a rate no faster than 1º C/min following the "soak requirements".
6. Repeat the simulated dynamic tests.

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Data Analysis

1. The data are evaluated on the Simulated Dynamic MWT Test Work Sheet, Item 14 and 15, for pass or fail.

11. Field Test

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A field test is required prior to final type approval. The field test ~~can~~ **must** be performed as a retrofit on a previously approved for commercial use belt-conveyor scale system or in a new application. The Field Test Procedures as defined in ~~paragraph 13 of the initial belt conveyor scale Type Evaluation section of Publication 14 and~~ **Sections N.2, N.3.1., and N.3.2. of** Handbook 44 are to be followed. The results of all tests must be within acceptance tolerances.

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12. Permanence Test

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Since this policy is intended for use only during the evaluation of master weight totalizers and not for the material handling system in which they will be installed, there is no field permanence test required. Permanence testing on the MWT instrument will take place during laboratory evaluations listed under Section E in this document.

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~~**A permanence test is conducted to determine the accuracy of the device in use over a period of time. The permanence test shall be conducted after a minimum of 20 days after successful completion of the initial performance test, and after a minimum volume of material has been transported across the belt conveyor scale. This minimum volume of material shall be no less than the maximum scale capacity times 8 hours times 20 days. (i.e.: A system with a maximum scale capacity of 1000 TPH requires a minimum volume of 160,000 tons [1000 * 8 * 20] to have been transported prior to the permanence test.). The results of all tests must be within acceptance tolerances.**~~

~~**The permanence test shall include:**~~

- ~~**Initial stable zero tests**~~
- ~~**at least two test loads at normal use capacity**~~
- ~~**simulated load tests**~~
- ~~**verification of audit trail recorded events**~~

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13. Data Sheet and Lab Test Procedure

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Temperature Testing: Belt-Conveyor Scale Code paragraphs T.3.1., T.3.1.1., T.3.1.2. The accuracy of the MWT is to be adjusted at 70% of the static scale capacity (SSC). A weight display of 0.01 percent (1 part in 10,000) is required for the laboratory tests. The allowable error is adjusted to 30 percent of the allowable error for the entire system type approval. If tests are run for a time greater than that needed for the minimum test load (MTL), substitute the totalized load (TL) for the MTL in the tolerance calculation in Test Conditions, step 3 (Table T.4)

Table T.4

Device Parameters	Abbrev.	Maximum	Minimum	Dim
1. Load per unit length from existing Certificate of Conformance; corresponds to the largest capacity and the lowest capacity rating	BL			lb/ft
2. Length of the weighbridge (inches) from existing Certificate of Conformance				In
3. Belt Speed from existing Certificate of Conformance	SP			ft/min
4. Determine scale capacity in units per hour SC=SP*BL*60/2000 (must correspond to existing Certificate of Conformance)	SC			ton/hr
5. Record the static scale capacity in units of weight SSC=(maximum weight per foot)(length of weighbridge)	SSC			lb
6. Allowable zero error for temperature change of 10 ºC (18 ºF) AZE= ~~(.003)~~**(0.3)**(0.0007)(SC_{min})(time)/60 where "time" is the time of the zero test in minutes	AZE			ton
7. Size of scale division required for zero	SD			ton

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8. Determine the minimum and maximum totalized loads	MTL			ton
Test Conditions		**Abbrev.**		
1. Determine the time n minutes to acquire MTL with the test load to be simulated in the laboratory	Test load, pound/foot			lb/ft
	Test load, total			lb
	Time (minutes) to deliver MTL (at least 10 minutes)	Time		min
2. Determine number of belt travel sensor revolutions required for the above time. Manufacturer to provide revolutions per foot or pulses per foot as appropriate to determine 3 belt revolutions and a delivery of 800d.		BTR		revolutions
3. Allowable weighing error (units of weight) for simulated dynamic tests which will be divisions on master weight totalizer. AWE = ~~(0.003)~~**(0.30)**(0.45)(0.005)(TL)	AWE			ton

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Table T.5
Initial Tests
1. Set up the unit at 20 ºC (68 ºF), zero the MWT and adjust the span following the manufacturer's procedure.
2. Conduct the sensitivity test at zero load.
3. Verify that the range of the automatic zero setting mechanism(s) do not exceed ±2% and ±5% of capacity.
4. Test the alarms for flow rates below 20% and over 100% of scale capacity.

Table T.6

Laboratory Tests
1. Stabilize the temperature at 20 ºC
2. Enable the speed simulator to represent 100% speed
3. Deactivate the automatic zero setting mechanism and zero the MWT
4. Run a zero test
Voltage tests
5. Run an accuracy test at 98% of scale capacity for the time to deliver 800d
6. Reduce the live voltage to 85% of nominal
7. Run a zero test
8. Run an accuracy test at 98% of scale capacity for the time to deliver 800d
9. Increase the line voltage to 110% of nominal
10. Run a zero test
11. Run an accuracy test at 98% of scale capacity for the time to deliver 800d
12. Return the live supply to nominal
Temperature Tests
13. Run a zero test. Do not reset zero or adjust the span at any time after the start of this test.
14. Adjust the load simulating device to represent normal loading of the scale (70% of scale capacity)
15. At 20 ºC, test the MWT dynamically with simulation of the load and speed. Test the MWT at the following "flow rates" (all percent values represent percent loads of static scale capacity): 0 (zero test), 35 percent(SSC_{min}), 35 percent, 70 percent, 98 percent, leave the MWT at full load for 1 hour, 98 percent, 70 percent, 35 percent, 35 percent((SSC_{min}), and 0 (zero test)

Table T.7

Percent of Static Scale Capacity	Time (Minutes)	Totalaized Load TL (ton)	Tolerance AWE= ~~(0.003)~~(0.30)(0.45)(0.005)(TL)
0	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		
35% of SSC_{min}	20 minutes, or MTL_{min}/[(0.35)(BL_{min})(belt speed for test)], whichever is greater		
35% of SSC_{max}	Time to deliver 800d		
70% of SSC_{max}	Time to deliver 800d		
98% of SSC_{max}	Time to deliver 800d		

Leave MWT under simulated load for 1 hour			
98% of SSC_{max}	Time to deliver 800d		
70% of SSC_{max}	Time to deliver 800d		
35% of SSC_{max}	Time to deliver 800d		
35% of SSC_{min}	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater		
0	20 minutes, or $MTL_{min}/[(0.35)(BL_{min})$(belt speed for test)], whichever is greater		

Table T.8
Laboratory Tests *(continued)*
16. Change the temperature to -10 ºC (14 ºF) at a rate no faster than 1 ºC/min. Follow soak requirements.
17. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
18. Change the temperature to 40 ºC (104 ºF) at a rate no faster than 1 ºC/min. Follow soak requirements.
19. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
20. Change the temperature to 20 ºC (68 ºF) at a rate no faster than 1 ºC/min. Follow soak requirements
21. Repeat the simulated dynamic tests performed in step 15 (Table T.6)
Data Analysis
1. The data are evaluated on the following Simulated Dynamic MWT Test Work Sheets for pass or fail
2. Approval is for addition of MWT to existing Certificate of Conformance without changes to minimum and maximum ranges.

14. Dynamic MWT Test Work Sheet and Laboratory Test Procedure No. 1

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The calibration point is the 70 percent load for the initial room temperature (20 ºC) test. Because the weight indication when in the test mode may not be at zero and may not be adjusted to indicate n weight values (e.g., the quantity indication may be voltage output or "counts", the table provides for calculations to convert indications into weight units). The scale indication shall not be zeroed during the test process. Corrections for the change in zero tests are to be done by calculation.

Places to record information needed for the test and the formulae needed to compute table entries are given below.

Static Scale Capacity, SSC = (maximum weight per foot)(length of weighbridge) = _____ lb.

Test load for 70 percent SSC = _____ lb.

Weight/foot = (static scale load)/(length of weighbridge) = Static scale capacity)/(length of weighbridge)

Start and end readings are in divisions and must be converted to weight values.

Conversion factor for divisions to weight = (change in static weight indication from zero to 70% SSC load) / (70% SSC load in pounds)

Change in zero = (Total change of zero during zero test({(time of test for applied load)/(time of zero test)}

Indication corrected for change of zero = (Indicated change) – (Change of zero)

Scale indication in lb = (Indication corrected for change of zero) / (Conversion factor)

Actual weight = {(Applied load)/(length of weighbridge)}(speed)(time)

Note: Speed and time must use the same units of time (e.g., feet per minute and minutes)

Error = Scale indication – actual weight

Tolerance is from the Belt-Conveyor Scale Data Sheet and Laboratory Test Procedure, step 3.

15. Dynamic MWT Test Work Sheet and Laboratory Test Procedure No. 2

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Scale indication at zero load (static scale indication) = _____ divisions

(Not required if MWT can display static weight)

Scale indication at 70 percent SSC (static scale indication) = _____ divisions

(Not required if MWT can display static weight)

Conversion factor = (change in static weight indication from zero to 70% SSC load) / (70% AAC load in pounds) = divisions/lb

Temperature _____ ºC Type of Tests _____ Signature _____

Table T.9

Test Load (lb)	Applied load (lb)	Time of test in minutes	Reading in counts		Indicated Change = End – Start	Change in Zero	Indication corrected for change in zero	Scale Indication (lb)	Actual Weight	Error (lb)	Tolerance (lb)
			End	Start							
Zero test	0										
35% SSC_{min}											
35% SSC_{max}											
70% SSC_{max}											
98% SSC_{max}											
Leave scale under simulated load for 1 hour											
98% SSC_{max}											
70% SSC_{max}											
35% SSC_{max}											
35% SSC_{min}											
Zero test	0										

16. Zero Change with Respect to Temperature

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Table T.10

	Low Temperature		High Temperature		20 °C		Performance limit for temperature effect on zero test, AZE, per 10 °C
Previous Temperature T_P	20 °C						
Current Temperature T_C					20 °C		
Change in Temperature ($T_C - T_P$)							
	Divisions	lb	Divisions	lb	Divisions	lb	
Zero load indication at T_P							

	Zero load indication at T_C							
	Change in zero							
	Change in zero per 5 ºC (9 ºF)							

Date:_____

Indicator Model Number:_____ Indicator Serial Number:_____

_____

Signature Title

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National Type Evaluation Program (NTEP)
Belt-Conveyor Scale (BCS) Sector Meeting Agenda

February 26, 2015 / St. Louis, MO.

Introduction

The charge of the BCS 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 and 2.21. BCS Systems. The sector's recommendations are 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 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***.

Glossary of Acronyms and Terms

Acronym	Term	Acronym	Term
BCS	Belt-Conveyor Scale	NTEP	National Type Evaluation Program
MTL	Minimum Test Load	NTETC	National Type Evaluation Technical Committee
MWT	Master Weight Totalizer	OWM	Office of Weights and Measures
NCWM	National Conference on Weights and Measures	USNWG	U.S. National Work Group
NIST	National Institute of Standards and Technology		

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I. Carry-over Items

A. Revision of the Belt-Conveyor Scale NTEP Checklist

1). Evaluation Checklist for Retrofit Master Weight Totalizers

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Amend *NCWM Publication 14 Belt-Conveyor Scales* by incorporating recommended changes that primarily were intended to allow for the evaluation of master weight totalizers (MWT) as a component of a belt-conveyor scale system. This was intended to facilitate the certification of MWT's as replacement instruments and would not necessarily require testing on the entire belt-conveyor scale system.

Background:

Prior to the 2009 BCS Sector meeting, Mr. Bill Ripka, (Sector Chair) presented a draft of an amended *NCWM Publication 14* Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures to the sector members for review. The proposed changes in this draft related primarily to Master Weight Totalizers intended to be installed as replacement or retrofitted instruments within an existing BCS system in addition to a number of other minor editorial changes. Among the recommended changes that were included in this draft were changes involving procedures used when evaluating semi-automatic and automatic zero-setting mechanisms.

This proposed draft has been offered to be used on a trial basis by NTEP labs when evaluating manufacturer's replacement instruments (Master Weight Totalizers) that are scheduled to undergo NTEP evaluation.

At the 2014 BCS Sector meeting, it was reported that there has not been any devices submitted for type approval that could appropriately be evaluated using the proposed amended checklist.

Following the February 2014 Sector meeting, the NTEP Belt-Conveyor Scale Sector members were contacted by the Sector Chair, Mr. Bill Ripka and were asked to participate in teleconference conducted to ask the Sector to deliberate on possible additional changes to the proposed amendments of *NCWM Publication 14 Belt-Conveyor Scales Technical Policy, Checklists, and Test Procedures.*

The primary focus of that teleconference was for the members to consider a change that would eliminate the requirement for a field permanence test as part of a type evaluation outlined in these proposed changes. Most Sector members agreed that a permanence test is necessary for the proper evaluation of an entire belt-conveyor scale system when installed however, this recommended further revision of this proposal is based upon the notion that a permanence test is not warranted for a MWT that is installed as an retrofit or replacement instrument for an existing system. The additional changes would not eliminate any type of testing performed under laboratory conditions however.

Following the teleconference and several follow-up email exchanges among the Sector members, the Sector was asked to respond to a ballot indicating whether or not this revision to the original proposal was supported. The balloting of the Sector members was conducted through email and the results indicated that all active members of the Sector supported the elimination of a permanence test for replacement instruments. The Sector agreed that in addition to the removal of a required permanence testing during a type evaluation for a MWT, several minor editorial changes were also approved. The Sector Chair agreed to forward the revised proposal to the NTEP Administrator.

Discussion:

Some participants of the 2015 meeting of the BCS Sector asked for clarification whether a MWT submitted for NTEP evaluation under the conditions of this proposal would be required to be installed in a conveyor system as needed for the performance of a material test as part of that type evaluation. The members of the Sector present at the meeting agreed that the NTEP evaluation procedure for a MWT as a stand-alone instrument would not include any material test performed in the field. It was recognized however that a MWT covered under a Certificate of Conformance issued using the procedure prescribed in this proposal would need to be certified as a commercial device in the field when that particular instrument was installed as part of a BCS system. This field certification by statutory authorities would then include all elements of an examination prescribed for an initial test.

Conclusion:

The participants of the 2015 BCS Sector meeting agreed to continue to support the proposed changes to *NCWM Publication 14* that would allow the type evaluation of a MWT intended for use as a replacement or retrofit component in an existing BCS system. Mr. Darrell Flocken informed the group that the Evaluation Checklist has been included in the 2015 edition of *NCWM Publication 14*.

2). Review of NCWM Publication 14 List of Sealable Parameters for BCS Systems

Source:

USNWG on Belt-Conveyor Scales.

Proposal:

To review and further develop (if necessary) a list of features associated with a belt-conveyor scale system (and weigh-belt systems) that will categorize those features as either sealable or non-sealable.

Background:

The table shown below was developed during the 2009-2010 NTETC BCS Sector meetings. The table was then incorporated in the 2011 edition of Publication 14. At that time NTEP laboratories were asked to report back to the sector with comments and recommended amendments for improvement. This item was included on the Sector's meeting agenda in 2014 and the members were informed that there had been no opportunities to use the table as part of an evaluation.

In addition during the 2014 meeting, it was recommended that the function of enabling a belt-profiling function for establishing a zero condition of a BCS system should be added as a sealable parameter in the table. Other features were considered for inclusion on this listing during that meeting however, there was no consensus among the Sector members to make further revisions.

It has been reported to NIST OWM that devices have recently been or possibly will be submitted in the near future for type evaluation which could offer an opportunity to test the usefulness of the following table.

Belt-Conveyor Scale Features and Parameters	
Typical Features to be Sealed	**Typical Features and Parameters Not Required to be Sealed**
Official verification zero reference Official verification span/calibration reference Linearity correction values Allowable range of zero (if adjustable) Selection of measurement units Division value, d Range of over capacity indications (if it can be set to extend beyond regulatory limits) Alarm limits for flow rate (high/low) Automatic zero-setting mechanism (on/off) Automatic zero-setting mechanism (range of a single step) Configuration (speed, capacity, calibrated test weight value if applicable, pulses per belt revolution, load cell configuration,)	Display update rate Baud rate for electronic data transfer Communications (Configuration of input, output signal to peripheral devices)
NOTE: *The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive, and there may be parameters other than those listed which affect the metrological performance of the device and must, therefore, be sealed. If listed parameters or other parameters which may affect the metrological function of the device are not sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device (i.e., all settings comply with the most stringent requirements of Handbook 44 for the applications for which the device is to be used).*	

Discussion:

At the 2015 BCS Sector meeting, this item was reviewed by the group to consider whether any additional features should be included or deleted from the above table. Participants of the meeting considered the possibility of additional features to be sealed including the function of a chart recorder. The Sector members recognized that the documentation provided by the chart recorder in a system is an important part of an official inspection and that those records should represent the actual performance of that system. Mr. Chuck Andrews added that since the chart recorder on a system is required by HB44, there is some justification for requiring the functioning of that component to be sealed.

Other members of the Sector at the meeting questioned how the chart recorder could be sealed and stated that it is not the peripheral devices in the system that need to be sealed but instead it is only the MWT and its functions that should be sealed.

The group considered communications between the MWT and other elements in the system as sealable parameters although, to some in the Sector "communications" is a general term and its meaning in this context is vague. Mr. Flocken agreed that the term "communications" is vague and suggested that devices not having "intelligence" and that would not impact the metrological features and functions of the system would not have to be sealed.

Mr. Flocken also stated that the table lists *typical* features and that it is up to the evaluator to do a thorough examination. If anything about that system turns out to be a security risk, then sealing of the affected parameters must become an issue regarding the device's certification.

Conclusion:

The Sector agreed to propose one additional modification of the table that would aid in clarifying the statement regarding communications in the table. The participants of the 2015 meeting agreed to the addition of the wording "…with no metrological influence" at the end of the statement pertaining to communications in the right-hand column containing non-sealable features as shown in the following table. No further changes to the list were recommended at this time.

Belt-Conveyor Scale Features and Parameters

Typical Features to be Sealed	Typical Features and Parameters Not Required to be Sealed
Official verification zero reference	Display update rate
Official verification span/calibration reference	Baud rate for electronic data transfer
Linearity correction values	Communications (Configuration of input, output signal to peripheral devices~~)~~ **with no metrological influence)**
Allowable range of zero (if adjustable)	
Selection of measurement units	
Division value, d	
Range of over capacity indications (if it can be set to extend beyond regulatory limits)	
Alarm limits for flow rate (high/low)	
Automatic zero-setting mechanism (on/off)	
Automatic zero-setting mechanism (range of a single step)	
Configuration (speed, capacity, calibrated test weight value if applicable, pulses per belt revolution, load cell configuration,)	

NOTE: *The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive, and there may be parameters other than those listed which affect the metrological performance of the device and must, therefore, be sealed. If listed parameters or other parameters which may affect the metrological function of the device are not sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device (i.e., all settings comply with the most stringent requirements of Handbook 44 for the applications for which the device is to be used).*

B. Linearization Feature for BCS:

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Develop recommended test procedures for *NCWM Publication 14 Belt-Conveyor Scales* to evaluate the use of any linearity correction feature when used in a belt-conveyor scale system.

Background:

Many manufacturers and service agents of belt-conveyor scales have supported the use of electronic instruments equipped with a linearity correction feature (i.e. multiple point calibrations) to reduce errors in device indications that deviate from a linear pattern. It has been reported by some Sector members that this practice may be considered as non-compliant by some weights and measures jurisdictions.

At the 2011 BCS Sector Meeting, some members agreed to participate in a sub-committee to develop a draft of recommended test procedures that would be submitted to the NTEP Committee as proposed changes within NCWM Publication 14.

This sub-committee conducted a teleconference (June 7, 2012) and agreed that the evaluation of a linearity correction feature could be performed either in controlled laboratory conditions or in a field installation. The sub-group also agreed that this feature would need to be a sealable function within the instrument. Some of the specific points regarding this issue considered by the sub-group in June 2012 included:

- The correction factor (linearization factor) must be applied at a minimum of three points or flow rates.
- It is to be determined if there is to be a limitation on the amount of correction permitted. If there is to be a limit established, the sub-group suggests that a limit of +/- 0.4% of scale capacity may be appropriate.
- The group determined that lab testing should be performed at pre-specified percentages of device capacity to ensure the feature is capable of performing correctly throughout the operating range of the device.
- The group recommended that testing be performed using predetermined correction factors. For instance:
    - flow rates equal to 25%, 50%, 75% and 90% of full scale;
    - tests for loading of +/- 0.5%, +/-1%, +/-1.5% and +/-2% of full scale at each flow rate.

At the 2014 BCS Sector meeting, the members discussed specifics about this issue including what value could be established as an appropriate limit for the amount of correction that would be allowed by a linearization correction feature. It had been suggested by the sub-committee that a limit of +/- 0.4% of scale capacity would be an appropriate value. Some members agreed in general with this limit, however others suggested that this restriction is arbitrary and that it may be overly prescriptive to place any limitation on the amount of correction allowed to the linearity.

While considering what should be included as elements included in a test procedure, the sector could not agree on certain points including what tolerance should be applied to the output of a system when linearization is being corrected through the use of this feature.

It was agreed at the 2014 meeting that this item needs to be further developed. The original sub-group formed to develop this item agreed to continue work on this item and to produce a draft test procedure that would be circulated for review by the Sector.

Discussion:

At the 2015 NTEP BCS Sector meeting, the participants were informed that no draft for a test procedure has been developed at this time. The group was reminded that the Sector had generally agreed that it was possible to perform an evaluation of a linearity correction feature either in a laboratory setting or in the field, once the MWT had been installed in a system. The Sector members were asked if there was any need for further test procedures to be developed recognizing that this feature could be evaluated simply by performing a required multiple flow rate material test.

Many of the participants of the 2015 meeting agreed that the use of a software-based feature such as linearity correction will mask defects or performance problems exhibited by the BCS system it is used on and that they would prefer that the cause of the substandard performance be corrected. Other members however, pointed out that linearity correction is commonly used on other types of devices such as vehicle scales.

Mr. Peter Sirrico stated that while this feature may be an asset, he would not support a linearity correction function with no limitation to the amount of correction performed.

There was additional discussion in general terms that included: how many points are used in the correction; and how much, if any influence correction at a certain point has on an adjacent correction point. It was also noted that the group had not established whether a linearity correction is applied to the output of a load cell or the totalization of material at different flow rates when considered in context of belt-conveyor scale systems. The Sector agreed that in that context, any correction in linearity would most likely be applied to the totalization of material at different flow rates. The participants of the 2015 meeting also agreed that it is the responsibility of the manufacturer of BCS to specify the conditions that must be met regarding the conveyor system that will promote satisfactory operation of the weighing device. Those specifications should be met by the owner/operator prior to the installation of the BCS.

Conclusion:

The Sector members agreed that there is no specific test procedure needed at this time for the evaluation of this type of feature and that an appropriately performed official test (including material testing at different flow rates), is needed to determine that this function is working properly. The members also agreed not to recommend any changes for the *NCWM Publication 14* unless there is a determination made that an alternative method to evaluate linearization in a lab for NTEP is needed.

Additional consideration may be given to this item in the future regarding specific test procedures needed, correction limitations, etc. if the Sector determines that it is needed in the future.

C. Conveyor Belt Profiling:

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Develop recommended test procedures for *NCWM Publication 14 Belt-Conveyor Scales* to evaluate the use of a belt profiling feature to provide a zero-load reference when used in a belt-conveyor scale system.

Background:

This means of establishing a zero-condition prior to a totalization operation involves the ability of the weighing device to establish "tare" weight values associated with distinct individual segments of the belt and synchronizing the application of those values to the movement of the belt segments over the scale portion of the conveyor. A number of Sector members have agreed that this feature should receive some level of evaluation, and that at a minimum, the ability to enable or disable any belt profiling feature should be protected by some form of security seal.

In addition, NIST OWM has received inquiries seeking guidance on whether this type of feature is permitted under U.S. standards. It is also being reported by some members of the USNWG BCS that some regulatory field officials will not issue an approval for devices equipped with this feature when it is not listed as a standard feature or an option on the NTEP Certificate of Conformance.

Members at the 2011 BCS Sector meeting also concluded that it may be preferable to have the analysis and necessary action(s) for the consideration of belt profiling features taken on by the same work group formed under the previous agenda item (item B. Linearization Feature for BCS).

During the 2014 meeting, the BCS Sector was informed that the same sub-group which was assigned to develop procedures for verifying the operation of a linearization correction had also been assigned to develop a procedure for testing the function of belt profiling. No draft procedures have been developed at the time of the 2014 BCS Sector meeting.

Similar to the previous item (linearization correction), the sector members acknowledged that this feature could readily be tested in the field and would most likely be more costly to test in a laboratory setting. All of the sector members agreed that this feature must be one protected by a type of security seal.

At the 2014 BCS Sector meeting, the sub-group asked to develop test procedures for the evaluation of this type of feature was assigned to continue work on this and to have a draft available to be presented to the sector at its next meeting for review. Since this draft test procedure has not been finalized and distributed to the members as planned, the Sector will need to consider what additional steps are to be taken to resolve this issue.

Discussion:

The comments heard at the 2015 NTEP BCS meeting regarding this item were similar to those made during the discussion on the previous item during the meeting. The use of a belt profiling feature was supported by some participants and opposed by others within the Sector. Many who expressed opposition for the use of this feature on commercial devices cited the same concerns that were mentioned in regard to linearity correction. Those members stated their belief that the use of belt profiling to establish a zero reference condition could mask inconsistencies in the composition and condition of the conveyor belt.

The Sector members generally acknowledged that those who support the use of this feature also support the testing of BCS using a minimum test load of less than the amount of material totalized in a full belt revolution. The use of belt profiling would facilitate this practice in that a zero reference value could be established with less than a full revolution of belt travel. The participants of the 2015 meeting also acknowledged that some Sector members that are ardent supporters of the use of belt profiling were not present at the 2015 meeting and therefore their input would not be heard during this discussion. This was a concern to the participants who were reluctant to develop any conclusions without the input of those that were not present at the meeting and in the absence of those members that are considered to be experts on the operation of this type of feature.

Conclusion:

The Sector members present at the 2015 meeting agreed that this issue should be tabled until a future meeting when additional members are present who are considered experts in this area. This item will be considered during a future meeting of the Sector.

II. New Items

A. Proposed changes to *NCWM Publication 14 - Belt-Conveyor Scales*

The following amendments are being proposed for the 2015 edition of *NCWM Publication 14 Belt-Conveyor Scales* to reflect changes adopted in 2014 to the *NIST Handbook 44 Section 2.21. Belt-Conveyor Scale Systems Code*.

1). NCWM Publication 14 Section 9.7.9.

Source:

USNWG on Belt-Conveyor Scales

Proposal:

This proposed change would eliminate altogether this item currently included on the checklist and would align *NCWM Publication 14* with the most current edition of *NIST Handbook 44*.

Background:

A change to *NIST Handbook 44, Belt-Conveyor Scale Systems Code*, paragraph was adopted in 2014 as follows:

UR.1.2. Conveyor Installation. – The design and installation of the conveyor leading to and from the belt-conveyor scale is critical with respect to scale performance. The conveyor can be horizontal or inclined, but if inclined, the angle shall be such that slippage of material along the belt does not occur. Installation shall be in accordance with the scale manufacturer's instructions and the following:
…

~~***(h) Conveyor Length. The conveyor shall be no longer than 300 m (1000 ft) nor shorter than 12 m (40 ft) from head to tail pulley.***~~

~~***[Nonretroactive as of January 1, 1986]***~~

This adopted change eliminated prescribed limits on the minimum and maximum lengths for conveyors used in belt-conveyor scale systems.

To align the content of *NCWM Publication 14 Belt-Conveyor Scales* with the current *NIST Handbook 44* the following change is recommended.

9.7.8. There shall be no tripper or movable head pulleys in the conveyor.

~~**9.7.9. The conveyor shall be no longer than 1000 ft (300 m) or shorter than 40 ft (12 m) from head to tail pulley. [Nonretroactive as of January 1, 1986]**~~

9.7.~~**10**~~**9**. Conveyor stringers at the scale and for not less than 20 ft (6 m) before and beyond the scale shall be continuous or securely joined and of sufficient size and so supported to eliminate relative deflection between the scale and adjacent idlers when under load.

… Subsequent paragraphs to be renumbered as needed.

Discussion/Conclusion:

During the 2015 NTEP BCS Sector meeting, there was a limited discussion regarding the implied result expected from the elimination of this item from the *NTEP Publication 14* checklist. Several Sector members asked for confirmation whether this action would affect a NTEP evaluation on weigh-belt type weighing systems. The Sector agreed that this change would have a significant impact on this type of device.

The Sector agreed with this suggested change, and that no further actions are necessary.

2). NCWM Publication 14 Section 9.7.1.

Source:

USNWG on Belt-Conveyor Scales

Proposal:

It is recommended that Section 9.7.1. of NCWM Publication 14 Belt-Conveyor Scales be amended as shown below.

9.7.1. ~~**If the belt length is such that a take-up device is required, this device shall be of the counter-weighted type for either vertical or horizontal travel.**~~ **Any take-up device shall provide constant and consistent tension for the belt under all operating conditions.**

9.7.1.1. Indicate the Type: **Counterweighted:** ☐ Vertical ☐ Horizontal

Other: ☐

Background:

This proposed change would align *NCWM Publication 14* with a change adopted in *NIST Handbook 44* in 2014 by removing prescriptive language from a requirement (UR.1.2.d) pertaining to the means by which a conveyor system uses to maintain tension on the conveyor belt. The change appearing in the 2015 edition of *NIST Handbook 44 BCS Systems Code is* shown below.

UR.1.2. Conveyor Installation. – …

…

(d) Take-up Device. – ~~**If the belt length is such that a take-up device is required, this device shall be of the counter-weighted type for either vertical or horizontal travel.**~~ **Any take-up device shall provide constant and consistent tension for the belt under all operating conditions.**
(Amended 2014)

Discussion/Conclusion:

The Sector was in agreement that the change proposed to NCWM Publication 14 under 9.7.1. is justified although some in the group questioned whether the changes being recommended for the sub-paragraph 9.7.1.1. is necessary. The NIST Technical Advisor to the Sector explained that NCWM Publication 14 already contains subparagraph 9.7.1.1. with check boxes included for a selection of "vertical" or "horizontal" and that this change would make these optional. Also optional with this proposal would be the use of neither vertical or horizontal "counterweighted" type of take-up, therefore a checkbox for "other" is being proposed. The Sector agreed with these recommendations and no further changes were proposed.

B. NTEP Belt-Conveyor Scale Sector Chair Position

Proposal/Background:

The current Chair of the NTEP Belt-Conveyor Scale Sector, Mr. Bill Ripka has indicated that he will no longer be able to serve in this capacity. Mr. Ripka's resignation creates a vacancy that Sector members will need to address by nominating a replacement.

Source:

NTEP Belt-Conveyor Scale Sector

Discussion/Conclusion:

Mr. Darrell Flocken (NTEP Specialist) provided the Sector members with details regarding the procedure involved in filling a vacant Sector Chair position. The Sector was informed that this procedure should include a nomination of candidates for that position by the Sector members and that this process could be done via email ballot. The NIST Technical Advisor informed the Sector members that he would initiate the balloting following the 2015 meeting. Once the balloting was completed, the results would be forwarded to the NTEP administrator for further action.

NIST Technical Advisor's note:

Following the Sector's 2015 meeting, the Sector members were asked to participate in a nomination of candidates for the position of NTEP BCS Sector Chairperson through an exchange of emails. Following the nomination process, Sector members were then asked to respond to a ballot that would identify their choice as Chair. The results of that ballot were that Mr. Peter Sirrico was identified as the Sector member's selection to fill the vacant Sector Chair position. Results were then forwarded to the NTEP Administrator.

III. Attendance:

Name	Organization	Telephone	Email
Art Amsler	Arcadia Controls	412 841-2708	artarcadia.@aol.com
Peter Sirrico	Thayer Scale	781 826-8101	psirrico@thayerscale.com
Mike Laffey	Laffey Equipment	314 427-7414	mlaffey@laffeyequipment.com
Chuck Andrews	Thermo Fisher Scientific	763 783-2699	chuck.andrews@thermofisher.com
Jason Kukachka	Thermo Fisher Scientific	763 783-2566	jason.kukachka@thermofisher.com
Zacharias Tripoulas	State of MD NTEP Lab	410 841-5790	Zacharias.tripoulas@maryland.gov
Darrell Flocken	NCWM/NTEP	614 620-6134	darrell.flocken@ncwm.net
James Alexander	DTE Energy	313 268-3169	alexanderj@dteenergy.com
Haukur Johannesson	Marel Seattle	206 926-5486	haukur.johannesson@marel.com
Al Page	State of Montana (retired)	406 861-0534	awp8866@gmail.com
John Barton	NIST	301 975-4002	john.barton@nist.gov

National Type Evaluation Program (NTEP)
Belt-Conveyor Scale (BCS) Sector Meeting Summary

February 22, 2016 / Pittsburgh, PA.

Introduction

The charge of the BCS 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 and 2.21. BCS Systems. The sector's recommendations are 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 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***.

Glossary of Acronyms and Terms

<u>Acronym</u>	<u>Term</u>
BCS	Belt-Conveyor Scale
MTL	Minimum Test Load
MWT	Master Weight Totalizer
NCWM	National Conference on Weights and Measures
NIST	National Institute of Standards and Technology
NTEP	National Type Evaluation Program
NTETC	National Type Evaluation Technical Committee
OWM	Office of Weights and Measures
USNWG	U.S. National Work Group

I. Carry-over Items

A. Conveyor Belt Profiling:

Source:

USNWG on Belt-Conveyor Scales

Proposal:

Develop recommended test procedures for *NCWM Publication 14* Belt-Conveyor Scales to evaluate the use of a belt profiling feature to provide a zero-load reference when used in a belt-conveyor scale system.

Background:

This means of establishing a zero-condition prior to a totalization operation involves the ability of the weighing device to establish "tare" weight values associated with distinct individual segments of the belt and synchronizing the application of those values to the movement of the belt segments over the scale portion of the conveyor. A number of Sector members have agreed that this feature should receive some level of evaluation, and that at a minimum, the ability to enable or disable any belt profiling feature should be protected by some form of security seal.

In addition, NIST OWM has received inquiries seeking guidance on whether this type of feature is permitted under U.S. standards. It is also being reported by some members of the USNWG that some regulatory field officials will not issue an approval for devices equipped with this feature when it is not listed as a standard feature or an option on the NTEP Certificate of Conformance.

During the 2014 meeting, the BCS Sector was informed that a sub-group from within the Sector membership which was assigned to develop procedures for verifying the operation of a linearization correction had also been assigned to develop a procedure for testing the function of belt profiling. Sector members acknowledged that this feature could readily be tested in the field and would most likely be more costly to test in a laboratory setting. All of the sector members agreed that this feature must be one protected by a type of security seal however, no draft procedures had been developed at the time of the 2014 BCS Sector meeting. The sub-group assigned to develop test procedures for the evaluation of this type of feature was asked to continue work on this issue and to have a draft available to be presented to the sector at its next meeting for review.

Those in attendance at the February 2015 meeting, generally acknowledged that those who support the use of this feature also support the testing of BCS using a minimum test load of less than the amount of material totalized in a full belt revolution. The use of belt profiling would facilitate this practice in that a zero reference value could be established with less than a full revolution of belt travel. The use of a belt profiling feature has been supported by some Sector members and opposed by others. Many who expressed opposition for the use of this feature on commercial devices stated their belief that the use of belt profiling to establish a zero reference condition could mask inconsistencies in the composition and condition of the conveyor belt.

The participants of the 2015 meeting recognized that some Sector members that are supporters of the use of belt profiling were not present at the 2015 meeting and therefore their input was not part of this discussion. This was a concern to the participants who were reluctant to develop any conclusions without the input of those that were not present at the meeting and who are considered to be experts on the operation of this particular feature. It was agreed that this issue should be tabled until a future meeting when additional members are present who are considered experts in this area.

Discussion:

During the February 2016 meeting of the NTEP Belt-Conveyor Scale (BCS) Sector, Sector Chair, Mr. Peter Sirrico asked the members if they believed that there should be test procedures developed and included in *NCWM Publication 14* to be used in evaluating the use of "belt profiling" if the device is so equipped. Mr. John Barton explained to the members that the basis for *NCWM Publication 14* is the requirements that are found in *NIST Handbook 44*. Mr. Nathan Gardner pointed out however, that references to linearization are found in *NCWM Publication 14* although no corresponding references are made in *NIST Handbook 44*.

Mr. Bill Ripka stated that his company, Thermo Fisher Scientific produces a device that has been awarded a Certificate of Conformance from the NTEP. The Certificate of Conformance (CC) lists both the "linearization" and "belt-profiling" as being features that are included on this device, yet there are apparently no specific test procedures to evaluate the proper functioning of those features. Mr. Ripka added that it is important that the manufacturer of a device submitted for type evaluation supply ample information about the device to the evaluators so that they may perform an adequate test.

Mr. Sirrico asked the Sector if it is appropriate for the manufacturer of a device that has been submitted for type approval to supply the proper testing procedures. Mr. Jim Truex explained that the basic need is for the manufacturers to simply provide the information on how the proper function of the device features can be verified. There is no need to explain the design of the device in any great detail.

Mr. Gardner suggested that a test could simply consist of creating an anomaly on the conveyor belt that would result in a "spike" in the totalizer during a zero test, and then verifying that the profiling function would mitigate the effects of the anomaly. This could be done simply by fastening a weight on to a specific location on the belt and running the conveyor belt with the feature disabled and then again with the feature enabled.

Conclusions:

The Sector was asked if they believe that *NCWM Publication 14* needs to be amended to include a minimal statement addressing the evaluation of a belt profiling feature (i.e., the system tested when profiling is enabled and also when it is disabled). Some participants of the February 2016 meeting supported including an item in the *NCWM Publication 14* Checklist that would provide additional test step(s) (as described above by Mr. Gardner) however, not all Sector members agreed that this is needed or that belt profiling should be permitted.

While the Sector acknowledged that there are a NTEP CCs that list belt profiling as a feature on type approved devices, the Sector did not support any proposed change to *NCWM Publication 14* regarding the belt-profiling function at this time.

II. New Items

A. Proposed changes to *NCWM Publication 14 - Belt-Conveyor Scales*

1). NCWM Publication Section: General (Multiple locations)

Ref: *NIST Handbook 44* BCS Code Paragraph: A.1. General.

This adopted change to the *NIST Handbook 44* BCS Code simply adds wording in paragraph A.1. to indicate that weigh-belt systems will also be included under the existing code as shown below.

> **A.1. General.** – This code applies to belt conveyor scale systems **and weigh-belt systems** used for the weighing of bulk materials.

The primary change that occurred to the *NIST Handbook 44* Belt-Conveyor Scale Systems Code in 2015 was the amendments made to a number of sections that allowed weigh-belt systems to be included under this code. There are numerous locations in *NCWM Publication 14* where the terminology "belt-conveyor scale(s)" is used but the terminology "weigh-belt systems" is not included.

It is recommended that since amendments to *NIST Handbook 44* have been adopted to include weigh-belt systems within the Belt-Conveyor Scale Systems Code, that the BCS Code would now be applied to weigh-belt systems submitted for type evaluation. To ensure that weigh-belt systems may also be evaluated under this *NCWM Publication 14*, the Sector is asked to determine whether or not the phrase "weigh-belt systems" must also be included wherever the term "belt-conveyor scales" is used in *NCWM Publication 14*.

One alternative to making this type of change in numerous locations in the *NCWM Publication 14* could be to add an informational statement in the "Technical Policy" section of *NCWM Publication 14* that would inform the reader that, while not always specifically stated, weigh-belt systems shall also be evaluated using this same *NCWM Publication 14*. If this approach is favored, it must also be recognized that there will be specific amendments needed to indicate where requirements or procedures will differ in the evaluation of these two types of conveyor weighing systems.

Should the Sector conclude that it would be best to amend individual references to "belt-conveyor scales" in *NCWM Publication 14* to also refer specifically to "weigh-belt systems" there have been a total of 28 locations in the current *NCWM Publication 14* that have been identified as not being explicitly inclusive of "weigh-belt systems."

Discussion/

The Sector was given an explanation of why weigh-belt systems need to be recognized in *NCWM Publication 14* now that *NIST Handbook 44*, Section 2.21. explicitly includes those devices under the Belt-Conveyor Scale Systems Code. Mr. Barton pointed out the list of specific locations in *NCWM Publication 14* that refer specifically to belt-conveyor scales, and noted that changes should be made to each of those sections or, perhaps a single statement could be added to the *NCWM Publication 14* indicating that weigh-belt systems would also be covered.

Mr. Truex expressed his belief that a single editorial change could be made and would suffice as declaration that weigh-belt systems will also be covered under the technical policy, checklist, and test procedures for belt-conveyor scales in *NCWM Publication 14*. This could be accomplished by adding "and Weigh-Belt Systems" to the title of the Belt-Conveyor Scales section in *NCWM Publication 14*.

Conclusion:

The Sector agreed to recommend that rather than making multiple individual changes for the many references of "belt-conveyor scales," a less disruptive means to indicate that this NCWM Publication 14 will also apply to weigh-belt systems would be to simply amend the chapter titles found on pages BCS-1 and BCS-3. On page BCS-1, it is recommended that the title be changed to "National Type Evaluation Program Belt-Conveyor Scales and Weigh-Belt Systems – Technical Policy. Also recommended is that the title on page BCS-3 be changed to National Type Evaluation Program, Belt-Conveyor Scales and Weigh-Belt Systems – Checklists and Test Procedures.

2). *NCWM Publication 14* – Section 8.8.3.

This change in the *NIST Handbook 44* Belt-Conveyor Scale Systems Code was adopted and provides latitude for marking requirements for those systems having adjustable belt speeds.

Ref: *NIST Handbook 44* BCS Code Paragraph S.4. Marking Requirements.

> **S.4. Marking Requirements.** – A belt-conveyor scale shall be marked with the following: (See also G-S.1. Identification)
>
> (a)…
> (b)…
> (c) the belt speed in terms of feet (or meters) per minute at which the belt will deliver the rated capacity**, or the maximum and minimum belt speeds for variable speed ~~weigh~~ belts**;

It is recommended that the *NCWM Publication 14*, be amended to reflect this change. The following change is suggested:

8.8.3. The belt speed in terms of feet (or meters) per minute at which the belt will deliver the rated capacity**, or the maximum and minimum belt speeds for variable speed belts**;

Discussion/Conclusion:

After explaining the change to *NIST Handbook 44*, the Sector members were asked if they will support recommending the change to section 8.8.3. in *NCWM Publication 14* as shown above. The Sector agreed to changes being proposed, and that this change should take place in "Checklist", Section 8.8.3., page BCS-10. No further comments were made at this time.

3). *NCWM Publication 14*, Section 14 - Field Test Procedure, N.2.1. Initial Verification

Ref: *NIST Handbook 44* BCS Code N.2.1. Initial Verification

This change to *NIST Handbook 44* Belt-Conveyor Scale Systems Code, paragraph N.2.1. is intended to clarify the type and number of test runs needed for an official test performed during the initial verification.

It is recommended that *NCWM Publication 14*, Section 14 (Field Test Procedures) be amended to reflect these changes in *NIST Handbook 44*.

N.2.1. Initial Verification. – A belt-conveyor scale system **or a weigh-belt system** shall be ~~**verified with**~~ **tested using of** a minimum of two test runs **performed** at each ~~**of the following flow rates:**~~ **setting for belt speed/belt loading as indicated in Table N.2.1.**

~~**(a) normal use flow rate;**~~

~~**(b) 35 % of the maximum rated capacity; and**~~

~~**(c) an intermediate flow rate between these two points.**~~

Table N.2.1.

Device Configuration	Minimum of 2 test runs at each of the following settings	Total Tests (minimum)
Constant belt speed/ Variable loading	– belt loading: high (normal) – belt loading: medium (intermediate) – belt loading: low (35%)	6
Variable belt speed/ Constant loading	– belt speed: maximum – belt speed: medium – belt speed: minimum	6
Variable belt speed/ Variable loading	– speed: maximum / belt loading: high (normal) – speed: maximum / belt loading: medium (intermediate) – speed: maximum / belt loading: low (35%) – speed: minimum/ belt loading: high (normal) – speed: minimum/ belt loading: medium (intermediate) – speed: minimum/ belt loading: low (35%)	12

Use the device configurations in the left-hand column to identify the scale being tested.

Perform 2 test runs (minimum) at each of the settings shown in the center column.

The following terminology applies:

- **High: maximum (normal use) operational rate.**
- **Low: 35% of the maximum rated capacity of the system.**
- **Medium: an intermediate rate between the high and low settings.**

Results of the individual test runs in each pair of tests shall not differ by more than the absolute value of the tolerance as specified in T.2. Tolerance Values, Repeatability Tests. All tests shall be within the tolerance as specified in T.1. Tolerance Values.

Test runs may also be conducted at any other rate of flow that may be used at the installation. A minimum of four test runs may be conducted at only one flow rate if evidence is provided that the system is used at a ~~**single flow rate**~~ **constant speed/constant loading setting** and that rate does not vary in either direction by an amount more than 10 % of the normal flow rate that can be developed at the installation for at least 80 % of the time.

Discussion/Conclusion:

The Sector agreed with the proposed changes to this item that are being recommended for *NCWM Publication 14* and that these changes should be placed under Section 14, Field Performance Test of the Belt-Conveyor Scale, page BCS-33. No additional comments were made at this time.

4). *NCWM Publication 14*, Section 14 - Field Test Procedure, N.2.3. Minimum Test Load

Ref: ***NIST Handbook 44*** **BCS Code N.2.3.**

The following changes to *NIST Handbook 44* BCS Code paragraph N.2.3. will appear in the 2016 edition and corresponding changes are recommended to the "Field Test Procedures" Section of *NCWM Publication 14.*.

N.2.3. Minimum Test Load.

N.2.3.1 Weigh-Belt Systems. - The minimum test load shall not be less than the largest of the following values.

a. 800 scale divisions;

b. the load obtained at maximum flow rate in one revolution of the belt; or

c. at least ~~**10**~~**1** minute of operation.

N.2.3.2. All Other Belt-Conveyor Scale Systems. - Except for applications where a normal weighment is less than 10 minutes, the minimum test load shall not be less than the largest of the following values.

a. 800 scale divisions;

b. the load obtained at maximum flow rate in one revolution of the belt; or

c. at least 10 minutes of operation.

For applications where a normal weighment is less than 10 minutes (e.g., belt-conveyor scale systems used exclusively to issue net weights for material conveyed by individual vehicles and railway track cars) the minimum test load shall be the normal weighment that also complies with N.2.3.2. (a) and (b).

The official with statutory authority may determine that a smaller minimum totalized load down to 2 % of the load totalized in 1 hour at the maximum flow rate may be used for subsequent tests, provided that:

1. the smaller minimum totalized load is greater than the quantities specified in **N.2.3.2.** (a) and (b); and
2. consecutive official testing with the minimum totalized loads described in N.2.3**.2.** (a), (b), or (c) and the smaller minimum test load has been conducted that demonstrates the system complies with applicable tolerances for repeatability, acceptance, and maintenance.
(Added 2004) (Amended 2008 **and 201X)**

In addition to recommending these changes to Section 14, Field Test Procedures on page BCS-34, an additional change is recommended to the Table T.4 on page BCS-27. The second half of Table T.4 contains the headings "Test Conditions" and "Abbrev." and rows numbered 1-3. Row 1 is subdivided into 3 rows, the last row contains the wording "Time (minutes) to deliver MTL (at least 10 minutes). It is recommended that this wording be changed to reflect the minimum operational time required for weigh-belt systems also as follows:

"Time (minutes) to deliver MTL (at least 10 minutes for belt-conveyor scales **or 1 minute for weigh-belt systems**)"

Discussion/Conclusion:

The Sector agreed with the proposed changes to this item that are being recommended to be placed in *NCWM Publication 14*, page BCS-34, under N.2.3. Minimum Test Load. No additional comments were made at this time.

5). *NCWM Publication 14*, Section 14, Field Test Procedures, N.3.1.1. Determination of Zero

Ref: HB44 BCS Code N.3.1.1.

Changes to *NIST Handbook 44* BCS Code paragraph N.3.1.1. Determination of Zero were adopted and will appear in the 2016 edition. Corresponding changes are recommended to be used in the revision of *NCWM Publication 14* as shown below.

N.3.1.1. Determination of Zero. – A zero-load test is a determination of the error in zero, expressed as an internal reference, a percentage of the full-scale capacity, or a change in a totalized load over a whole number of complete belt revolutions. ~~**For belt-conveyor scales with electronic integrators, the test must be performed over a period of at least three minutes and with a whole number of complete belt revolutions. For belt-conveyor scales with mechanical integrators, the test shall be performed with no less than three complete revolutions or 10 minutes of operation, whichever is greater.**~~ **A zero-load test shall be performed as follows:**

(a) For belt-conveyor scales with electronic integrators, the test must be performed over a period of at least 3 minutes and with a whole number of complete belt revolutions;

(b) For belt-conveyor scales with mechanical integrators, the test shall be performed with no less than three complete revolutions or 10 minutes of operation, whichever is greater;

(c) For weigh belt systems the test must be performed over a period of at least one minute and at least one complete revolution of the belt.

(Added 2002) **(Amended 20XX)**

Discussion/Conclusion:

The Sector agreed with the proposed changes to this item that are being recommended for *NCWM Publication 14*. Also, that these changes should appear in *NCWM Publication 14*, Section 14, Field Test Procedures, page BCS-34. No additional comments were made at this time.

III. Additional Items

A. Linearity Correction Feature

The discussion regarding a linearity correction feature by the Sector members is a continuation of the same discussion which began during a USNWG on Belt-Conveyor Scales meeting that immediately preceded this Sector meeting. This linearization feature would facilitate adjustment of the curve plotted on a graph showing the range of error in the totalization of loads at various flow rates. Using a linearity adjustment, the errors observed during totalizations at different flow rates of the system could be brought closer in line with the other errors observed. The result would be represented as a graph that more resembled a straight line when the errors are plotted according to the flow rate and variance from the reference weight used a test load.

This topic has often been discussed in tandem with the topic of belt-profiling during meetings of the USNWG and the NTEP Sector since the use of both these features are being questioned by field officials when they are encountering systems in the field that are equipped with them. It has been reported that some field officials are not granting approval of systems that are equipped with these features if those features are not listed on the NTEP Certificate of Conformance.

The Sector has been considering whether devices that have these features installed should undergo any specific testing during type evaluation to verify the correct function of the belt-profiling and linearity correction.

Discussion:

During the Sector's February 2016 meeting, Mr. Gardner noted that linearization is referred to in *NCWM Publication 14* although, there is no mention of testing this feature there. Mr. Truex acknowledged this and added that if a manufacturer were to submit a device for type evaluation, there would need to be a procedure for testing that feature provided by the manufacturer. Mr. Truex added that the reference in *NCWM Publication 14* to linearization is found in the table that lists sealable parameters and non-sealable parameters. Linearization is listed as a sealable parameter in that table.

The Sector considered what test procedures would be necessary to evaluate the linearization feature. Mr. Truex stated that he believes all that would be needed is to verify that the feature works through a performance-based test that would include the operation of the BCS at different flow rates. Mr. Barton added that perhaps all that is needed is that the system could be tested with the linearity correction feature enabled and then again when disabled, it would be obvious that this feature is working as it should.

Mr. Sirrico added that during previous discussions regarding this topic, some Sector members advocated placing a limitation of the ability of a linearity correction feature to reduce the degree of variation between errors. Some suggested not permitting this feature affect any totalization results that would exceed a limited range of results (i.e., 5%). Others supported a linearity correction that did not have those limitations restrict the amount of variation of results that could be acted upon.

Conclusions:

The Sector members agreed that the ability to enable or disable a linearity correction feature must be a sealable parameter and also acknowledge that it is already listed as such in *NCWM Publication 14*. The Sector members could not agree upon any specific testing to recommend be done during type evaluation to verify its operation. No recommended changes for *NCWM Publication 14* were offered at this time.

B. VCAP Information:

The Verified Conformity Assessment Program (VCAP) will include mandatory audits to verify the evaluation of certain weighing devices that are subject to compliance with requirements involving their performance when exposed to certain influence factors. Belt-conveyor scale systems are one of those weighing devices subject to this type of testing.

Discussion/Conclusion:

Mr. Truex (NTEP Administrator) provided the Sector with information regarding the eventual implementation of the audit process mentioned above. Mr. Truex encouraged the device manufacturers in the Sector to become familiar with this process in that the devices they manufacturer and submit for NTEP evaluation will need to comply. He further explained that devices submitted for type evaluation will need to be tested for compliance with performance requirements during periods when the devices are exposed to certain environmental influence factors (e.g., changes in temperature and humidity, electrical current anomalies, etc.) and eluded to the fact that at least some of that testing will involve placing the device into a controlled environmental chamber.

Because of the size of some types of belt-conveyor scale systems, in the past it has been impractical (if not impossible) to enclose the entire system in the confines of the environmental chambers used. Mr. Truex informed the Sector that the existing policy on the VCAP program does not allow for exceptions from this testing and he suggested that Sector members (primarily device manufacturers) develop a proposal to the NCWM Board of Directors to enact some changes in this policy.

The device manufacturers in the Sector agreed that it would be beneficial to collaborate in this effort.

IV. Attendance:

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