Appendix A

Belt-Conveyor Scales and Weigh-Belt Systems

Recommended changes to NCWM Publication 14 based on 2020 NIST Handbook 44 Amendments

Section Number	Amendment	Page	Source
Document	Please note that the Weighing Devices publication has been thoroughly reviewed by NCWM staff. Changes have been made, but none are to change intent of the policies, checklists or test procedures, thus considered editorial. Issues or concerns should be brought to the attention of NCWM staff.	Document	Editorial
1.6	Amended		
1.8	Amended		
5	S.5. Code reference amended		
8	New marking requirement 8.5 added		
12	Initial Tests – percentages amended		
12	Voltage Tests – parameters added for different accuracy classes		
12	Temperature Tests (17) – Table amended to reflect MTL for different accuracy classes		
13.5.1.9	Values for minimum scale division added for different accuracy classes		
13.5.5.	Zero-Setting Mechanism: 13.5.5.7. amended to include different accuracy classes		
13.5.10.	Voltage Tests: length of run time added for different accuracy classes		
Table T.3.	Nominal time column amended to account for different accuracy classes		
Table T.4.	Row #2 under Test Conditions: Delivery times amended to account for different accuracy classes		
Table T.6.	Row #11 amended to account for different accuracy classes		
Table T.7;	Time (Minutes) column amended to account for different accuracy classes		
14	Table N.2.1. amended to include category Constant belt speed and constant loading systems		
14	Editing done to reflect recent language changes in HB44 regarding test runs		
14	Editing done (under N.2.2.) to reflect recent language changes in HB44 regarding test procedures		
14	Amendments made to N.2.3.1. Weight-Belt Systems and N.2.3.2. All other Belt-Conveyor Scale Systems to account for different accuracy classes		
14	Amendments made to N.3.1.2. Test of Zero Stability made to account for different accuracy classes		
14	Note amended under N.3.1.3. to account for different accuracy classes		
14	Amendments made under N.3.2.1. Accuracy of Material to account for different accuracy classes		
14	Amendments made under T.1. Tolerance Values to account for different accuracy classes		
14	T.1.1. Tolerance Values added		

16	Amendments made to Table under Temperature Tests in Time column to account for different accuracy classes	BCS-47&48	HB 44

National Type Evaluation Program
Belt-Conveyor Scales and Weigh-Belt Systems – Technical Policy

A. Models to be Submitted for Evaluation

No changes

B. Certificate of Conformance Parameters

No changes

C. Replacement Parts

No changes

D. Substitution of Load Cells in Scales

No changes

E. Criteria for Scales Not Using NTEP Load Cells

No changes

F. Substitution of Master Weight Totalizers

No changes

G. Policy on Remanufactured and Repaired Devices

No changes.

National Type Evaluation Program
Belt-Conveyor Scales and Weigh-Belt Systems – Checklists and Test Procedures

1. Indicating and Recording Elements

…

Field Test

The accumulated measured 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.

Code Reference: G-S.5.1.

1.1. The capacity of the MWT shall be at least 10 hours times the maximum rated flow rate of the scale. ☐ Yes ☐ No ☐ N/A

Field Test Only

1.2. The value of the scale division shall be: ☐ Yes ☐ No ☐ N/A

1.2.1. For scales installed prior to January 1, 1986 ~~less than or equal to~~not greater than ~~0.1%~~ 1/1200 of the ~~minimum totalized load.~~rated capacity of the device;

1.2.2. For scales not marked with an accuracy class and installed on or after January 1, 1986 not greater than 0.125 % (1/800) of the minimum totalized load;

1.2.3. For scales marked Class 0.25, not greater than 0.125 % (1/800) of the minimum totalized load; and

~~1.1.1.~~1.2.4. for scales marked Class 0.1, not greater than 0.05 % (1/2000) of the minimum totalized load.

Code Reference: S.1.2.

~~1.2.~~1.3. The scale shall indicate in one or more of the following weight units (check the applicable unit(s)). ☐ Yes ☐ No ☐ N/A

Commented [BJ(1]: Add units of weight make reference to section 1.8.
Perhaps the table shown following 1.8.2. belongs here?

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

1.4. 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: ☐ Yes ☐ No ☐ N/A

1.4.1. 0.125 % (1/800) of the minimum totalized load for devices not marked with an accuracy class and those marked Class 0.25~~.~~; and

~~1.2.1.~~1.4.2. 0.05 % (1/2000) of the minimum totalized load for devices marked Class 0.1.

What is a scale division?

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

~~1.2.2.~~1.4.3. Verify that the value of the scale division is protected by an acceptable security means (e.g., physical seal or audit trail). ☐ Yes ☐ No ☐ N/A

Code Reference: G-S.5.1.

~~1.3.~~1.5. The indicated weight value must be expressed without the use of a multiplier. ☐ Yes ☐ No ☐ N/A

Code Reference: S.1.6.

~~1.4.~~1.6. A scale 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.

~~1.4.1.~~1.6.1. During normal operation, the MWT shall advance only when the belt conveyor is in operation and under load. ☐ Yes ☐ No ☐ N/A

~~1.4.2.~~1.6.2. 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

~~1.4.3.~~1.6.3. It must be possible to deactivate the no-flow lockout during the zero test. ☐ Yes ☐ No ☐ N/A

2. Recording Element

No change

3. Rate of Flow Indicator and Recorder

No change

4. Rate of Flow Alarms

No change

5. Design of Weighing Elements

…

Code Reference: S.2.2. and S.~~5~~6.

5.1. The term "adjustable component" may refer to a variety of devices. It could be a mechanical adjustment of a lever arm, a zeroing screw, or a potentiometer, the entry of data through a keyboard, or the changing of switch settings on a printed circuit board. Any adjustable component that can affect the performance of the device (except for the zero-setting mechanism):

5.1.1. Shall not be capable of adjustment without breaking a security seal or activating another approved security means. ☐ Yes ☐ No ☐ N/A

…

6. Zero-Setting Mechanism

No change

7. Sensitivity at Zero Load

No change

8. Marking Requirements

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

The abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)

~~8.2.~~8.5. For devices manufactured on or after January 1, 2020 the designation of an accuracy class. The marking of an accuracy class shall be as Class 0.25 or Class 0.1, ☐ Yes ☐ No ☐ N/A

Renumber all remaining paragraphs

9. Installation Requirements

10. Material Test

No Changes

11. Belt Travel (speed)

No Changes

12. Laboratory Test Procedures

…

Initial Tests

1. Calibrate the scale at 20 °C. The reference test for the scale calibration shall be run at 70% of the static scale capacity.
2. Conduct the sensitivity test at zero load (S.3.2.)
3. Verify that the range of the automatic zero setting mechanism does not exceed ± 2% of capacity (S.3.1.)
4. Test the alarms for flow rates below ~~35~~20% and over ~~98~~100% of rated capacity (S.1.5.)
5. Exercise the scale three times by loading the scale to ~~98~~100% of scale capacity. Do not run the exercise tests before the other temperature tests. (S.2.3.)

…

Voltage Tests

5. Run an accuracy test at ~~98~~100% of scale capacity:
   a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d.
   ~~a)~~b) for devices marked Class 0.1, for the time to deliver 2 000 d.
6. Change the voltage of the power supply to 100 V.
7. Run a zero test.
8. Run an accuracy test at ~~98~~100% of scale capacity:
   a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d.
   b) for devices marked Class 0.1, for the time to deliver 2 000 d.

~~8. for the time to deliver 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:
    a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d.
    b) for devices marked Class 0.1, for the time to deliver 2 000 d.

~~11. for the time to deliver 800 d.~~

12. Return the voltage of the power supply to a nominal value.

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. Apply a test load to the weighing element in a manner consistent with the normal loading of the scale.
15. Test the scale dynamically to simulate the operation of the belt-conveyor scale. Test the scale at the following "flow rates" (all percent values represent percent loads of static scale capacity (SSC)): 0 (zero test), 35% (SSC_{min}), 35%, 70%, 98%, leave scale under load for 1 hour, 98%, 70%, 35%, 35%(SSC_{min}), and 0 (zero test.)

    Note: SSC_{min} is minimum static scale capacity.

    The tolerance to be applied for the laboratory test is set at 0.45 times the tolerance for the complete scale. An example of the tolerance application is given to illustrate the process. The reference value for a particular accuracy test is the weight placed on the scale times the "length of belt that has passed over the scale." Numbers that could result from a laboratory test are given below.

    98% load - Zero load test = Difference

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

16. Change the temperature to -10 °C (14 °F) at a rate no faster than 1° C/min. Allow equipment to soak for at least an additional two hours, but not more than six hours after the surface temperature of the largest mass of the scale has reached -10 °C. For the convenience of the test, however, an overnight period may be used for the soak period before running the next temperature test.
17. Repeat the dynamic tests performed at 20 °C.

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)][2] 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}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 800 d~~	
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 800 d~~	
98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 800 d~~	
Leave the scale under load for 1 hour.		

[1] An independent counter is needed for the speed pick-up to count its revolutions. The scale manufacturer shall provide the counter. The manufacturer shall specify the number of speed sensor revolutions corresponding to the distance of belt travel.

[2] Conducting the zero test for this length of time is the "worst-case" condition to maintain zero. The results of this test depend on the accuracy with which the zero setting was established and the inherent load cell drift over time. The objective is to assure that any error in the zero setting will not have a significant effect on the test results. Because the laboratory tests do not include a belt, it may be very easy to precisely set the zero reference.

98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 800 d~~	
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 800 d~~	
35% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d. b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~Time to deliver 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	

…

13. Evaluation of Stand-Alone Master Weight Totalizers

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.

13.5.1.8. 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 ☐

13.5.1.9. The value of the scale division shall be capable of being established for a value less than or equal to: Yes ☐ No ☐ N/A ☐

13.5.1.9.1. For scales installed prior to January 1, 1986 not greater than 1/1200 of the rated capacity of the device;

13.5.1.9.2. For scales not marked with an accuracy class and installed on or after January 1, 1986 not greater than 0.125 % (1/800) of the minimum totalized load;

13.5.1.9.3. For scales marked Class 0.25 not greater than 0.125 % (1/800) of the minimum totalized load; and

~~13.5.1.8.1.~~13.5.1.9.4. For scales marked Class 0.1 not greater than 0.05 % (1/2000) of the minimum totalized load.

Renumber all remaining paragraphs

13.5.2. Recording Element

No changes

13.5.3. Rate of Flow Indicator and Recorder

No changes

13.5.4. Rate of Flow Alarms

No changes

13.5.5. Zero-Setting Mechanism

…

13.5.5.7. A belt-conveyor scale shall be equipped with a zero-ready indicator that produces an audio or visual signal during an unloaded belt condition when the zero balance is within: ~~Yes ☐ No ☐ N/A ☐~~

13.5.5.7.1. ± 0.12 % of the rated capacity of the scale for scales not marked with an accuracy class; Yes ☐ No ☐ N/A ☐

13.5.5.7.2. ± 0.12 % of the rated capacity of the scale for scales marked Class 0.25; and Yes ☐ No ☐ N/A ☐

~~13.5.5.7.1.~~13.5.5.7.3. ± 0.05 % of the rated capacity of the scale for scales marked Class 0.1. ~~during an unloaded belt condition~~. Yes ☐ No ☐ N/A ☐

13.5.6. Sensitivity at Zero Load

No changes

13.5.7. Marking Requirements

No changes

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

No changes

13.5.9. RFI/EMI Environment

No changes

13.5.10. Laboratory Test Procedures

…

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:

a) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d.

~~a)~~b) for devices marked Class 0.1, for the time to deliver 2 000 d. ~~for the time to deliver 800d.~~

~~1.~~2. Reduce the line power supply to 85% of nominal (i.e.: 100 VAC or 20.4 VDC).

~~2.~~3. Run a zero test.

4. Run an accuracy test at 98 percent of scale capacity:

c) for devices marked Class 0.25 or those not marked with an accuracy class, for the time to deliver 800 d.

~~b)~~for devices marked Class 0.1, for the time to deliver 2 000 d. ~~for the time to deliver 800d.~~

~~3.~~5. Increase the line power supply to 110% of nominal (i.e.: 130 VAC or 26.4 VDC).

~~4.~~6. Run a zero test.

~~5.~~7. Run an accuracy test at 98 percent of scale capacity for the time to deliver 800d.

~~6.~~8. Return the line power supply to the nominal value.

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}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d. b) for devices marked Class 0.1, time to deliver 2 000 d.~~Time to deliver 800d~~	
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d. b) for devices marked Class 0.1, time to deliver 2 000 d.~~Time to deliver 800d~~	
98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d. b) for devices marked Class 0.1, time to deliver 2 000 d.~~Time to deliver 800d~~	
Leave MWT under simulated load for 1 hour		
98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d. b) for devices marked Class 0.1, time to deliver 2 000 d.~~Time to deliver 800d~~	
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d. b) for devices marked Class 0.1, time to deliver 2 000 d.~~Time to deliver 800d~~	
35% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, time to deliver 800 d.	

	b) for devices marked Class 0.1, time to deliver 2 000 d.~~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	_____

…

13.5.11. Field Test

No changes

13.5.12. Permanence Test

No changes

13.5.13. Data Sheet and Lab Test Procedure

…

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=(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
8. Determine the minimum and maximum totalized loads	MTL			ton
Test Conditions		**Abbrev.**		
	Test load, pound/foot			lb/ft

1. Determine the time n minutes to acquire MTL with the test load to be simulated in the laboratory	Test load, total			lb
	Time (minutes) to deliver MTL (at least 10 minutes for belt-conveyor scales or 1 minute for weigh-belt systems)	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: a) 800 d for devices marked Class 0.25 or those not marked with an accuracy class; and b) 2 000 d for devices marked Class 0.1~~800d~~.		BTR		revolutions
3. Allowable weighing error (units of weight) for simulated dynamic tests which will be divisions on master weight totalizer. AWE = (0.30)(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 for devices marked Class 0.25 or those not marked with an accuracy class, and 2 000 d for devices marked Class 0.1.
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}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800d~~		
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800d~~		
98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800d~~		
Leave MWT under simulated load for 1 hour			
98% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800d~~		
70% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800d~~		
35% of SSC_{max}	a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~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.

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

No changes...

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

No changes

National Type Evaluation Program
Belt-Conveyor Scales and Weigh-Belt Systems – Field Test Procedures

14. Field Test Procedure

….

Field Performance Test of the Belt-Conveyor Scale or Weigh-Belt System

N.2.1. Initial Verification
A belt-conveyor scale system or a weigh-belt system shall be tested using of a minimum of two test runs performed at each setting for belt speed/belt loading as indicated in Table N.2.1.

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
Constant Belt Speed and Constant Loading	- When system is operated only at a single flow rate, minimum of four test runs at the flowrate used in normal operation	*4

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.

*As provided in N.2.1. Initial Verification; for single flow rate systems, a minimum of four test runs at a single flow rate are required.

The r~~R~~ange of the results of test runs performed consecutively and under the same (or practically identical) test conditions shall not exceed the absolute value of the tolerance as specified in T.2.1. Tolerance Values, Repeatability Tests. The

results of each individual test shall be within the tolerance as specified in T.1. Tolerance Values.~~esults 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. For totalization operations performed consecutively under different test conditions (e.g., different flow rates, different test loads, different test material) during the conduct of material tests, the results relative to the weight of the reference material shall not exceed plus or minus (±) the tolerance as specified in T.2.2. Linearity Tests, for Systems that Operate Using Multiple or Variable Flow Rates. ~~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 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.~~

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.

N.2.2. Subsequent Verification

Subsequent testing shall include testing at the normal use flow rate and other flow rates used at the installation using a minimum of two consecutive test runs performed at each flow rate. The official with statutory authority may determine that testing only at the normal use flow rate is necessary for subsequent verifications if evidence is provided that the system is used to operate:

a. At no less than 70% of the maximum rated capacity for at least 80% of the time (excluding time that the belt is unloaded.)
OR

b. With a normal use flow rate that does not vary by more than 10% of the maximum rated capacity.

Example: If a belt-conveyor scale system has a maximum rated capacity of 200 tons per hour (tph), and the normal use flow rate is 150 tph (75% of the maximum rated capacity), no testing at additional flow rates is required provided the flow rates remain above 140 tph for more than 80% of the time. If the same device were operating with a normal use flow rate of 130 tph, it is operating at 65% of the maximum rated capacity. In this case, testing at flow rates in addition to the normal use flow rate would be required if the normal use flow rate varies by more than 20 tph (10% of the maximum rated capacity.) (Added 2004)

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 for systems not marked with an accuracy class, 800 scale divisions for systems marked Class 0.25, and 2 000 divisions for systems marked Class 0.1; or

(b) the load obtained at maximum flow rate in one revolution of the belt; or

(c) the load obtained during at least one minute of operation.

~~**800 scale divisions.**~~

~~**The load obtained at maximum flow rate in one revolution of the belt. OR**~~

~~**At least 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 for systems not marked with an accuracy class, 800 scale divisions for systems marked Class 0.25, and 2000 scale divisions for systems marked Class 0.1; or

(b) the load obtained at maximum flow rate in one revolution of the belt; or

~~(a)~~ the load obtained during at least ten minutes of operation.~~800 scale divisions.~~

~~(b) The load obtained at maximum flow rate in one revolution of the belt. OR~~

~~(c) At least 1 minute of operation.~~

~~(d)~~(c)

For application where the 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 2016)

N.3.1. Zero Load Tests

No changes

N.3.1.1. Determination of Zero

No changes

N.3.1.2. Test of Zero Stability (see also T.1.1. Tolerance Values – 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.~~:

(a) ± 0.06 % of the totalized load at full scale capacity for the duration of the test for scales not marked with an accuracy class;

(b) ± 0.06 % of the totalized load at full scale capacity for the duration of the test for scales marked Class 0.25; or

(c) ± 0.03 % of the totalized load of full scale capacity for the duration of the test for scales that are marked Class 0.1.

~~-~~No adjustments can be made during the three consecutive zero-load test readings.
(Added 2002) (Amended 2004 and 2009)

N.3.1.3. Check for Consistency of the Conveyor Belt along Its Entire Length

During a zero-load test with all operational low-flow lockout disabled, the total change indicated in the totalizer during any complete revolution of the belt shall not exceed the absolute value of 0.12% of the minimum totalized load.

Note: The end value of the zero-load test must meet the values referenced in N.3.1.2. Test for Zero Stability of:

(1) ± 0.06 % for scales not marked with an accuracy class;
(2) ± 0.06 % for scales marked Class 0.25; or
(3) ± 0.03 % for scales marked Class 0.1.

~~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)~~

Simulated Load Tests

No changes.

Material Tests

N.3.2. Material Tests

No changes

N.3.2.1. Accuracy of Material

The quantity of material comprising the material test shall be weighed statically or on an uncoupled-in-motion railroad track scale to an accuracy equal to:

(a) 0.1 % for scales not marked with an accuracy class and those marked Class 0.25; or

(b) 0.035 % for scales that are marked Class 0.1.

~~to or less than 0.1%.~~ The scale used to weigh material shall be tested immediately prior to running the material test. Typical scales used for this purpose include class II, III, III L scales, or a scale with the tolerances as described in Table T.1.1. of *NIST Handbook 44* Section 2.20.

T.1. Tolerance Values[3]

Maintenance and acceptance tolerances on material tests, relative to the weight of the material, shall be:

(a) ± 0.25 % of the test load for systems not marked with an accuracy class;

(b) ± 0.25 % of the test load for systems marked Class 0.25; and

(c) ± 0.1 % of the test load for systems marked Class 0.1.

~~**±0.25% of the test load.**~~

T.1.1. Tolerance Values – Test of Zero Stability. – Immediately after material has been weighed over the belt-conveyor scale during the conduct of any material test run, the zero-load test shall be repeated. The change in the accumulated or subtracted weight during the zero-load test shall not exceed:

(a) 0.12 % of the totalized load at full scale capacity for the duration of that test for scales that are not marked with an accuracy class;

(b) 0.12 % of the totalized load at full scale capacity for the duration of that test for scales marked Class 0.25; and

(c) 0.06 % of the totalized load at full scale capacity for the duration of the test for scales that are marked Class 0.1.

If the range of zero adjustments during a complete (official) verification test exceeds 0.18 % of the totalized load at full scale capacity for the duration of the zero-load test for unmarked scales and those marked Class 0.25 or 0.09 % of the totalized load at full scale capacity for the duration of the zero-load test for scales marked Class 0.1, the official with statutory authority may establish an interval for zero-load testing during normal operation.

Simulated Load Tests

No changes

15. Permanence Test

No changes

16. Data Sheet and Laboratory Test Procedure

Temperature Testing

…

Temperature Tests

3. Run a zero test. Do not reset zero or adjust the span at any time after the start of this test.
4. Apply a test load to the weighing element in a manner consistent with the normal loading of the scale.
5. At 20%C, test the scale dynamically to simulate the operation of the belt-conveyor scale. Test the scale at the following "flow rates" (all percent values represent percent loads of static scale capacity): 0 (zero test), 35%(SSC_{min}), 35%, 70%, 98%, leave scale under load for 1 hour, 98%, 70%, 35%, 35%(SSC_{min}), and 0 (zero test.)

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}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800 d~~		
70% of SSC_{max}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800 d~~		
98% of SSC_{max}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800 d~~		
Leave the scale under load for 1 hour.			
98% of SSC_{max}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800 d~~		
70% of SSC_{max}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d. b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 800 d~~		
35% of SSC_{max}	* a) for devices marked Class 0.25 or those not marked with an accuracy class, the time to deliver 800 d.		

	b) for devices marked Class 0.1, the time to deliver 2 000 d.~~Time to deliver 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		

* If results are near the tolerance limit for 1000 d, run a longer test.

Commented [JB2]: Check with NTEP – not sure if this note needs to remain.

...

150% Load Test

No changes.

Data Analysis

No changes

17. Dynamic Scale Test Work Sheet and Laboratory Test Procedure No. 1

No changes

18. Dynamic Scale Test Work Sheet and Laboratory Test Procedure No. 2

No changes

Appendix A

No changes