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:

Name	Organization	Telephone	Email
Peter Sirrico	Thayer Scale	781 826-8101 x 328	psirrico@thayerscale.com
Zacharias Tripoulas	State of MD NTEP Lab	410 841-5790	zacharias.tripoulas@maryland.gov
John Barton	NIST	301 975-4002	john.barton@nist.gov
Matthew David	East Kentucky Power Coop.	(859) 745-9645	matthew.david@ekpc.com
Nathan Gardner	Oregon Weights and Measures	(505) 991-4586	ngardner@oda.state.or.us
Bill Ripka	Thermo Fisher Scientific	(800) 445-3503	bill.ripka@thermofisher.com
Jim Truex	National Conference on Weights and Measures	(740) 919-4350	jim.truex@ncwm.net