National Council on Weights and Measures
Professional Certification Program

Module: 8.9
Large Capacity Weighing Systems (Registered Service Agents)

Overview and Scope

This module sets standards for basic inspection and testing of large static weighing systems over 150 kg (300 lb), both unmarked and marked, and typically marked Class III and III L. This includes static weighing applications using platform, hopper, livestock, railroad track and other designs. The module is focused on specific concepts related to device technology, operations, the specific inspection requirements and test procedures for these devices found in NIST Handbook 44, General Code, Scales, and Appendices A, B, C, and D, and NIST EPOs 7 (Medium Capacity Scales), 12 (Livestock and Animal Scales Part 1), and 13 (Vehicle and Axle-Load Scales), and NTEP Certificates of Conformance .

Prerequisites

Module 8.1 - NIST Handbook 44 and NIST Handbook 130 – Basic (Registered Service Agents)

Learning Objectives

1 Technology, Terminology and General Requirements Used in Large Capacity Scales

A registered serviceperson should understand the method of operation and the primary technology, terminology and general requirements associated with typical large capacity scales. To demonstrate this, the registered serviceperson can:

1.1 Identify the weighing technology (strain gage load cell, lever, etc.) used in the scale and identify the locations of the main load sensors.

1.2 Identify the indicator technology (analog, analog electronic, digital electronic, beam, dial, etc.) used in the scale.

1.3 Restate that these scales may be made up of weighing elements/modules and indicator elements/modules.

1.4 Explain that these scales may be interfaced with printers and may also be interfaced to computer systems that record and/or control the weighing operations.

1.5 Recognize that scale performance will vary with the size of the load , position of load, influences such as temperature, supply voltage, etc., and disturbances such as drafts, vibration, EMI/RFI, etc.

1.6 Locate and apply the definitions found in NIST Handbook 44, Appendix D.

1.7 Understand and apply NIST Handbook 44, General Code.

2 Scale Markings and Operations

A registered serviceperson should understand the various marking requirements applicable to a large capacity scale system and demonstrate the ability to properly operate a scale. To demonstrate this, the registered serviceperson can:

2.1 Recognize and interpret required identification markings on weighing equipment (Table 6.3.a.). Find the marking requirements in NIST Handbook 44 and apply them.

2.2 Recognize and interpret required markings on the controls, indications and features of a scale in this category.

2.3 Operate and evaluate the following functions/operations on a scale.

2.3.1 Power on/off

2.3.2 Zero

2.3.3 Tare - if scale has a tare function

2.3.4 Printing

2.3.5 Weigh-in/out features or other combinations particular to the application

2.4 Recognize and interpret the information displayed on a scale, including:

2.4.1 Gross, Net, and Tare weight indications

2.4.2 Center of Zero, Motion, and others

2.4.3 Underload/Overload error conditions

3 Applications, Tolerances and Performance Requirements for Scales with a Class Mark

A registered serviceperson should understand the classification system for static scales and be able to apply the performance standards under each class. To demonstrate this, the serviceperson can:

3.1 Recognize how basic tolerances, requirements for repeatability, sensitivity, discrimination, agreement of indications, and General Code performance requirements work together to define limits to deviations in scale performance.

3.2 Describe the organization of parameters for accuracy classes for marked scales specified in NIST Handbook 44, Scales, Table 3.

3.3 Determine if a given scale is suitable for weighing certain commodities by using NIST Handbook 44, Scales, Table 7a.

3.4 Determine if a scale conforms to the class declared by the manufacturer.

3.5 Compute tolerances for any class marked scale as shown in NIST Handbook 44, Scales, Table 6.

3.6 Understand how to find either the acceptance or maintenance tolerance for any load on a scale given the scale class, capacity and division size.

4 Applications, Tolerances and Performance Requirements for Unmarked Scales Not Marked with an Accuracy Class

A registered serviceperson should understand the differences in code applications for unmarked scales. To demonstrate this, the serviceperson can:

4.1 Understand how unmarked scales are defined from their application rather than class design as described in NIST Handbook 44, Section 2.20 Scales, Table 7.b. and Table T.1.1.

4.2 Determine if an unmarked scale is suitable for use in an application as specified in NIST Handbook 44, Section 2.20 Scales, Table 7.b.

4.3 Compute the tolerances for unmarked scales for a given test load and test procedures in accordance with NIST Handbook 44, Section 2.20 Scales, Table T.1.1.

5 Technical Requirements

A registered serviceperson should understand the various technical requirements applicable to a large capacity scale. To demonstrate this, the registered serviceperson can:

5.1 Apply the requirements regarding the following scale features/indications and identify where to find the requirements in NIST Handbook 44.

5.1.1 Zero load indications, zero setting operations, and automatic zero setting (zero tracking).

5.1.2 Scale capacities, scale divisions and limit of indications.

5.1.3 Motion detection requirements – zero, tare, printing, etc.

5.1.4 Design requirements for weighing elements.

5.1.5 Audit trails and methods of sealing

5.1.6 Requirements for weighbeams

5.2 Apply the requirements for matching weighing elements to indicating elements (modules) and identify where to find the requirements in NIST Handbook 44.

5.3 Apply the requirements for matching load cells to the specific scale application specified in NIST Handbook 44, Section 2.20 Scales, S.5.4.

5.4 Identify and apply the marking requirements found in NSIT Handbook 44, Section 2.20 Scales, Table S.6.3.a. and Table S.6.3.b.

6 User Requirements

A registered serviceperson should understand the various user requirements applicable to a large capacity scale. To demonstrate this, the registered serviceperson can:

6.1 Assess suitability of a large capacity scale for a given application, considering design, class (if marked), application and typical load, and be able to cite the appropriate sections of NIST Handbook 44 to support the assessment.

6.2 Apply requirements for scale installation in NIST Handbook 44, Section 2.20 Scales, UR.2. and all applicable subsections.

6.3 Apply general use requirements in NIST Handbook 44, Section 2.20 Scales, UR.3. and all applicable subsections.

6.4 Apply maintenance requirements in NIST Handbook 44, Section 2.20 Scales, UR.4. and all applicable subsections.

7 Basic Test Procedures

A registered serviceperson should be able to apply the appropriate performance tests to a large capacity scale and evaluate compliance with the applicable tolerances and performance standards. To demonstrate this, the registered serviceperson can:

7.1 Appraise whether the verification standards to be used in the test are appropriate for use in official tests.

7.2 Use test weights appropriately and care for them when not in use.

7.3 Determine minimum amounts of standards required for testing a given scale and minimum amounts of the test loads that must be applied in official tests.

7.4 Select appropriate test weights and test loads for an increasing load test for a given scale, perform the test, and evaluate the test results for compliance with applicable tolerances.

7.4.1 Correctly use substitution test procedures, where appropriate, given the available test weights and test loads.

7.4.2 Correctly use strain-load test procedures, where appropriate, given the available test weights and test loads.

7.5 Select appropriate test weights and test loads for a decreasing load test for a given scale, perform the test, and evaluate the test results for compliance with applicable tolerances.

7.6 Select appropriate test weights or test loads for a shift test for a given scale, perform the test, and evaluate the test results for compliance with applicable tolerances and agreement requirements.

7.7 Discuss appropriate times to perform a discrimination test or a repeatability test.

7.8 Select appropriate test weights for a discrimination test for a given scale, perform the test, and evaluate the test results for compliance with the applicable standards.

7.9 Select appropriate test weights or test loads for a repeatability test for a given scale, perform the test, and evaluate the test results for compliance with applicable tolerances and agreement requirements.

7.10 Decide when error weights should be used to precisely determine scale errors to less than one scale division, and demonstrate ability to determine the precise error of a scale in an appropriate test.

7.11 Select appropriate test weights for a sensitivity test for a given scale, perform the test, and evaluate the test results for compliance with the applicable standards.

7.11 Recognize and interpret an NTEP Certificate of Conformance (CoC) and that the scale system, as installed, conforms to the CoC.

7.12 Recognize and apply procedures in NIST EPOs 7, 9, 12 and 13 including safety notes and reminders.

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