NIST | OFFICE OF WEIGHTS AND MEASURES

Examination Procedure Outlines (EPOs) for Commercial Weighing and Measuring Devices

EPO No. 7

Medium-Capacity Scales

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EPO No. 7
NIST Examination Procedure Outline (EPO) for
Medium-Capacity Scales

1. Scope.

It is recommended this outline be followed as minimum criteria for examining medium-capacity portable platform scales and warehouse scales, including self-contained and built-in types, with the following types of indicating elements: beams, dials, and electronic digital-indicators. Requirements that apply only to scales marked with an accuracy class are indicated with an asterisk (*). Nonretroactive requirements are followed by the applicable date in parentheses.

On occasions when a handbook code requirement cites either its exceptions or applicability to specific scale types this device information in entirety is included in this EPO. The information is intended to provide the EPO user with additional details on the complete scope of the requirement across multiple device applications. Note that other EPOs are available which fully address inspection and test procedures for weighing applications or scale types for devices designated as Accuracy Class, I, II, and III that are cited but not the subject of this EPO.

2. Safety Notes.

When excerpting this Examination Procedure Outline for duplication, the "Safety Considerations" section and the "Glossary of Safety Key Phrases" should be duplicated and included with the outline.

Safety policies and regulations vary among jurisdictions. It is essential that inspectors or servicepersons be aware of all safety regulations and policies in place at the inspection site and to practice their employer's safety policies. The safety reminders included in this EPO contain general guidelines useful in alerting inspectors and servicepersons to the importance of taking adequate precautions to avoid personal injury. These guidelines can only be effective in improving safety when coupled with training in hazard recognition and control.

Prior to beginning any inspection, the inspector should read and be familiar with the EPO Safety Annex - "Safety Considerations and Glossary of Safety Key Phrases." The terms and key phrases in each safety reminder of this outline are found in the glossary of the EPO Safety Annex. The inspector is reminded of the importance of evaluating potential safety hazards prior to an inspection and taking adequate precautions to avoid personal injury or damage to the device. As a minimum, the following safety precautions should be noted and followed during the inspection:

- **Clothing**
- **Electrical Hazards**
- **Lifting**
- **Personal Protection Equipment**
  - e.g. Safety Shoes
- **Safety Data Sheets (SDS)**
- **Support—for Scale and Test Weights**
- **Transportation of Equipment**

Also

- **Wet/Slick Conditions**

- **Chemicals and Hazardous Materials**
- **Obstructions**

SAFETY REMINDER!!!

- **Check the inspection site carefully for safety hazards and take appropriate precautions.**
- **Learn the nature of hazardous products used at or near the inspection site.**
- **Use personal protection equipment appropriate for the inspection site.**
- **Be sure that a first aid kit is available and that the kit is appropriate for the type of inspection activity.**

3. Inspection.

NOTE: Code references used throughout the document are drawn from NIST Handbook 44 (HB 44) General Code (Section 1.10) and Scales Code (Section 2.20). The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only. The code section and paragraph designation(s) are then shown immediately after the corresponding line item or task listed in the procedure. For example, NIST HB 44 General Code (Section 1.10) is designated as "1.10:" followed by the paragraph designation(s) relevant to the line item. Nonretroactive requirements are followed by the applicable date in parentheses.

When a specific code requirement is applicable to a certain type of weighing device that kind of device is identified by a single letter designation. The specific "*Code Reference*:" is immediately followed on the next line by the statement "*Code Applies to*:" and the appropriate letter designation for each device type. A key to identify the meaning of each device-type letter designation appears at the beginning of each inspection and test section of the EPO.

Key to the letter designation used to identify the type of weighing device(s) the "*Code Applies to*:" are as follows:

B = Beam Scales
D = Dial Scales
E = Electronic digital scales
M = Scales marked with an accuracy designation
U = Unmarked scales

3.1. Accessibility and Assistance in Inspecting, Testing, and Sealing.

Device must be readily accessible for purposes of testing. Assistance shall be provided by the firm if needed.

Code Reference: 1.10: G-UR.2.3., G-UR.4.4.

3.2. Zero-Load Balance and Level Condition.

Check the zero-load balance and level condition as found. If the device is not indicating a zero-balance condition and/or level condition, the user should be made aware of these requirements and a warning issued if necessary. For prepackaging scales, check to determine if tare is being taken.

Code Reference: 2.20: UR.4.1., UR.4.2.

3.2.1. Zero Indication.

3.2.1.1. Zero Indication – General.

Code Reference: 2.20: S.1.1.

3.2.1.2. Zero Indication – Digital.

- Display of digital zero.
  Code Reference: 1.10: G-S.5.2.2.(d) (1/1/86).
  Code Applies to: M and E only.
- Digital zero, representation of balance condition.
  Code Reference: 2.20: S.1.1.1.(a).
  Code Applies to: E only.
- Zero deviation after zero setting.
  Code Reference: 2.20: S.1.1.(b) (1/1/25).
  Code Applies to: E only.
- Digital center-of-zero indication.
  Code Reference: 2.20: S.1.1.1.(c) (1/1/93).
  Code Applies to: E only.

3.2.1.3. Weighbeams - normal balance position.

Code Reference: 2.20: S.1.5.1.
Code Applies to: B only.

3.2.2. Zero-Load Adjustment.

3.2.2.1. General Means.

Code Reference: 2.20: S.2.1.1.

3.2.2.2. Manual and Semiautomatic Zero-Setting, Direct Sales.

Code Reference: 2.20: S.2.1.2.

3.2.2.3. Automatic Zero-Tracking (scales manufactured between 1/1/81 and 1/1/07).

Code Reference: 2.20: S.2.1.3.1.(a) and (c).
Code Applies to: E only.

3.2.2.4. Automatic Zero-Tracking (scales manufactured on or after 1/1/07).

Code Reference: 2.20: S.2.1.3.2.(b).
Code Applies to: E only.

3.2.2.5. Initial Zero-Setting Mechanism (may be a feature in Accuracy Class I, II, and III scales).

Code Reference: 2.20: S.2.1.5.

- Complete scales.
  Code Reference: 2.20: S.2.1.5.(a).
- Scales with separable components.
  Code Reference: 2.20: S.2.1.5.(b) (1/1/09).
  Code Applies to: E only.

3.2.3. Combined Zero-Tare ("0/T") Key for Scales Not Used in Direct Sales.
Code Reference: 2.20: S.2.1.6.
Code Applies to: E only.

3.2.4. Balance Indicator.
Code Reference: 2.20: S.2.2.
Code Applies to: B only.

3.2.4.1. Dairy Product Test, Grain Test, Prescription, and Class I And II Scales.
Code Reference: 2.20: S.2.2.1.

3.2.4.2. Equal-Arm Scale.
Code Reference: 2.20: S.2.2.2. (1/1/89).

3.2.5. Level-Indicating Means.
Code Reference: 2.20: S.2.4.

3.2.5.1. Level Condition.
Code Reference: 2.20: UR.4.2.

3.3. Selection and Suitability.

3.3.1. Suitability, General.
Code Reference: 1.10: G-UR.1.1., G-UR.1.2., 2.20: UR.1.

3.3.2. Special Designs.
Code Reference: 2.20: UR.3.6.

3.3.3. Adjustable Components.
Code Reference: 2.20: S.1.10.

3.3.4. Electronic Adjustable Components
Code Reference: 1.10: G-S.8. (1/1/90).
Code Applies to: E only.

3.3.5. Design of Weighing Devices, Accuracy Class.
Code Reference: 2.20: S.5*.

3.3.6. Designation of Accuracy Class.
Code Reference: 2.20: S.5.1. (1/1/86)*, UR.1.1.
Code Applies to: M only

3.3.7. Parameters for Accuracy Class.
Code Reference: 2.20: S.5.2. (1/1/86)*.
Code Applies to: M only.

3.3.8. Relationship of the Minimum Load Cell Verification Interval Value (v_{min}) to the Verification Scale Interval (e).

Code Reference: 2.20: S.5.4. (1/1/94).
Code Applies to: E only.

3.3.9. Typical Class for Weighing Applications.

Code Reference: 2.20: UR.1.1., Table 7a. and Table 7b.

3.3.10. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.
Code Applies to: M only.

3.3.10.1. Minimum Load, Grain Dockage Determination.

Code Reference: 2.20: UR.3.1.1.

3.3.11. Maximum Load.

Code Reference: 2.20: UR.3.2.

3.3.12. Environment.

3.3.12.1. Suitable for the environment in which it is used.

Code Reference: 1.10: G-UR.1.2.

3.3.12.2. Protection from environmental factors.

Code Reference: 2.20: UR.2.3.

3.3.13. Permanence.

Code Reference: 1.10: G-S.3.

3.4. Installation.

3.4.1. In Accordance with Manufacturer's Instructions.

Code Reference: 1.10: G-UR.2.1.

3.4.2. Indicating and Recording Elements.

Code Reference: 1.10: G-UR.2.2.

3.4.3. Foundation, Supports, and Clearance.

Code Reference: 2.20: UR.2.1., UR.2.4.

SAFETY REMINDER!!!

- **Check to be sure the scale supports are adequate to support the scale and test weights equal to the capacity of the scale!**

3.4.4. Position of Equipment.

Code Reference: 1.10: G-UR.3.3.

3.4.4.1. Customer Indications.
Code Reference: 2.20: S.1.8.4.

3.5. Use.

3.5.1. Facilitation of Fraud.
Code Reference: 1.10: G-S.2.

3.5.2. Method of Operation.
Code Reference: 1.10: G-UR.3.1.

Special designs. Scales designed and marked for special applications shall not be used for other than the intended purpose.
Code Reference: 1.10: G-UR.3.1., 2.20: UR.3.6.

3.5.3. Operation with Associated and Nonassociated Equipment.
Code Reference: 1.10: G-UR.3.2.

3.5.4. Recommended Minimum Load.
Code Reference: 2.20: UR.3.1.

3.5.5. Maximum Load.
Code Reference: 2.20: UR.3.2.

3.6. Maintenance.

3.6.1. Maintenance of Equipment, General.
Code Reference: 1.10: G-Ur.4., G-Ur.4.1.

3.6.2. Abnormal Performance.
Code Reference: 1.10: G-Ur.4.2.

3.6.3. Scale Modification.
Code Reference: 2.20: Ur.4.3.

3.6.4. Use of Adjustments.
Code Reference: 1.10: G-Ur.4.3.

3.6.5. Check for the Presence of Security Seals on Any Component Designed to be Sealed.
Code Reference: 1.10: G-UR.4.5.

3.7. Design of Weighing Devices.
Code Reference: 2.20: S.5*.
Code Applies to: M only.

3.7.1. Designation of Accuracy Class.
Code Reference: 2.20: S.5.1. (1/1/86)*, UR.1.1.

3.7.2. Parameters for Accuracy Class.

Code Reference: 2.20: S.5.2. (1/1/86)*.

3.7.3. Multi-Interval/Multiple-Range Scale Division Value.

Code Reference: 2.20: S.5.3.
Code Applies to: M and E only.

3.7.4. Relationship of the Value of the Minimum Load Cell Verification Interval to the Scale Interval.

Relationship of the minimum load cell verification interval (v_{min}) to the value of the scale interval (e).

Code Reference: 2.20: S.5.4. (1/1/94).
Code Applies to: M and E only.

3.7.5. Class III, III L, and IIII Scales Value of the Verification Scale Interval.

Relationship of the verification scale interval (e) of a weighing/load-receiving element to the value of the scale division (d). Except for dynamic monorails and weight classifiers, the value of "e" must be equal to "d" on Class III, III L, and IIII scales.

Code Reference: 2.20: S.1.2.2.2*.
Code Applies to: M only.

3.7.6. Weight Classifiers Value of the Verification Scale Interval (e).

On a weight classifier such as a postal or shipping scale that rounds up and is marked for special use, the value of "e" shall be equal to "d."

Code Reference: 2.20: S.1.2.2.2.2.

3.7.7. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.

3.8. Marking.

3.8.1. Markings – Overview.

3.8.1.1. Identification.

Code Reference: 1.10: G-S.1., G-S.1.1. (1/1/04), G S.1.2.

3.8.1.2. Size and character; designation and marking of subordinate values.

Code Reference: 1.10: G-S.5.2.3.

3.8.1.3. Values.

Code Reference: 1.10: G-S.5.2.4.

3.8.1.4. Permanence of Markings.

Code Reference: 1.10: G-S.5.2.5.

3.8.1.5. Accuracy Class.

Code Reference: 2.20: S.5.

3.8.1.6. Location.

Code Reference: 2.20: S.6.2.

3.8.1.7. Specific Scales Code markings.

Code Reference: 2.20: S.6.3., Table S.6.3.a. and Table S.6.3.b.

3.8.1.8. Special Design.

Scale designed for special application rather than general use shall be marked to restrict its use to that application.

Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b. (1/1/86), UR.3.6.

Except for Class I and II prescription scales which meet NIST HB 44 requirements for counting features, scales with operational counting feature must be marked to show counting feature is not legal for trade.

Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b.

3.8.2. Marking Requirements – All Devices.

3.8.2.1. Scales, General.

Code Reference: 2.20: S.6.

3.8.2.2. Identification.

Code Reference: 1.10: G-S.1.

3.8.2.2.1. Name, Initials, or Trademark of Manufacturer or Distributor.

Code Reference: 1.10: G-S.1.(a) (Retroactive).

3.8.2.2.2. Model Identifier.

Code Reference: 1.10: G-S.1.(b) (Retroactive).

Model identifier prefix and acceptable abbreviation for “model” and “number.”
Code Reference: 1.10: G-S.1.(b)(1) (1/1/03).

3.8.2.2.3. Nonrepetitive Serial Number.

Code Reference: 1.10: G-S.1.(c) (1/1/68).

Serial number prefix.
Code Reference: 1.10: G-S.1.(c)(1) (1/1/86).

Acceptable abbreviations for “serial” and “number.”
Code Reference: 1.10: G-S.1.(c)(2) (1/1/01).

3.8.2.2.4. Software Version or Revision Identifier, Software-Based Devices.

3.8.2.2.4.1. Software version or revision identifier for not-built-for-purpose software-based devices.

Code Reference: 1.10: G-S.1.(d) (1/1/04).

3.8.2.2.4.2. Software version or revision identifier for all software-based devices.

Code Reference: 1.10: G-S.1.(d) (1/1/22).

3.8.2.2.4.3. Software version or revision identifier preface.

Code Reference: 1.10: G-S.1.(d)(1)(i) (1/1/07).

3.8.2.2.4.4. Software version or revision identifier is continuously displayed or accessible via the display.

Code Reference: 1.10: G-S.1.(d)(1)(ii) (1/1/22).

3.8.2.2.4.5. Abbreviations for "version," "number," and "revision."

Code Reference: 1.10: G-S.1.(d)(2) (1/1/07).

3.8.2.2.5. NTEP CC number for devices with NTEP CC.

Code Reference: 1.10: G-S.1.(e).

3.8.2.2.5.1. NTEP CC prefix and number (with appropriate designation).

Code Reference: 1.10: G-S.1.(e) (1/1/03).

3.8.2.3. Location of marking information for not-built-for-purpose, software-based devices.

Code Reference: 1.10: G-S.1.1. (1/1/04).

3.8.2.4. Devices or Main Elements Remanufactured as of 1/1/02.

Code Reference: 1.10: G-S.1.2. (1/1/02).

Name, initials, or trademark of last remanufacturer or distributor.
Code Reference: 1.10: G-S.1.2.(a) (1/1/02).

Model designation if different from original model designation.
Code Reference: 1.10: G-S.1.2.(b) (1/1/02).

3.8.2.5. Operational Controls, Indications, and Features.

Code Reference: 1.10: G-S.6. (1/1/77).

3.8.2.6. Lettering.

Code Reference: 1.10: G-S.7.

3.8.2.7. Visibility of Identification – Installation to ensure ready visibility of markings.

Code Reference: 1.10: G-UR.2.1.1.

3.8.2.8. Interchange or Reversal of Parts.

Code Reference: 1.10: G-S.4.

3.8.2.9. Special Application.

Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b. Note 13, UR.3.6.

- Scales designed for special application appropriately marked to restrict its use (e.g. postal scale, prepack scale, weight classifier).
  Code Reference: Note 13 (Nonretroactive 1/1/86).

- Scales with operational counting feature marked "counting feature not legal for trade" except for Class I and II prescription scales complying with all NIST HB 44 requirements for counting features.
  Code Reference: Retroactive.

3.8.3. Marking Requirements – Weighing, load-receiving, and indicating element in same housing or covered on the same CC (in addition to "marking requirements - all devices").

Code Reference: 2.20: S.6.3., Table S.6.3.a. and Table S.6.3.b.

3.8.3.1. Accuracy Class.

Code Reference: Note 17 (Nonretroactive 1/1/86).
Code Applies to: M only.

3.8.3.2. Nominal Capacity.

Code Reference: Note 3 Retroactive (portions Nonretroactive) and Note 4.

Where the value of "e" is equal to the value of "d," the nominal capacity shall be shown together with the value of the scale division "d" or the verification scale interval "e."

Code Reference: Note 3 (Nonretroactive 1/1/83).

For any scale that has no "d" or where "e" does not equal "d", the nominal capacity shall be shown together with the value of the scale division "d" and the verification scale interval "e."

Code Reference: Note 4 (Nonretroactive 1/1/86).

3.8.3.3. Temperature Limits.

Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F).

Code Reference: Note 5 (Nonretroactive 1/1/86).
Code Applies to: M only.

3.8.4. Marking Requirements – Indicating element not permanently attached or covered on separate CC (in addition to markings for all devices).

Code Reference: 2.20: S.6.3., Table S.6.3.a. and Table S.6.3.b.

3.8.4.1. Accuracy Class.

Code Reference: Note 8 (Nonretroactive 1/1/88).
Code Applies to: M only.

3.8.4.2. Nominal Capacity.

Code Reference: Note 3 (portions Nonreteroactive).

Where the value of "e" is equal to the value of "d," the nominal capacity shall be shown together with the value of the scale division "d" or the verification scale interval "e."

Code Reference: Note 3 (Nonretroactive 1/1/83)

For any scale that has no "d" or where "e" does not equal "d", the nominal capacity shall be shown together with the value of the scale division "d" and the verification scale interval "e."

Code Reference: Note 4 (Nonretroactive 1/1/86)

3.8.4.3. Temperature Limits.

Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F).

Code Reference: Note 5 (Nonretroactive 1/1/86).
Code Applies to: M only.

3.8.4.4. Maximum Number of Verification Scale Intervals.

Maximum number of verification scale intervals (n_{max}).

Code Reference: Note 8 (Nonretroactive 1/1/88).

3.8.5. Marking Requirements – Weighing and load-receiving element not permanently attached or covered on separate CC (in addition to marking for all devices).

Code Reference: 2.20: S.6.3., Table S.6.3.a. and Table S.6.3.b.

3.8.5.1. Accuracy Class.

Code Reference: Note 19 (Nonretroactive 1/1/88).
Code Applies to: M only.

3.8.5.2. Nominal Capacity.

Code Reference: Note 3 Retroactive (portions Nonretroactive 1/1/83), Note 18.

3.8.5.3. Temperature Limits.

Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F).

Code Reference: Note 5 (Nonretroactive 1/1/86).
Code Applies to: M only.

3.8.5.4. Maximum Number of Verification Scale Intervals.

Maximum number of verification scale intervals (n_{max}).

Code Reference: Note 19 (Nonretroactive 1/1/88).
Code Applies to: M only.

3.8.5.5. Minimum Verification Scale Division.

Minimum verification scale division for which device complies with the requirements (e_{min} or d).

Code Reference: Note 19 (Nonretroactive 1/1/88).
Code Applies to: M only.

3.8.6. Marking Requirements –Load Cell with Certificate of Conformance (in addition to marking for all devices).

Code Reference: 2.20: S.6.3., Table S.6.3.a. and Table S.6.3.b., S.5.4. (1/1/94).
Code Applies to: E only.

Note: Requires information on a data plate attached to the load cell or in an accompanying document. If a document is provided, the serial number shall appear on the load cell and in the document.

Code Reference: Note 11 (Nonretroactive 1/1/88).

3.8.6.1. G-S.1. information, including the following shall be marked on both the load cell and in accompanying documents.

Code Reference: Note 11 (Nonretroactive 1/1/91).

- Manufacturer's name or trademark.
  Code Reference: Note 11 (Nonretroactive 1/1/91).
- Model designation.
  Code Reference: Note 11 (Nonretroactive 1/1/91).
- Model designation prefix.
  Code Reference: Note 11 (Nonretroactive 1/1/91).
- Serial number.
  Code Reference: Note 11 (Nonretroactive 1/1/91).
- Serial number prefix.
  Code Reference: Note 11 (Nonretroactive 1/1/91).
- Abbreviation for word "serial."
  Code Reference: Note 11 (Nonretroactive 1/1/91).

3.8.6.2. Accuracy Class.

Code Reference: Note 17 (Nonretroactive 1/1/86).
Code Applies to: M only.

3.8.6.3. Temperature Limits If Narrower Than and Within – 10 °C to 40 °C (14 °F to 104 °F).

Code Reference: Note 5 (Nonretroactive 1/1/86).

3.8.6.4. Maximum Number of Verification Scale Intervals (n_{max}).

Code Reference: Note 6 (Nonretroactive 1/1/88).

3.8.6.5. "S" or "M" for Single or Multiple Cell Applications.

Code Reference: Note 7 (Nonretroactive 1/1/88).

3.8.6.6. Direction of loading, if not obvious.

Code Reference: Note 15 (Nonretroactive 1/1/88).

3.8.6.7. Minimum Dead Load, Maximum Capacity, Safe Load Limit, and Load Cell Verification Interval (v_{min}).

Code Reference: Note 11 (Nonretroactive 1/1/88).

3.8.6.8. Load Cell Verification Internal (v_{min}) stated in mass units.

Code Reference: Note 21 (Nonretroactive 1/1/01).

3.9. Indicating and Recording Elements.

3.9.1. Appropriateness of Design.

3.9.1.1. Accuracy Class.

Code Reference: 2.20: S.5*.
Code Applies to: M only.

3.9.1.2. Computing Capability (for price computing scales).

Code Reference: 2.20: S.1.8.

3.9.1.3. Indicating and Recording Elements, General.

Code Reference: 1.10: G-S.5.

3.9.1.4. Capacity Indication, Weight Ranges, and Unit Weights.

This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically derived totalized values.

Code Reference: 2.20: S.1.7.

3.9.1.5. Maximum Range of Initial Zero-Setting Mechanism.

- Complete scales.
  Code Reference: 2.20: S.2.1.5.(a).
- Scales with separable components.
  Code Reference: 2.20: S.2.1.5.(b) (1/1/09).
  Code Applies to: E only.

3.9.1.6. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.
Code Applies to: M and E only.

3.9.1.7. Maximum Load.

Code Reference: 2.20: UR.3.2.

3.9.2. Display Height. For electronic cash registers (ECRs) and point-of-sale systems (POS systems) the display of measurement units, including those part of video displays and other user-provided indicating elements shall be a minimum of 9.5 mm (3/8 inch) in height.

Code Reference: 2.20: S.1.1.1.(d) (1/1/21), UR.2.10. (1/1/21).
Code Applies to: E only.

3.9.3. Value of Scale Division and/or Interval.

3.9.3.1. Value – General.

Code Reference: 1.10: G-S.5.3., G-S.5.3.1., 2.20: UR.1.1.(b).

Code Applies to: M only.

3.9.3.2. Value of Scale Units.

Code Reference: 2.20: S.1.2. (1/1/86)*.

3.9.3.3. Digital Indicating Scales, Units.

Code Reference: 2.20: S.1.2.1. (1/1/89).
Code Applies to: M and E only.

Class I and II scales, with an auxiliary indications and the value of the verification scale interval (e) general.

Code Reference: 2.20: S.1.2.2.2.1.
Code Applies to: M only.

Except for dynamic monorail scales and weight classifiers, the value of "e" must be equal to "d" on Class III, III L, and IIII scales.

Code Reference: 2.20: S.1.2.2.2*.
Code Applies to: M only.

On a weight classifier such as a postal or shipping scale that rounds up and is marked for special use, the value of "e" shall be equal to "d."

Code Reference: 2.20: S.1.2.2.2.2.
Code Applies to: M only.

3.9.3.4. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.
Code Applies to: M only.

3.9.3.5. Recorded scale division shall be the same as the value of the indicated division, except for Class I scales.

Code Reference: 2.20: UR.1.3. (1/1/86), UR.1.3.1.(a).

3.9.3.6. Multi-Interval and Multiple-Range Scales.

Code Reference: 2.20: S.5.3.

3.9.3.7. Prepackaging Scales Only.

Code Reference: 2.20: S.1.9.

3.9.4. Graduations.

Code Reference: 2.20: S.1.3.

3.9.5. Indicators.

Code Reference: 2.20: S.1.4.

3.9.6. Price Computing.

Verify appropriateness of graduations, computations, and agreement of indications and associated recorded representations and customer indications on any price-computing scale or system.

Code Reference: 1.10: G-S.5.5., 2.20: S.1.8.

3.9.7. Prepackaging Scales Only.

Code Reference: 2.20: S.1.9.1.

3.9.8. Tare.

3.9.8.1. Value of Tare Division.

Code Reference: 2.20: S.2.3. (1/1/83).

3.9.8.2. Tare Mechanism.

Code Reference: 2.20: S.2.3.

3.9.8.3. Combined Zero-Tare ("0/T") Key.

Code Reference: 2.20: S.2.1.6.

3.9.9. Repeatability.
Code Reference: 1.10: G-S.5.4.

3.9.10. Recorded Representations.

3.9.10.1. Recorded Representations, General.
Code Reference: 1.10: G-S.5.6., 2.20: UR.1.3. (1/1/86).

3.9.10.2. Recorded Representations, Prepackaging Scales.
Code Reference: 2.20: S.1.9.2.

3.9.10.3. Recorded Representations, Abbreviations of Units.
Code Reference: 1.10: G-S.5.6.1.

- Equipment manufactured on or after January 1, 2008.
  Code Reference: 1.10: G-S.5.6.1.(a).
- Equipment manufactured prior to January 1, 2008.
  Code Reference: 1.10: G-S.5.6.1.(b), Table 1.

3.9.10.4. Devices that indicate or record in more than one unit.
Code Reference: 1.10: G-S.5.3.1.

3.9.11. Weighbeams.
Code Reference: 2.20: S.1.5.
Code Applies to: B and D only.

3.9.12. Poises.
Code Reference: 2.20: S.1.6.
Code Applies to: B and D only.

3.9.13. Dials and balance indicators with graduations having a specific value.

3.9.13.1. Graduations.
Code Reference: 2.20: S.1.3.1., S.1.3.2., S.1.3.3.
Code Applies to: B and D only.

3.9.13.2. Indicators.
Code Reference: 2.20: S.1.4.1., S.1.4.2., S.1.4.3.
Code Applies to: B and D only.

3.9.13.3. Clearance.
Code Reference: 2.20: S.1.4.4.

3.9.13.4. Parallax.
Code Reference: 2.20: S.1.4.5.

3.9.14. Damping.

3.9.14.1. Damping Means.
Code Reference: 2.20: S.2.5.

3.9.14.2. Motion Detection, Digital Indicating Elements.
Code Reference: 2.20: S.2.5.1.(b)
Code Applies to: E only.

3.9.15. Adjustable Components.
Code Reference: 2.20: S.1.10.

3.9.16. Manual Weight Entries.
Code Reference: 2.20: S.1.12. (Portion 1/1/93, Portion 1/1/05), UR.3.10.

3.10. Weighing Elements.

3.10.1. Antifriction Means.
Code Reference: 2.20: S.4.1.

3.10.2. Adjustable Components.
Code Reference: 2.20: S.1.10., S.4.2.

3.10.3. Multiple Load-Receiving Elements.
Code Reference: 2.20: S.4.3.
Code Applies to: E only.

3.10.4. Drainage, if wet commodities are weighed.
Code Reference: 2.20: S.3.2., UR.3.7.

3.10.5. Scoop Counterbalance.
Code Reference: 2.20: S.3.3.

3.11. Provision for Sealing.

3.11.1. Sealing, General.
A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.
Code Reference: 1.10: G-S.8. (1/1/90).

A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.
Code Reference: 1.10: G-S.8., 2.20: S.1.11.2.

Except for devices and systems adjusted using a removable digital storage device and Class I scales, the following provisions for sealing apply:
Code Reference: 2.20: S.1.11.2.

Provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device.
Code Reference: 2.20: S.1.11.2.(a) (1/1/79).

A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.
Code Reference: 2.20: S.1.11.2.(b) (1/1/90).

Audit trails shall use the format set forth in Table S.1.11. Categories of Device and Methods of Sealing.
Code Reference: 2.20: S.1.11.2 (c)(1/1/95), Table S.1.11. (1/1/95).

3.11.2. A metrologically-significant software change is a sealable event.
Code Reference: 1.10: G-S.9.
Code Applies to: E only.

3.11.3. Weight Classifier Option. Scales with option to function as a weight classifier or a normal round off scale shall be provided with a sealable means for selecting the mode and a clear annunciator adjacent to the display indicating the weight classifier mode.
Code Reference: 2.20: S.1.8.4.1. (1/1/01).
Code Applies to: E only.

3.11.4. Physical Means of Security.

3.11.4.1. Security Seals. Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new ones as needed.
Code Reference: 1.10: G-UR.4.5.

3.11.4.2. Accessibility to Security Seals. When applicable, the adjusting mechanism shall be readily accessible for the purpose of affixing a security seal. The device shall be installed or located such that access is provided to permit inspecting and applying security seals.
Code Reference: 1.10: G-UR.2.3.

3.11.5. Parameters Accessed Via Removable Digital Storage.
For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device**, such as a secure digital (SD) card, USB flash drive, etc., security shall be provided for those parameters using either:

(1) an event logger in the device; or
(2) a physical seal that must be broken in order to remove the digital storage device from the device (or system).

** This applies only to removable digital storage devices that must remain in the device or system for it to be operational.
Code Reference: 1.10: G-S.8.2., 2.20: S.1.11., Table S.1.11. (1/1/95).

3.11.6. Audit Trails, General.

3.11.6.1. Audit Trail Information. If the system is equipped with an audit trail, note the event counter settings on the report form for future reference. If equipped with an event logger, print a copy of the event log and attach it to the report form for future reference.

Note that on some systems an electronic copy of the event log may also be available; however, the system must still be able to provide a hard copy. Examine these records for any signs of misuse of adjustments.

Code Reference: 1.10: G-S.8. (1/1/90), 2.20: S.1.11.1., S.1.11.2.(c) (1/1/95), Table S.1.11. (1/1/95).
Code Applies to: E only.

3.11.6.2. Single Provision for Sealing Multiple Elements. For multiple measuring elements with a single provision for sealing, a change to the adjustment of any measuring element must be individually identified.

Code Reference: 1.10: G-S.8.1. (1/1/10).
Code Applies to: E only.

3.11.7. Event Logger.

If security is provided using an event logger, the event logger shall include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter.

The event logger information must be available on demand through the device or through another on-site device at the time of inspection.

In addition to providing a printed copy of the information, the information may be made available electronically.

The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (**Note:** Does not require 1000 changes to be stored for each parameter.)

Code Reference: 1.10: G-S.8. (1/1/90), 2.20: S.1.11., Table S.1.11. (1/1/95).

4. Pretest Determinations.

NOTE: Code references used throughout the document are drawn from NIST Handbook 44 (HB 44) General Code (Section 1.10) and Scales Code (Section 2.20). The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only. The code section and paragraph designation(s) are then shown immediately after the corresponding line item or task listed in the procedure. For example, NIST HB 44 General Code (Section 1.10) is designated as "1.10:" followed by the paragraph designation(s) relevant to the line item. Nonretroactive requirements are followed by the applicable date in parentheses.

When a specific code requirement is applicable to a certain type of weighing device that kind of device is identified by a single letter designation. The specific "*Code Reference*:" is immediately followed on the next line by the statement "*Code Applies to*:" and the appropriate letter designation for each device type. A key to identify the meaning of each device-type letter designation appears at the beginning of each inspection and test section of the EPO.

Key to the letter designation used to identify the type of weighing device(s) the "*Code Applies to*:" are as follows:

B = Beam Scales

D = Dial Scales

E = Electronic digital scales
M = Scales marked with an accuracy designation
U = Unmarked scales

4.1. Tolerances – General.

4.1.1. Acceptance/Maintenance.

Code Reference: 1.10: G-T.1., G-T.2.

4.1.2. Application.

Code Reference: 1.10: G-T.3.

4.1.3. Intermediate Values

Code Reference: 1.10: G-T.4.

4.1.4. Principles.

Code Reference: 2.20: T.N.1.
Code Applies to: M only.

4.2. Tolerances – Values.

4.2.1. Tolerances on Tests When Type 2 Transfer Standards Are Used.

Code Reference: 1.10: G-T.5.

When Type 2 transfer standards are used to conduct accuracy tests, adjust the tolerances as described in General Code paragraph G-T.5. Tolerances on Tests When Type 2 Transfer Standards Are Used.

4.2.2. Determine the Number of Verification Scale Intervals (n).

Using the following formula[1] determine the number of verification scale intervals (n):

$$n = \frac{Scale\ Capacity}{Value\ of\ the\ Verification\ Scale\ Interval\ (e)}$$

4.2.3. Unmarked Scales – Tolerance Values.

Code Reference: 2.20: T.1.1.

4.2.3.1. Unmarked Scales With "n" Equal to 5000 or Less.

Code Reference: 2.20: Table T.1.1.

Apply Class III, T.N.3.1. as specified in Table 6., or T.N.3.2. in accordance with the instructions indicated in Table T.1.1. Tolerances for Unmarked Scales. Also apply "Other Applicable Requirements" (T.N. paragraphs referenced in Table T.1.1.).

[1] On a multiple range or multi-interval scale, the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of verification scale intervals, (n), for each weighing range is determined by dividing the scale capacity for each range by the verification scale interval, (e), for each range. On a scale system with multiple load-receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class. (See NIST HB 44 Section 2.20. Table 3 Parameters for Accuracy Classes, Footnote 3, Added 1997, Amended 2024)

4.2.3.2. Unmarked Scales With "n" Greater Than 5000.

Code Reference: 2.20: Table T.1.1.

Apply the tolerances specified in Table T.1.1. Tolerances for Unmarked Scales and the corresponding T.N. paragraphs referenced in the Table.

4.2.3.3. Unmarked Postal and Parcel Post Scales – Tolerance Values.

Code Reference: 2.20: T.1.1., Table T.1.1., T.1.2., Table 5.

4.2.4. Marked Scales – Tolerance Values.

Code Reference: 2.20: T.N.2.1.

4.2.4.1. Subsequent Verification Examinations.

Code Reference: 2.20: T.N.2.3.

4.2.4.2. Multi-Interval and Multiple Range Scales.

Code Reference: 2.20: T.N.2.4.

4.2.4.3. Ratio Tests (scales equipped with commercial weights).

Code Reference: 2.20: T.N.2.5.
Code Applies to: B only.

4.2.4.4. Maintenance Tolerance Values.

Code Reference: 2.20: T.N.3.1. [Table 6 (Class III)]

4.2.4.5. Acceptance Tolerance Values.

Code Reference: 2.20: T.N.3.2.

4.2.4.6. Tolerances for Substitution Test.

Code Reference: 2.20: T.N.3.11.

4.2.4.7. Tolerances for Strain-Load Test.

Code Reference: 2.20: T.N.3.12.

4.2.4.8. Multiple Indicating/Recording Elements.

Code Reference: 2.20: T.N.4.1.

4.2.4.9. Single Indicating/Recording Elements.

Code Reference: 2.20: T.N.4.2.

4.2.4.10. Single Indicating Element/Multiple Indications.

Code Reference: 2.20: T.N.4.3.

4.2.4.11. Shift Test or Section Test (agreement of indications).

Code Reference: 2.20: T.N.4.4.
Code Applies to: M only.

4.2.4.12. Repeatability.

Code Reference: 2.20: T.N.5.

4.3. Sensitivity.

4.3.1. Application.

Code Reference: 2.20: T.2.1.
Code Applies to: U and B only.

4.3.1.1. General.

Code Reference: 2.20: T.2.2.
Code Applies to: U and B only.

4.3.1.2. Sensitivity Requirement, Equilibrium Change.

Code Reference: 2.20: T.3.
Code Applies to: U and B only.

4.3.1.3. Sensitivity.

Code Reference: 2.20: T.N.6.
Code Applies to: M and B only.

4.4. Discrimination.

4.4.1. Analog Automatic Indicating.

Analog automatic indicating (includes balance indicators with graduations having specific values).

Code Reference: 2.20: T.N.7.1.
Code Applies to: M and D only.

4.4.2. Digital Automatic Indicating.

Code Reference: 2.20: T.N.7.2.
Code Applies to: E only.

4.5. Minimum Test Weights and Test Loads.

Code Reference: 2.20: N.3., Table 4.

5. Test Notes.

NOTE: Code references used throughout the document are drawn from NIST Handbook 44 (HB 44) General Code (Section 1.10) and Scales Code (Section 2.20). The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only. The code section and paragraph designation(s) are then shown immediately after the corresponding line item or task listed in the procedure. For example, NIST Handbook 44 (HB 44) General Code (Section 1.10) is designated as "1.10:" followed by the paragraph designation(s) relevant to the line item. Nonretroactive requirements are followed by the applicable date in parentheses.

When a specific code requirement is applicable to a certain type of weighing device that kind of device is identified by a single letter designation. The specific "*Code Reference*:" is immediately followed on the next line by the statement "*Code Applies to*:" and the appropriate letter designation for each device type. A key to identify the meaning of each device-type letter designation appears at the beginning of each inspection and test section of the EPO.

Key to the letter designation used to identify the type of weighing device(s) the "*Code Applies to*:" are as follows:

B = Beam Scales
D = Dial Scales
E = Electronic digital scales
M = Scales marked with an accuracy designation
U = Unmarked scales

5.1. Test Methods. Permissible test methods for verifying compliance of commercial weighing and measuring systems with the provisions of NIST Handbook 44 include, but are not limited to, test methods and apparatus that have been approved by the Director as outlined in NIST HB 44 Appendix A – Fundamental Considerations.

Code Reference: 1.10: G-N.3., Appendix A – Fundamental Considerations.

5.2. Zero-Load Balance and Level Condition.

Code Reference: 2.20: UR.4.1., UR.4.2.

- Check for maintenance of the zero-load balance and level condition.
- Establish correct zero-load balance and level conditions prior to beginning the test.
- For scales equipped with nonautomatic (beam) indication, balance small error weights on the platform, the smallest weight being equal to the minimum tolerance value at maximum test load.

5.3. Repeatability and Agreement of Indications. Check repeatability of, and agreement among, indications throughout the test.

5.3.1. Repeatability of Indications.

Code Reference: 1.10: G-S.5.4., 2.20: T.N.4., T.N.5.

5.3.2. Digital Indication and Representation.

Code Reference: 1.10: G-S.5.2.2.

5.4. Return to Zero-Load Balance. Recheck the zero-load balance each time the test load is removed.

5.4.1. Zero-Load Balance Change.

Code Reference: 2.20: N.1.9.

5.4.2. Abnormal Performance.

Code Reference: 1.10: G-UR.4.2.

5.5. Recorded Representations – Availability.

Verify that any options for obtaining a recorded representation are appropriate. For systems required by the Scales Code to issue a recorded representation, the recorded representation shall be made available to the customer in hard copy form unless otherwise specified by the customer. The customer may be given the option of not receiving the recorded representation. If the system is equipped with the capability of issuing an electronic receipt, the customer may also be given the option of receiving the recorded representation electronically (e.g., via cell phone, computer, etc.) in lieu of or in addition to a hard copy.

Code Reference: 1.10: G-S.5.6.

5.6. Steps at Each Test Load – Recorded Representations.

If scale is equipped with a ticket printer or type-recording beam, print ticket at each test load. Check the effectiveness of motion detection.

5.6.1. Digital Indication and Representations, Agreement and Display. Check that any recorded representations for weight, unit price, and total sale agree with their associated corresponding values that are displayed and are appropriately displayed.

Code Reference: 1.10: G-S.5.2.2., G-S.5.6., 2.20: S.1.8.3
Code Applies to: E only.

5.6.2. Motion Detection. Check the effectiveness of motion detection.

Code Reference: 2.20: S.2.5.1.(b).

Value of the Indicated and Recorded Scale Division. Verify that the value of the scale division as recorded on the recorded representation is the same as the division value indicated.

Code Reference: 2.20: UR.1.3. (1/1/86).

5.7. Steps at Each Test Load – Price Computations and Display (Computing Devices).

5.7.1. Money Value, Mathematical Agreement. Verify price calculations based on weight are rounded to the nearest cent.

Code Reference: 1.10: G-S.5.5.

5.7.2. Price Computations. Check price computations on all indicators in the system and on any recorded representation.

Code Reference: 1.10: G-S.5.6.

5.8. Zone of Uncertainty and Width of Zero. If, during the conduct of the test, the performance of the device is questionable with respect to the zone of uncertainty or the width of zero, adequate tests should be conducted to determine compliance; however, they must be conducted under controlled conditions.

5.8.1. Digital Indicating Elements.

Code Reference: 2.20: S.1.1.1.(a), S.1.1.1.(c) (1/1/93).
Code Applies to: E only.

5.8.2. Discrimination Test.

Code Reference: 2.20: N.1.5. (1/1/86)
Code Applies to: M, D, and E only.

5.8.3. Digital Device - Test Point for Discrimination Test.

Code Reference: 2.20: N.1.5.1.
Code Applies to: E only.

5.9. Operational Features. If the scale is equipped with operational features such as manual weight entries, programmable tare, multiple tare memory, weigh-in/weigh-out capability, or multiple weighing elements, verify proper operation and appropriateness.

Code Applies to: E only.

5.9.1. Maintenance of Equipment.
Code Reference: 1.10: G-UR.4.1.

5.9.2. Abnormal Performance.
Code Reference: 1.10: G-UR.4.2.

5.9.3. Multiple Load-Receiving Elements.
Code Reference: 2.20: S.4.3.

5.9.4. Manual Gross Weight Entry.
Code Reference: 2.20: S.1.12. (Portion 1/1/93, Portion 1/1/05), UR.3.10.

SAFETY REMINDER!!!

- **Wear Safety Shoes!**
- **Use Proper Lifting Techniques!**

6. Test.

NOTE: Code references used throughout the document are drawn from NIST Handbook 44 (HB 44) General Code (Section 1.10) and Scales Code (Section 2.20). The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only. The code section and paragraph designation(s) are then shown immediately after the corresponding line item or task listed in the procedure. For example, NIST HB 44 General Code (Section 1.10) is designated as "1.10:" followed by the paragraph designation(s) relevant to the line item. Nonretroactive requirements are followed by the applicable date in parentheses.

When a specific code requirement is applicable to a certain type of weighing device that kind of device is identified by a single letter designation. The specific "*Code Reference:*" is immediately followed on the next line by the statement "*Code Applies to:*" and the appropriate letter designation for each device type. A key to identify the meaning of each device-type letter designation appears at the beginning of each inspection and test section of the EPO.

Key to the letter designation used to identify the type of weighing device(s) the "*Code Applies to:*" are as follows:

B = Beam Scales
D = Dial Scales
E = Electronic digital scales
M = Scales marked with an accuracy designation
U = Unmarked scales

6.1. Zero-Load Balance and Level Condition. Check for maintenance of the zero-load balance and level condition. Establish correct zero-load balance and level conditions prior to beginning the test.
Code Reference: 2.20: UR.4.1., UR.4.2., N.1.9.

6.2. Sensitivity Test, Zero Load. For scales equipped with beams and balance indicators only, test for compliance with the specified sensitivity requirement ("SR") at zero load.

Code Reference: 2.20: N.1.4., T.2., T.N.6.
Code Applies to: B only.

6.3. Discrimination Test, At or Near Zero (Automatic Indicating Scales). Except for Class I or II scales in which e = d and is less than 5 mg, if deemed necessary and if environmental conditions can be controlled, conduct a Discrimination Test at or near zero load.

6.3.1. Analog Automatic Indicating.

Code Reference: 2.20: N.1.5. (1/1/86)*, T.N.7.1.

6.3.2. Digital Device.

Code Reference: 2.20: N.1.5. (1/1/86)*, N.1.5.1.*, T.N.7.2.
Code Applies to: E only.

6.4. Automatic Zero-Tracking Mechanism. Test for proper configuration of automatic zero-tracking mechanism, if device is so equipped.

Code Reference: 2.20: S.2.1.3.

6.5. Semi-Automatic Zero-Setting Mechanism. Test for proper configuration of automatic zero-tracking mechanism, if device is so equipped.

Code Reference: 2.20: S.2.1.2.

6.6. Increasing-Load Test (with the test load approximately centered).

Code Reference: 2.20: N.1.1.

6.6.1. Initial Verification – to Capacity.

Code Reference: 2.20: N.3.

6.6.2. Subsequent Verification.

a. Small scales: At minimum load (20 d), 500 d, 2000 d, 4000 d to capacity.
b. Larger scales: At minimum load (20 d), 500 d, 2000 d, 4000 d to capacity or, at tolerance intervals to Table 4 values.

6.7. Ratio Test, Beam Scales. For scales not equipped with a full-capacity beam, a Ratio Test shall be conducted by applying field standard weights, specifically designed for this purpose, onto the scale's counterpoise hanger.

Code Reference: 2.20: N.1.7.
Code Applies to: B only.

The Ratio Test is conducted at test loads corresponding to each counterpoise weight with which the scale is equipped. At each of these test loads, substitute the scale's counterpoise weight with a field standard counterpoise weight of equal value and observe the results.

Code Applies to: B only.

If there is a noticeable change in indication, remove the counterpoise weight from service until it can be determined that it meets the requirements in the Weights Code of NIST Handbook 44.

Code Reference: NIST HB 44 Section 2.23. Weights.
Code Applies to: B only.

Ratio Test tolerances apply to tests conducted using field standard test weights that are representative of the designated multiples specified in the scale's design.

Code Reference: 2.20: T.N.2.5.
Code Applies to: B only.

6.8. Shift Test.

6.8.1. Scales with a Nominal Capacity of 1000 lb or Less:

Code Reference: 2.20: N.1.3.7. (a).

Use one-third capacity test load (defined as test weights in amounts of at least 30 % of scale capacity, but not to exceed 35 % of scale capacity) centered as nearly as possible in each quadrant of the load-receiving element using the prescribed test pattern as shown in Figure 1.

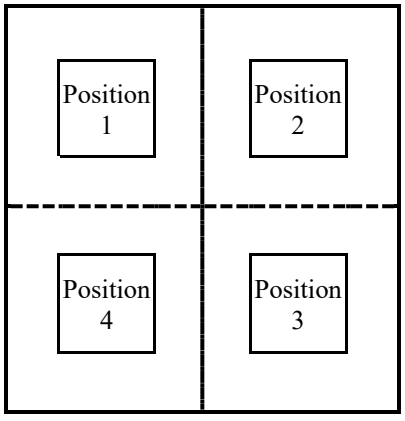
6.8.2. Scales with a Nominal Capacity Greater Than 1000 lb.

Code Reference: 2.20: N.1.3.7. (b).

Use one-third capacity test load (as defined above for Scales with a nominal capacity of 1000 lb or less) centered as nearly as possible in each quadrant of the load-receiving element as shown in Figure 1 or one-quarter capacity test load centered as nearly as possible over each corner of the load-receiving element as shown in Figure 2.

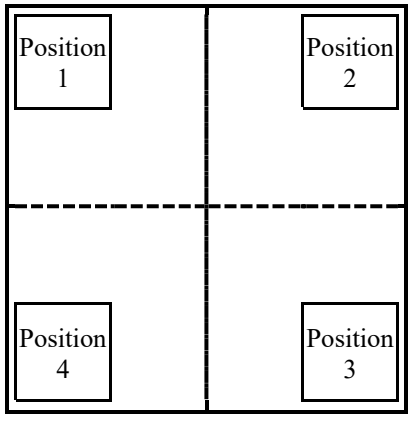
Shift-Test Positions
Medium-Capacity Platform Scales

Figure 1



The above test pattern indicates the correct positions of a one-third capacity shift-test load and may be applied when performing the shift test on any medium capacity platform scale.

Figure 2



The above alternative test pattern indicates the correct positions of a one-quarter capacity shift-test load and may be applied alternatively to the positions shown and test loads indicated in Figure 1 when performing a shift test on medium capacity platform scales having a nominal capacity greater than 1000 lb.

Note: When multiple field standards are used as the prescribed shift-test load, do not concentrate those field standards in a test pattern that would be less than if that same load were comprised of only a single field standard.

6.9. Sensitivity Test, Maximum Test Load. For scales equipped with beams and balance indicators only, test for compliance with the specified sensitivity requirement ("SR") at maximum test load.

Code Reference: 2.20: N.1.4., T.2., T.N.6.
Code Applies to: B only.

6.10. Discrimination Test, Maximum Test Load (Automatic Indicating Scales). Except for Class I or II scales in which e = d and is less than 5 mg, if deemed necessary and if environmental conditions can be controlled, conduct a Discrimination Test at maximum test load.

6.10.1. Analog Automatic Indicating.

Code Reference: 2.20: N.1.5. (1/1/86)*, T.N.7.1.

6.10.2. Digital Device.

Code Reference: 2.20: N.1.5. (1/1/86)*, N.1.5.1.*, T.N.7.2.
Code Applies to: E only.

6.11. RFI/EMI Tests.

RFI/EMI tests are conducted if a problem is suspected. Operate each potential source one at a time.

Code Reference: 2.20: N.1.6.
Code Applies to: E only.

- Radio Frequency Interference (RFI).
- Electromagnetic Interference (EMI).

6.11.1. Tolerance RFI/EMI Tests.

Code Reference: 2.20: T.N.9.
Code Applies to: E only.

6.12. Associated and Non-Associated Equipment.

Code Reference: 1.10: G-UR.3.2.

6.13. Testing with Non-Associated Equipment.

Code Reference: 1.10: G-N.2.

6.14. Environment.

Code Reference: 1.10: G-UR.1.2.

6.15. Abnormal Performance.

Code Reference: 1.10: G-UR.4.2.

6.16. Test for Over-Capacity Indication.

Code Reference: 2.20: S.1.7.

6.17. Decreasing-Load Test (Automatic-Indicating Scales).

Code Applies to: D and E only.

The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element.

Code Reference: 2.20: N.1.2.

6.17.1. Test Loads for Scales Marked with an Accuracy Class Designation and Having 1000 or More Verification Scale Intervals (n).

Code Reference: 2.20: N.1.2.1.
Code Applies to: M only.

The decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance value. For example, on a Class III scale, at test loads equal to 4000 d, 2000 d, and 500 d; for all other scales, the test load shall be equal to one-half of the maximum load applied in the increasing-load test.

6.17.2. Test Load for All Other Scales.

Code Reference: 2.20: N.1.2.2.

The decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test.

6.18. Zero-Load Balance Change. Remove the test load and verify the zero-load balance does not change by more than the minimum applicable tolerance. Reestablish correct zero balance and level conditions if necessary.

Code Reference: 2.20: N.1.9., UR.4.1., UR.4.2.

6.19. Substitution or Strain Load Test.

Code Reference: 2.20: N.1.11., N.1.12., Table 4.

Scales shall be tested using at least the minimum amount of test weights and to the minimum test loads specified in Table 4. In instances where the amount of test weight available for testing is equal to or greater than the minimum required by Table 4, but less than the amount of test load required, not more than three substitutions are to be performed to achieve a test load that equals at least the minimum required.

Where practical, scales should be tested to capacity on an initial verification and to at least used capacity on subsequent tests. In accordance with Table 4, not more than three substitutions shall be used during substitution testing, after which the tolerances for strain load tests apply.

6.20. Out-of-Level Test. Conduct out-of-level test (portable scales without level-indicating means only).

Code Reference: 2.20: S.2.4.

6.21. Automatic Zero-Tracking Mechanism. Test for proper design of automatic zero-tracking mechanism if scale is so equipped.

Under normal operating conditions the maximum load that can be "rezeroed" when placed on or removed from the platform all at once shall be 0.6 scale division for bench and counter scales and 1.0 scale division for all other scales manufactured between January 1, 1981, and January 1, 2007; and 0.5 scale division for scales manufactured on or after January 1, 2007.

6.21.1. Scales Manufactured Between 1/1/81 and 1/1/07.

Code Reference: 2.20: S.2.1.3.1.(a) and (c).
Code Applies to: E only.

6.21.2. Scales Manufactured On or After 1/1/07.

Code Reference: 2.20: S.2.1.3.2.(b).
Code Applies to: E only.

6.22. Tare. Check proper design of tare auto-clear, if scale is so equipped.

Code Reference: 2.20: S.2.3. (1/1/83)
Code Applies to: E only.

6.23. Motion Detection. If scale is equipped with a semi-automatic zero-setting mechanism, test the effectiveness of motion detection.

Code Reference: 2.20: S.2.1.2.
Code Applies to: E only.

7. Post-Test Tasks.

NOTE: Code references used throughout the document are drawn from NIST Handbook 44 (HB 44) General Code (Section 1.10) and Scales Code (Section 2.20). The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only. The code section and paragraph designation(s) are then shown immediately after the corresponding line item or task listed in the procedure. For example, NIST Handbook 44 (HB 44) General Code (Section 1.10) is designated as "1.10:" followed by the paragraph designation(s) relevant to the line item. Nonretroactive requirements are followed by the applicable date in parentheses.

When a specific code requirement is applicable to a certain type of weighing device that kind of device is identified by a single letter designation. The specific "*Code Reference*:" is immediately followed on the next line by the statement "*Code Applies to*:" and the appropriate letter designation for each device type. A key to identify the meaning of each device-type letter designation appears at the beginning of each inspection and test section of the EPO.

Key to the letter designation used to identify the type of weighing device(s) the "*Code Applies to*:" are as follows:

B = Beam Scales
D = Dial Scales
E = Electronic digital scales
M = Scales marked with an accuracy designation
U = Unmarked scales

7.1. Security Means.

Adequate provision shall be made for applying a physical security seal and/or providing other approved means of security such as a data change audit trail.

Code Reference: 1.10: G-S.8. (1/1/90), G-S.8.1. (1/1/10), 2.20: S.1.11. (portions Nonretroactive), Table S.1.11. (1/1/95).

For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices.

Code Reference: 1.10: G-S.8.2., 2.20: S.1.11.1.
Code Applies to: E only.

For multiple measuring elements with a single provision for sealing, a change to the adjustment of any measuring element must be individually identified.

Code Reference: 1.10: G-S.8.1. (1/1/10).

A metrologically-significant software change is a sealable event.

Code Reference: 1.10: G-S.9.
Code Applies to: E only.

7.1.1. Audit Trail Information. If the system is equipped with an audit trail, note the event counter settings on the report form for future reference. If equipped with an event logger, print a copy of the event log and attach it to the report form for future reference. Note that on some systems an electronic copy of the event log may also be available; however, the system must still be able to provide a hard copy. Examine these records for any signs of misuse of adjustments.

Code Reference: 1.10: G-S.8. (1/1/90), 2.20: S.1.11.1., S.1.11.2.(c) (1/1/95), Table S.1.11. (1/1/95).
Code Applies to: E only.

7.2. Security Seal. Check for the presence of security seals on the device. Document missing seals on the official report and apply new ones as needed.

Code Reference: 1.10: G-UR.4.5.

7.3. Review/Analyze Results. After all equipment at a location has been tested, review the results to determine compliance with requirements for equipment maintenance and use of adjustments.

Code Reference: 1.10: G-UR.4.1., G-UR.4.3.

7.4. Record Compliance Action and Explain Results. Record the compliance action and disposition of the device on the report and explain the results to the device owner.

SAFETY REMINDER!!!

- **Secure all test equipment when transporting it to next location.**