

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

EPO No. 5

Prescription and Jeweler Scales

- Part I – Electronic Prescription and Jeweler Scales
- Part II – Mechanical Equal Arm Prescription and Jeweler Scales
- Appendix A. Conversion Tables for Units of Mass Measurement

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EPO No. 5

NIST Examination Procedure Outline (EPO) for Prescription and Jeweler Scales

1. Scope.

It is recommended this outline be followed as minimum criteria for examining scales and balances used in prescription and jeweler applications. EPO No. 5 is divided into two parts: Part I – Electronic Prescription and Jeweler Scales and Part II – Mechanical Equal Arm Prescription and Jeweler Scales. Part I applies to electronic prescription and jeweler scales and also includes procedures for verifying proper operation of a legal for trade counting feature on a Class I and Class II prescription scale. Part II applies to mechanical equal arm scales and balances used in prescription and jeweler applications.

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.

2. Safety Notes.

Prescription scales are often located and used in areas where controlled substances are stored. Access to these areas, except by qualified personnel, is generally prohibited. Do not enter any restricted areas unless authorized to do so by personnel having proper authority to grant such access.

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.

- **Chemicals and Hazardous Materials**
- **Clothing**
- **Electrical Hazards**
- **First Aid Kit**
- **Lifting**
- **Location**
- **Obstructions**
- **Personal Protection Equipment**
 - e.g., Safety Shoes

- **Preventing Cross Contamination**
- **Safety Data Sheet (SDS)**
- **Support – for Scale and Test Weights**
- **Transportation of Equipment**

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 a first aid kit is available and the kit is appropriate for the type of inspection activity.**

3. Equipment List.

3.1. Mass Standards.

In accordance with NIST Handbook 44, Appendix A Fundamental Considerations Section 3 Testing Apparatus paragraph 3.2. Tolerances for Standards, the combined error and uncertainty of any standard used for testing must be less than one-third the applicable device tolerance. The use of the mass standards indicated for each of the scale accuracy classes listed below will ensure conformance with this fundamental consideration.

- Class I Scales: OIML E₂, ASTM 1, or standards of greater accuracy.
- Class II Scales: OIML F₁, ASTM 2, or standards of greater accuracy.
- Class III Scales: NIST Class F, ASTM 6, or standards of greater accuracy.
- Unmarked scales: Use standards of the proper level of accuracy that comply with NIST Handbook 44 Fundamental Considerations.

Note: Verify the performance of the scale at multiple test points when different units of measurement are in commercial use for a particular application. The conversion tables for units of measurement commonly indicated on jeweler and prescription scales are available formatted in both Word (as part of EPO No. 5) and Excel (as a standalone set of tables for the conversion of additional test points) each are listed as Appendix A. “Conversion Tables for Units of Mass Measurement” and include the following:

- Table A-1. Carat (SI) to Grams
- Table A-2. Pennyweight (Troy) to Grams
- Table A-3. Pounds (Avoirdupois) to Grams
- Table A-4. Ounces (Avoirdupois) to Grams
- Table A-5. Ounces (Troy) to Grams

3.2. Special Handling Equipment.

- Clean lint free and dust free gloves.
- Tweezers.
- Ash-free, acid-free filter paper.

3.3. Handling and Care of Mass Standards.

Special care is required when handling mass standards to maintain the accuracy level needed to properly test most prescription and jeweler scales and scales marked Class I or Class II. At minimum when handling testing equipment:

- a. Never touch standards with bare hands or otherwise contaminate standards by placing them on dirty surfaces.
- b. Always wear suitable gloves or use tweezers when handling precision standards to prevent substances (oils, lint, moisture, etc.) from adhering to their metal surfaces.
- c. Special filter papers are available and should be used to prevent contact with dirty surfaces.
- d. Proper cleaning methods are to be used.
- e. Exercise care in storing and transporting standards to avoid physical damage.

Part I – Electronic Prescription and Jeweler Scales

4. Inspection.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

4.1. 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.

4.2. Zero-Load Balance and Level Condition.

Check the zero-load balance and level conditions as found. If the device is not indicating a zero-balance and/or level condition, the user should be made aware of these requirements and a warning issued if necessary.

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

4.2.1. Zero Indication.

4.2.1.1. Zero Indication, General.

- Indicate or record zero-balance condition.

Code Reference: 2.20: S.1.1.

4.2.1.2. Zero Indication - Digital.

- Display of digital zero.

Code Reference: 1.10: G-S.5.2.2.(d) (1/1/86).

- Digital zero representation of balance condition.

Code Reference: 2.20: S.1.1.1.(a).

- Zero deviation after zero setting.
Code Reference: 2.20: S.1.1.1.(c) (1/1/93).
- Deviation of the weighing results after zero-setting (gross zero or net zero).
Code Reference: 2.20: S.1.1.1.(b) (1/1/25).

4.2.2. Zero-Load Adjustment.

4.2.2.1. General Means.

Code Reference: 2.20: S.2.1.1.

4.2.2.2. Manual and Semi-Automatic Zero-Setting, Direct Sales.

Code Reference: 2.20: S.2.1.2.

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

Code Reference: 2.20: S.2.1.3.1.(a).

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

Code Reference: 2.20: S.2.1.3.2.(b).

4.2.2.5. Initial Zero-Setting Mechanism (Class I, II, and III only).

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).

4.2.3. Combined Zero-Tare (“0/T”) Key for Scales not Used in Direct Sales.

Code Reference: 2.20: S.2.1.6.

4.2.4. Level-Indicating Means.

Code Reference: 2.20: S.2.4. (1/1/86 for Class I and II prescription and jeweler scales).

4.2.4.1. Level Condition.

Code Reference: 2.20: UR.4.2.

4.3. Selection and Suitability.

4.3.1. Suitability, General.

Code Reference: 1.10: G-UR.1.1., G-UR.1.2., 2.20: UR.1., UR.3.1.

4.3.2. 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.

4.3.3. Adjustable Components.

Code Reference: 2.20: S.1.10.

4.3.4. Electronic Adjustable Components.

Code Reference: 1.10: G-S.8. (1/1/90).

4.3.5. Design of Weighing Devices, Accuracy Class.

Code Reference: 2.20: S.5.*

4.3.5.1. Designation of Accuracy Class.

Code Reference: 2.20: S.5.1.* (1/1/86), UR.1.1.

4.3.5.2. Parameters for Accuracy Class.

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

4.3.6. Typical Class for Weighing Applications.

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

4.3.7. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

4.3.8. Maximum Load.

Code Reference: 2.20: UR.3.2.

4.3.9. Environment.**4.3.9.1. Suitable for the Environment in Which it is Used.**

Code Reference: 1.10: G-UR.1.2.

4.3.9.2. Protection from Environmental Factors.

Code Reference: 2.20: UR.2.3.

4.3.10. Permanence.

Code Reference: 1.10: G-S.3.

4.4. Installation.**4.4.1. In Accordance with Manufacturer's Instructions.**

Code Reference: 1.10: G-UR.2.1.

4.4.2. Indicating and Recording Elements.

Code Reference: 1.10: G-UR.2.2.

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!

4.4.3. Foundation, Supports, and Clearance – Soundness of the scale's support structure and clearance of its parts from any impedance.

Code Reference: 2.20: UR.2.1., UR.2.2., UR.2.4.

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

Code Reference: 1.10: G-UR.2.1.1.

4.4.5. Position of Equipment.

Not applicable to prescription scales.

Code Reference: 1.10: G-UR.3.3.

4.4.5.1. Customer Indications.

Code Reference: 2.20: S.1.8.4.

4.5. Use.

4.5.1. Facilitation of Fraud.

Code Reference: 1.10: G-S.2.

4.5.2. Method of Operation.

Code Reference: 1.10: G-UR.3.1.

4.5.3. 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.

4.5.4. Operation with Associated and Nonassociated Equipment.

Code Reference: 1.10: G-UR.3.2.

4.5.5. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

4.5.6. Maximum Load.

Code Reference: 2.20: UR.3.2.

4.6. Maintenance.

4.6.1. Maintenance of Equipment, General.

Code Reference: 1.10: G-UR.4., G-UR.4.1.

4.6.2. Abnormal Performance.

Code Reference: 1.10: G-UR.4.2.

4.6.3. Scale Modification.

Code Reference: 2.20: UR.4.3.

4.6.4. Use of Adjustments.

Code Reference: 1.10: G-UR.4.3.

4.6.5. Check for the presence of security seals on any component designed to be sealed.

Code Reference: 1.10: G-UR.4.5.

4.7. Design of Weighing Device.

4.7.1. Designation of Accuracy Class.

Code Reference: 2.20: S.5.1.* (1/1/86), UR.1.1.

4.7.2. Parameters for Accuracy Class.

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

4.7.3. Multi-Interval and Multiple Range.

Code Reference: 2.20: S.5.3.

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).

Relationship of the verification scale interval (e) of a weighing/load-receiving element to the value of the scale division (d).

Code Reference: 2.20: S.1.2.2.1.

4.7.4. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.

4.8. Markings.

4.8.1. Markings – Overview.

4.8.1.1. Identification.

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

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

Code Reference: 1.10: G-S.5.2.3.

4.8.1.3. Values.

Code Reference: 1.10: G-S.5.2.4.

4.8.1.4. Permanence of Markings.

Code Reference: 1.10: G-S.5.2.5.

4.8.1.5. Accuracy Class.

Code Reference: 2.20: S.5.

4.8.1.6. Location.

Code Reference: 2.20: S.6.2.

4.8.1.7. Specific Scales' Code markings.

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

4.8.1.8. Special Design.

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

Scales designed for special application appropriately marked to restrict its use (e.g., postal scale, prepack scale, weight classifier).

Code Reference: Table S.6.3.a. and Table S.6.3.b. Note 13 (Nonretroactive 1/1/86).

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

Code Reference: Table S.6.3.a. and Table S.6.3.b. Note 13 Retroactive.

4.8.2. Marking Requirements – All Devices.

4.8.2.1. General.

Code Reference: 2.20: S.6.

4.8.2.2. Identification.

Code Reference: 1.10: G-S.1.

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

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

4.8.2.2.2. 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).

4.8.2.2.3. 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).

4.8.2.2.4. As of 2004 the current software version or revision identifier for not-built-for-purpose software-based devices and as of 2022 the current software version or revision identifier for all software-based devices.

Code Reference: 1.10: G-S.1.(d) (1/1/04), G-S.1.(d) (1/1/22).

Software version or identifier.

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

- (1) Preface identifying it as such.

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

- (2) Continuously displayed or accessible via display.

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

- (3) Acceptable abbreviations for “version,” “number,” and “revision.”

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

4.8.2.2.5. NTEP CC Number for devices with NTEP CC.

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

Preface by the terms “NTEP CC,” “CC,” or “Approval” followed by either the word or an acceptable abbreviation of “number.”

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

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

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

4.8.2.4. Devices or main elements remanufactured as of January 1, 2002.

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).

4.8.2.5. Operational Controls, Indications, and Features.

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

4.8.2.6. Lettering.

Code Reference: 1.10: G-S.7.

4.8.2.7. Visibility of Identification – installation to ensure ready visibility of markings.

Code Reference: 1.10: G-UR.2.1.1.

4.8.2.8. Interchange or Reversal of Parts.

Code Reference: 1.10: G-S.4.

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

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

4.8.3.1. Accuracy Class.

Code Reference: Table S.6.3.b. Note 17 (Nonretroactive 1/1/86).

4.8.3.2. Nominal Capacity.

Code Reference: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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: 2.20: Table S.6.3.b. Note 3 (Nonretroactive 1/1/83).

For any scale that has no “d,” the nominal capacity shall be shown together with the verification scale interval “e.”

Code Reference: Table S.6.3.b. Note 4(a) (Nonretroactive 1/1/86).

For any scale 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: 2.20: Table S.6.3.b. Note 4(b) (Nonretroactive 1/1/86).

4.8.3.3. Temperature Limits.

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

4.8.4. Marking Requirements – Indicating 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.

4.8.4.1. Accuracy Class.

Code Reference: 2.20: Table S.6.3.b. Note 8 (Nonretroactive 1/1/88).

4.8.4.2. Nominal Capacity.

Code Reference: 2.20: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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: 2.20: Table S.6.3.b. Note 3 (Nonretroactive 1/1/83).

For any scale that has no “d,” the nominal capacity shall be shown together with the verification scale interval “e.”

Code Reference: 2.20: Table S.6.3.b. Note 4(a) (Nonretroactive 1/1/86).

For any scale 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: 2.20: Table S.6.3.b. Note 4(b) (Nonretroactive 1/1/86).

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

4.8.4.4. Maximum Number of Verification Scale Intervals ($n_{\max}$).

Code Reference: 2.20: Table S.6.3.b. Note 6 (Nonretroactive 1/1/88).

4.8.5. 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.

4.8.5.1. Accuracy Class.

Code Reference: 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).

4.8.5.2. Nominal Capacity.

Code Reference: 2.20: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

4.8.5.4. Maximum Number of Verification Scale Intervals ($n_{\max}$).**Code Reference:** 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).**4.8.5.5. Minimum verification scale division for which device complies with the requirements ($e_{\min}$ or d).****Code Reference:** 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).**4.8.6. Marking Requirements Overview – For Prescription and Jeweler Scales.**

An overview of the required marking information is shown in the list below.

Code Reference: 1.10: G-S.1., 2.20: S.6., S.6.3., Table S.6.3.a. and Table S.6.3.b.**Note:** The nominal capacity of a prescription scale that is not marked with an accuracy class designation can be assumed to be $\frac{1}{2}$ apothecary ounce, unless otherwise marked, in accordance with Code Reference 2.20: N.6. Nominal Capacity of Prescription Scales.

For not-built-for-purpose, software-based devices, additional requirements may apply for marking and/or designating the software version or revision identifier. For details see Code Reference 1.10: G-S.1.

4.8.6.1. G-S.1. information and scale specific markings overview.**Code Reference:** 2.20: Table S.6.3.b. Note 11 (Nonretroactive 1/1/91).

- Manufacturer's Name or Trademark.
Code Reference: 1.10: G-S.1.(a).
- Model Designation.
Code Reference: 1.10: G-S.1.(b).
- Model Designation Prefix.
Code Reference: 1.10: G-S.1.(b)(1) (Nonretroactive 1/1/03).
- Serial Number.
Code Reference: 1.10: G-S.1.(c) (Nonretroactive 1/1/68).
- Serial Number Prefix.
Code Reference: 1.10: G-S.1.(c)(1) (Nonretroactive 1/1/86).
- Abbreviation for word "Serial" and "Number."
Code Reference: 1.10: G-S.1.(c)(2) (Nonretroactive 1/1/01).
- Certificate of Conformance (CC) Number or CC Addendum Number and Prefix.
Code Reference: 1.10: G-S.1.(e) (Nonretroactive 1/1/03).
- Special Application.
Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b. (Nonretroactive 1/1/86), UR.3.6.
- Nominal Capacity.
Code Reference: 2.20: N.6.
- Nominal Capacity and Value of the Scale Division, "d" Displayed together.
Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b. Note 3 (Nonretroactive 1/1/83).
- Value of the Verification Scale Interval, "e" if different from the Value of the Scale Division "d."
Code Reference: 2.20: Table S.6.3.a. and Table S.6.3.b. Note 4 (Nonretroactive 1/1/86).

- Temperature Limits Class III Scales.
Applies only when the temperature range on the NTEP CC is narrower than and within – 10 °C to 40 °C (14 °F to 104 °F).
Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).
- Accuracy Class.
Code Reference: 2.20: Table S.6.3.b. Note 17 (Nonretroactive 1/1/86).

4.9. Indicating and Recording Elements.

4.9.1. Appropriateness of Design.

4.9.1.1. Accuracy Class.

Code Reference: 2.20: S.5.

4.9.1.2. Computing Capability (for price-computing scales).

Code Reference: 2.20: S.1.8.

4.9.1.3. Indicating and Recording Elements, General Design.

Code Reference: 1.10: G-S.5.1.

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

Code Reference: 2.20: S.1.7.

4.9.1.5. 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).

4.9.1.6. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

4.9.1.7. Maximum Load.

Code Reference: 2.20: UR.3.2.

4.9.2. 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).

4.9.3. Value of Scale Division and/or Interval.

4.9.3.1. Value – General.

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

4.9.3.2. Value of Scale Units.

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

4.9.3.3. Digital Indicating Scales, Units.

Code Reference: 2.20: S.1.2.1. (1/1/89).

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

Code Reference: 2.20: S.1.2.2.1.*

4.9.3.5. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.

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

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

4.9.3.7. Multi-Interval and Multiple-Range Scales.

Code Reference: 2.20: S.5.3.

4.9.3.8. Prepackaging Scales Only.

Code Reference: 2.20: S.1.9.

4.9.4. Price Computing.**4.9.4.1. Money Value Graduations.**

Code Reference: 2.20: S.1.8.1., S.1.8.2.

4.9.4.2. Money Value Computations.

Code Reference: 2.20: S.1.8.3.

4.9.4.3. Customer Indications, Computing Scales.

Code Reference: 2.20: S.1.8.4.

4.9.5. Prepackaging Scales Only.

Code Reference: 2.20: S.1.9.1., S.1.9.2.

4.9.6. Tare.**4.9.6.1. Value of Tare Division.**

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

4.9.6.2. Tare Mechanism.

Code Reference: 2.20: S.2.3.

4.9.6.3. Combined Zero-Tare (“0/T”) Key.

Code Reference: 2.20: S.2.1.6.

4.9.7. Repeatability.

Code Reference: 1.10: G-S.5.4.

4.9.8. Recorded Representations.

4.9.8.1. Recorded Representations, General.

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

4.9.8.2. Recorded Representations, Prepackaging Scales.

Code Reference: 2.20: S.1.9.1., S.1.9.2.

4.9.8.3. Indicated and Recorded Representation, 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).

4.9.9. Damping Means.

Code Reference: 2.20: S.2.5.

4.9.9.1. Motion Detection, Digital Indicating Elements.

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

4.9.10. Adjustable Components.

Code Reference: 2.20: S.1.10.

4.9.11. Manual Weight Entries.

Code Reference: 2.20: S.1.12. (1/1/93 and 1/1/05), UR.3.10.

4.10. Weighing Elements.**4.10.1. Antifriction Means.**

Code Reference: 2.20: S.4.1.

4.10.2. Adjustable Components.

Code Reference: 2.20: S.1.10., S.4.2.

4.10.3. Multiple Load-Receiving Elements.

Code Reference: 2.20: S.4.3.

4.11. Provision for Sealing.**4.11.1. 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.

Note: 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).

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: 2.20: S.1.11.2.

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).

4.11.2. A metrologically-significant software change is a sealable event.

Code Reference: 1.10: G-S.9.

4.11.3. 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).

4.11.4. Physical Means of Security.

4.11.4.1. 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.

4.11.4.2. 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.

4.11.5. 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).

4.11.6. Audit Trails, General.

4.11.6.1. 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).

4.11.6.2. 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).

4.11.7. 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).

4.11.8. Manual Weight Entries.

Code Reference: 2.20: S.1.12. (1/1/93 and 1/1/05), UR.3.10.

5. Pretest Determinations.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

5.1. Verification Scale Interval (e).

For Class I and II scales equipped with a verification scale interval (e) that does not equal the value of the displayed scale division (d), verify that the relationship between “e” and “d” conforms to the expression:

$$d < e \leq 10 d$$

For Class III scales that are marked with a manufacturer’s designated verification scale interval (e), verify that the value of “e” is less than or equal to the value of “d.”

Code Reference: 2.20: S.1.2.2.1.*, S.1.2.2.2.*.

5.2. Tolerances – General.

5.2.1. Acceptance/Maintenance Tolerances.

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

5.2.2. Application.

Code Reference: 1.10: G-T.3., 2.20: T.N.2.1.*, T.N.2.3., T.N.2.4.

5.2.3. Intermediate Values.

Code Reference: 1.10: G-T.4.

5.3. Tolerance Values

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

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

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

5.3.2. Tolerance Associated with the Standard.

5.3.2.1. Tolerance 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.

5.3.3. Unmarked Scales – Tolerance Values.

5.3.3.1. Unmarked Scales – All.

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

- Multiple Indicating or Recording Elements.
Code Reference: 2.20: T.N.4.1.
- Single Indicating or Recording Elements.
Code Reference: 2.20: T.N.4.2.
- Single Indicating Element, Multiple Indications.
Code Reference: 2.20: T.N.4.3.
- Repeatability.
Code Reference: 2.20: T.N.5.
- Discrimination.
Code Reference: 2.20: T.N.7.2., N.1.5. (1/1/86), N.1.5.1.
- Operating Temperature.
Code Reference: 2.20: T.N.8.1.4. (Nonretroactive 1/1/81).
- Radio Frequency Interference and other interferences.
Code Reference: 2.20: T.N.9.

5.3.3.2. Unmarked Scales With “n” Equal to 5000 or Less.

Code Reference: 2.20: T.1.1.

- Tolerance Application.
Code Reference: 2.20: T.N.2.
- General Tolerances.
Code Reference: 2.20: T.N.2.1.
- Subsequent Verification Examinations.
Code Reference: 2.20: T.N.2.3.
- Multiple-Range and Multi-Interval Scales.
Code Reference: 2.20: T.N.2.4.
- Ratio Tests (scales equipped with commercial weights).
Code Reference: 2.20: T.N.2.5.
- Tolerance Values.
Code Reference: 2.20: T.N.3., T.N.3.1., Table 6, T.N.3.2.

5.3.3.3. Unmarked Scales With “n” Greater Than 5000.

Code Reference: 2.20: Table T.1.1.

- Tolerances – General.
Code Reference: 2.20: T.1., Table T.1.1.
- Ratio Tests (scales equipped with commercial weights).
Code Reference: 2.20: T.N.2.5.

5.3.4. Marked Scales – Tolerance Values.

5.3.4.1. Scales marked with an accuracy class designation, design.

Code Reference: 2.20: T.N.1.1.

- Accuracy Classes.
Code Reference: 2.20: T.N.1.2.
- Verification Scale Interval.
Code Reference: 2.20: T.N.1.3.

- General Tolerances.
Code Reference: 2.20: T.N.2.1.
- Subsequent Verification Examinations.
Code Reference: 2.20: T.N.2.3.
- Multiple-Range and Multi-Interval Scales.
Code Reference: 2.20: T.N.2.4.
- Ratio Tests (scales equipped with commercial weights).
Code Reference: 2.20: T.N.2.5.
- Maintenance Tolerance Values.
Code Reference: 2.20: T.N.3.1. [Table 6].
- Acceptance Tolerance Values.
Code Reference: 2.20: T.N.3.2.
- Multiple Indicating or Recording Elements.
Code Reference: 2.20: T.N.4.1.
- Single Indicating or Recording Elements.
Code Reference: 2.20: T.N.4.2.
- Single Indicating Element, Multiple Indications.
Code Reference: 2.20: T.N.4.3.
- Shift or Section Test (agreement of indications).
Code Reference: 2.20: T.N.4.4.
- Repeatability.
Code Reference: 2.20: T.N.5.
- Discrimination.
Code Reference: 2.20: T.N.7.2., N.1.5. (1/1/86), N.1.5.1.
- Operating Temperature.
Code Reference: 2.20: T.N.8.1.4.
- Radio Frequency Interference and other Interferences.
Code Reference: 2.20: T.N.9.

5.4. Accuracy of Field Standards.

Code Reference: 2.20: N.2.

5.5. Minimum Test Weights and Test Loads.

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

6. Test Notes.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

6.1. 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 HB 44 Appendix A – Fundamental Considerations.

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

6.2. Zero-Load Balance and Level Condition. Check for maintenance of the zero-load balance and level condition. Establish a correct zero-load balance and level condition prior to beginning the test.

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

6.3. Repeatability. Check repeatability of indications throughout the test.

6.3.1. Repeatability of Indications.

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

6.3.2. Digital Indications and Representations.

Code Reference: 1.10: G-S.5.2.2.

6.3.3. Single Indicating/Recording Element with Component Parts.

Code Reference: 2.20: T.N.4.2.

6.3.4. Single Indicating Element, Multiple Indications.

Code Reference: 2.20: T.N.4.3.

6.4. Agreement of Indications. Check for agreement of indications throughout the test.

Code Reference: 1.10: G-S.5.2.2., 2.20: T.N.4.

6.4.1. Multiple Digital Indications and Representations.

Code Reference: 2.20: T.N.4.1.

6.4.2. Single Indicating/Recording Element with Component Parts.

Code Reference: 2.20: T.N.4.2.

6.4.3. Single Indicating Element, Multiple Indications.

Code Reference: 2.20: T.N.4.3.

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

6.5.1. Zero-Load Balance Change.

Code Reference: 2.20: N.1.9.

6.5.2. Abnormal Performance.

Code Reference: 1.10: G-UR.4.2.

6.6. Recorded Representations.

6.6.1. Availability of Recorded Representation. Verify that any options available for obtaining a recorded representation are appropriate. For systems specifically required by a section of 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.

6.7. Steps After Each Test Load – Recorded Representations. If the scale is equipped with a printer, print a ticket or label at each test load. Verify the following:

6.7.1. 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.

6.7.2. Motion Detection. Check the effectiveness of motion detection. If the scale is equipped with a semiautomatic zero-setting mechanism (i.e., pushbutton zero), a pushbutton tare feature, or a ticket printer, verify the correct operation of motion detection.

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

6.7.3. 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).

6.8. Steps After Each Test Load – Price Computations and Display.

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

Code Reference: 1.10: G-S.5.5.

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

Code Reference: 1.10: G-S.5.1., G-S.5.2. (except G-S.5.2.1.), G-S.5.3., G-S.5.3.1., G-S.5.4., G-S.5.5., G-S.5.6.

6.9. Zone of Uncertainty and Width of Zero, Electronic Scales Only. 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 (see test procedure below), adequate tests should be conducted to determine compliance

Code Reference: 2.20: N.1.5. (1/1/86), N.1.5.1., S.1.1.1.(a), S.1.1.1.(b) (1/1/25), S.1.1.1.(c) (1/1/93).

6.10. Other Operational Features, Electronic Scales Only. If the device is equipped with operational features such as programmable tare and/or unit prices, multiplier keys, sales accumulation, manual weight entries, price retention, two scales with one printer, etc., check proper operation and appropriateness.

Code Reference: 1.10: G-UR.4.1., G-UR.4.2., 2.20: S.4.3., S.1.12. (1/1/93 and 1/1/05), UR.3.10.

6.11. Class I and Class II Scales.

Class I and Class II scales shall be equipped with an appropriate means for arresting the oscillation of the mechanism.

Code Reference: 2.20: S.2.5.2.

Class I and Class II scales with a counting feature shall indicate to the operator when the piece weight computation is complete by a stable display of the quantity placed on the load-receiving element.

Code Reference: 2.20: S.2.5.3.

6.12. Scales Equipped with Automatic Zero-Tracking (AZT) Mechanism.

Manufactured between 1/1/81 and 1/1/07.

Code Reference: 2.20: S.2.1.3.1.(a).

Manufactured on or after 1/1/07.

Code Reference: 2.20: S.2.1.3.2.(b).

To verify correct operation of an AZT feature on a scale in which the value of the scale division (d) is equal to the value of the verification scale interval (e), (i.e., the scale manufacturer has not declared a verification scale interval) complete step a. through step f. below.

- a. Zero the scale with no load on the platter.
- b. Apply all at once test weights equal to 0.7 d.
- c. Verify that the indicator is continuously displaying the value of 1 d.
- d. Zero the scale with the 0.7 d test weights remaining on the platter.
- e. Remove the 0.7 d in test weights all at one time.
- f. The scale must display a continuous behind zero indication using one of the following means:
 - Display a value equal to minus 1 d;
 - Blank the display; or
 - Display error symbols that cannot be interpreted as a weight value.

Be aware that step a. through step c. verify the correct operation of an AZT feature on the positive side of zero while step d. through step f. verify the correct operation of an AZT feature behind zero. A continuous display of 1 d (in step c.) and a continuous display of a behind zero indication (i.e., in accordance with any of the conditions noted in step f.) confirms the correct operation of an AZT feature on both sides of zero. However, if the displayed indication is zero following the completion of step b. or step e., the AZT feature may not be functioning properly. In this case, verify the feature is not functioning properly by repeating the AZT test before rejecting the device.

If the scale is equipped with a verification scale interval (e) that is not equal to the value of the scale division (d), the value of “e” is used to calculate the maximum permissible amount of weight that can be re-zeroed during this test. To verify correct operation of an AZT feature on a scale in which the value of the scale division (d) is not equal to the value of the verification scale interval (e), complete step a. through step f. below.

- a. Zero the scale with no load on the platter.
- b. Apply all at once test weights equal to 0.7 e.
- c. Verify that the indicator is continuously displaying the appropriate d value and if scale rounding is necessary, the value displayed is to the nearest d value in accordance with G-S.5.2.2. Digital Indication and Representation.
- d. Zero the scale with the 0.7 e test weights remaining on the platter.
- e. Remove the 0.7 e test weights all at one time.

- f. The scale must display a continuous behind zero indication using one of the following means:
- Display the appropriate negative d value (i.e., if scale rounding is necessary, the value displayed is to the nearest minus d value in accordance with G-S.5.2.2.); or
 - Blank the display; or
 - Display error symbols that cannot be interpreted as a weight value.

In instances where multiplying the value of the verification scale interval (e) by 0.7 results in a value that is smaller than the smallest available test standard, a field test of the AZT feature is not possible.

6.13. Tare Auto Clear Design.

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

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

6.14. Discrimination Test.

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

Note: A Discrimination Test should be performed when environmental conditions permit and when the test standards available for testing are adequate in amount and are of suitable denominations. Steps a. through d., of the 7.1.2.1. Procedures for Testing Discrimination At or Near Zero Load and 7.1.2.2. Procedures for Testing Discrimination Near Maximum Capacity indicated below, specify the total amount and the minimum denominations of the test standards needed to properly perform a discrimination test.

7. Test.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

7.1. Test for Electronic Scales.

7.1.1. Zero-Load Balance and Level Condition.

Check for maintenance of the zero-load balance and level condition. Establish a correct zero-load balance and level condition prior to beginning the test.

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

SAFETY REMINDER!!!

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

7.1.2. Discrimination Test.

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

Note: A Discrimination Test should be performed when environmental conditions permit and when the test standards available for testing are adequate in amount and are of suitable denominations. Steps a. through d., of the Procedures for Testing Discrimination at or Near Zero Load and Procedures for Testing Discrimination Near Maximum Capacity indicated below, specify the total amount and the minimum denominations of the test standards needed to properly perform a discrimination test.

7.1.2.1. Procedures for Testing Discrimination At or Near Zero Load for a Scale, Where $d = e$.

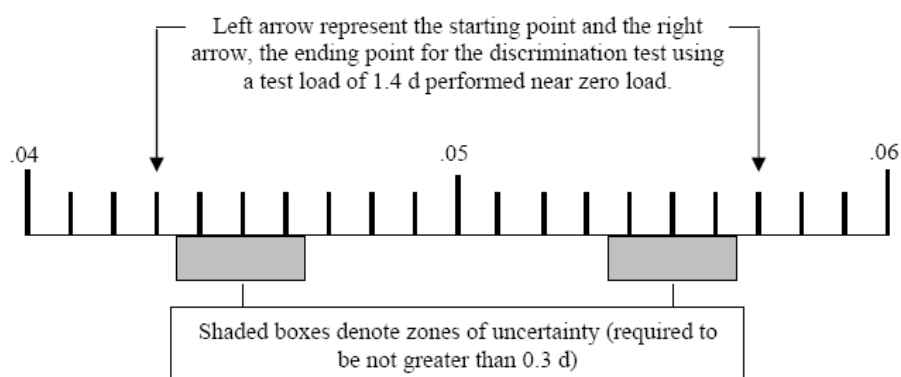
The procedures for testing discrimination near zero load on scales equipped with a scale division value (d) that is equal to the value of the verification scale interval (e), (i.e., $d = e$) are indicated below in step a. through step f. and illustrated in Figure 1.

- With the scale on zero, place decimal weights on the scale equal to the value of 1 d .
- Zero the scale and place a load equal to the value of 5 d on the platter.
- Remove the decimal weights in 0.1 d increments until the indication flickers between the values representing 4 d and 5 d . If the indication does not flicker but indicates a steady 4 d value, add 0.1 d . If the scale indicates 5 d , it is at the breakpoint in the zone of uncertainty (remove the 0.1 d if it was added to the 4 d value to verify the breakpoint).
- Add a test load equal to 1.4 d to the scale.
- The indication should read a stable 6 d (i.e., the addition of 1.4 d should change the displayed indication 2 d).
- If the scale passes the Discrimination Test at a load near zero, a Discrimination Test should also be performed near the maximum capacity of the scale.

Example: Discrimination Test near Zero Load for a Scale, where $d = e$.

Scale Capacity: 610 g x 0.01 g

Figure 1. Example of a Discrimination Test Near Zero Load



7.1.2.2. Procedures for Testing Discrimination Near Maximum Capacity for a Scale, Where $d = e$.

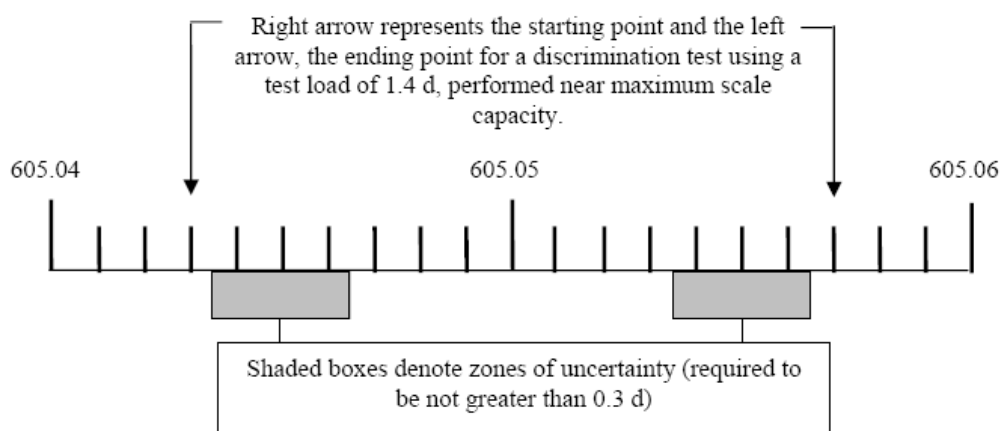
The procedures for testing discrimination near maximum load on scales equipped with a division value (d) that is equal to the value of the scale verification interval (e), are indicated below in step a. through step e. and illustrated in Figure 2.

- With the scale on zero and no load on the load-receiving element, apply test weights equal to $1.4 d$ and zero the device.
- Add a test load sufficient in amount to cause the scale to indicate a stable value near maximum capacity.
- With the scale indication stable at a near capacity test load, add test standards in $0.1 d$ increments until the indication continually flickers back and forth between the indication that was stable and the next higher increment. Then add $0.1 d$ to cause the indication to become stable at the higher of the two flickering increments.
- Remove the $1.4 d$ test weights.
- To pass the Discrimination Test near maximum capacity, the removal of the $1.4 d$ test weights should cause the indication to change (decrease) by $2 d$.

Example: Discrimination Test near maximum capacity for a Scale, where $d = e$.

Scale Capacity: $610 \text{ g} \times 0.01 \text{ g}$

Figure 2. Example of a Discrimination Test Near Maximum Load



7.1.2.3. Procedures for Testing Discrimination Near Zero Load or at Maximum Capacity for a Scale, Where $d \neq e$.

The procedures for testing discrimination near zero load and near maximum scale capacity when the value of the minimum scale division (d) is not equal to the value of the minimum verification scale interval (e), are as follows:

- Zero the scale with no load on the platter.
- Apply a test load equal to $2 e$ to the platter and observe the displayed indication.
- Apply an additional test load of $2 d$ to the platter and observe the displayed indication.
- The addition of $2 d$ in step c. must increase the displayed indication by $2 d$.
- For the Discrimination Test at or near maximum capacity, apply a test load near scale capacity, then remove $2 d$ and observe the change in the displayed indication.
- The displayed indication must change by $2 d$ when a test load of $2 d$ is removed.
- The results of these tests confirm that a scale can detect small changes in weight being added or removed from the platter over the scale's entire weighing range.

7.1.3. Increasing-Load Test. Conduct an increasing load-load test with the test loads approximately centered on the platter.

Code Reference: 2.20: N.1.1.

7.1.3.1. Scales Not Marked with an Accuracy Class

For scales not marked with an accuracy class, test at several points to capacity, including test loads at or near one-quarter, one-half, and three-quarters scale capacity and at full capacity.

7.1.3.2. Scales Marked with an Accuracy Class

For scales marked with an accuracy class, test at several points in each tolerance range including at or near the highest test load that can be applied to the scale without the tolerance increasing to the next tolerance range.

7.1.3.3. Increasing-Load Test Procedure Place the recommended minimum load on the load-receiving element of the scale up to an amount equal to the shift-load (i.e., a test-weight load equal to at least 30 % of scale capacity, but not to exceed 35 % of scale capacity).

7.1.4. Shift Test. Conduct a shift test using test weights equal to no less than 30 % of scale capacity, but not to exceed 35 % of scale capacity.

A shift test shall be conducted using a one-third nominal capacity test load centered as nearly as possible at the center of each quadrant of the load-receiving element using the prescribed test pattern as shown in Figures 3 and 4 below. NIST Handbook 44 Scales Code paragraph N.1.3.7.(a) defines one-third nominal capacity test load as test weights in amounts of at least 30% of scale capacity, but not to exceed 35% of scale capacity.

The shift test can be conducted during the increasing load test once one-third capacity test load is achieved.

Code Reference: 2.20: N.1.3.7.(a)., T.N.4.4.*.

Shift Test Pattern (One-third capacity test load)

The numbered boxes identify the positions for placing the shift test load.

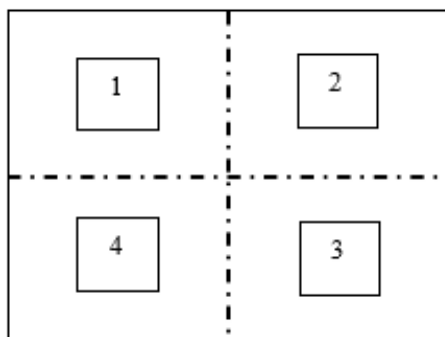


Figure 3. Rectangular Platter

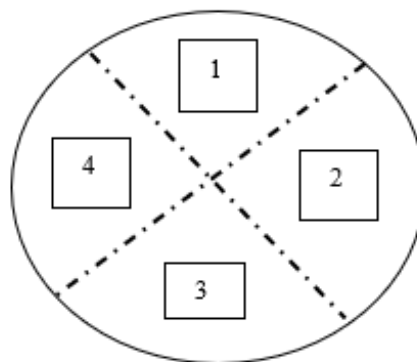


Figure 4. Circular Platter

7.1.5. Continuation of the Increasing-Load Test. Continue increasing-load test.

7.1.5.1. For scales indicating in SI units – at 2.5 kg intervals to capacity.

7.1.5.2. For other scales – at 5 lb intervals to capacity.**7.1.6. Radio Frequency Interference (RFI)/Electromagnetic Interference (EMI).**

Conduct test at or near capacity when RFI/EMI transmission sources are present or if a problem is suspected.

Code Reference: 1.10: G-N.2., G-UR.1.2., G-UR.3.2., G-UR.4.2., 2.20: N.1.6., T.N.9.

7.1.7. Over-Capacity Indication. Test for over-capacity indication.

Code Reference: 2.20: S.1.7.(a), S.1.7.(b) (1/1/93).

7.1.8. Decreasing-Load Test.

The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element. Determine the number of verification scale intervals, which is the capacity divided by the value of the verification scale interval:
$$n = \frac{\text{Capacity}}{e}$$

Decreasing-load tests shall be conducted on scales marked I, II, III or IIII and with “n” equal to or greater than 1000 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 scales with n less than 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. (Also see Table 6. Maintenance Tolerances.)

Code Reference: 2.20: N.1.2.1.

For all other scales, test at one-half maximum test load applied during the increasing-load test.

Code Reference: 2.20: N.1.2.2.

7.1.9. Zero-Load Balance Change. Remove the test load and verify the zero-load balance does not change by more than the minimum applicable tolerance.

Code Reference: 2.20: N.1.9., G-UR.4.2.

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

Code Reference: 2.20: S.2.1.3.1.(a) or S.2.1.3.2.(b).

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 scales manufactured between January 1, 1981 and January 1, 2007, and 0.5 scale division for scales manufactured after January 1, 2007.

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

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

7.1.12. Semiautomatic Zero-Setting Mechanism. If scale is equipped with a semi-automatic zero-tracking mechanism, test effectiveness of motion detection.

Code Reference: 2.20: S.2.1.2.(b).

SAFETY REMINDER!!!

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

8. Post-Test Tasks – Electronic Scales.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

8.1. 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.

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.

8.1.1. 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).

8.1.2. 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.

8.2. 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.

8.3. 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.

**Additional Tests for Prescription and Jeweler Scales
with a Legal for Trade Counting Feature**

It is recommended that the additional requirements in this outline be followed for a Class I or Class II prescription scale equipped with a legal for trade counting feature. The counting feature is based on commodity weight; therefore, accuracy of the weighing function must be verified before conducting a test of the counting feature.

9. Inspection.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

9.1. Specific Scales’ Code Marking.

9.1.1. Piece Weight and Piece Count.

A Class I or Class II prescription scale with an operational counting feature shall be marked with the minimum individual piece weight and the minimum number of pieces used in the sample to establish an individual piece weight.

Code Reference: 2.20: S.6.6.

9.1.2. Special Application.

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

9.1.3. Operational Controls, Indications, Features.

- An operational counting feature is only legal for prescription filling applications on a compliant Class I or Class II device.
- A prescription scale with a legal for trade counting feature must be marked: “Counting Feature for Prescription Filling Only”
- Class I or Class II prescription scales equipped with an operational counting feature that does not comply with all applicable NIST Handbook 44 requirements for the count feature must be marked on both the customer and operator’s side: “The Counting Feature is Not Legal for Trade.”

Code Reference: 1.10: G-S.6., 2.20: Table S.6.3.b. Note 13.

9.2. Zero Indication of Count.

A scale with a legal for trade counting feature shall be capable of indicating zero in the count mode of operation.

Code Reference: 2.20: S.1.1.

9.3. Tare Mechanism.

Code Reference: 2.20: S.2.3.

9.3.1. Value of the Tare Division.

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

10. Pretest Determinations.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

10.1. Tolerances for Count.**10.1.1. Determining the Tolerances for Count.**

Code Reference: 2.20: T.N.3.10., Table T.N.3.10.

10.1.2. Determine the Maximum Counting Capacity.

The scales’ maximum counting capacity (i.e., the maximum number of pieces the scale is capable of indicating) is determined by inserting the appropriate corresponding values marked on the device into the following formula:

$$\text{Maximum Counting Capacity} = \frac{\text{Nominal Capacity}}{\text{Minimum Individual Piece Weight}}$$

Consider the example of a scale marked as follows:

Capacity:	610 x 0.01 g
Minimum Individual Piece Weight:	0.03 g
Minimum Sample Piece Count:	10 pieces

Using the formula, the maximum count value in pieces is calculated as follows:

$$\frac{610 \text{ g}}{0.03 \frac{\text{g}}{\text{piece}}} = 20\,333.333\,3 \text{ pieces}$$

Truncate the result to the nearest whole number of 20 333 pieces.

10.1.3. Determine the Count Accuracy.

Select at least three count values to verify the count accuracy of a legal for trade counting feature similar to that illustrated below:

A count value between 90 and 100 pieces inclusive;

A count value between 180 and 200 pieces inclusive; and

A count value equal or near the scale's maximum counting capacity as determined in 10.1.2. above.

NOTE: When choosing the count value near a scale's maximum counting capacity, select a whole number that is slightly lower than the maximum possible count. For example, one possible choice at the maximum end of the counting capacity for the scale described above is 20 300. The resulting value of 20 300 is slightly less than the actual truncated value of 20 333 and is less likely to introduce rounding errors when converted to a corresponding weight value. The result is also more practical when selecting denominations of test standards for use in testing the count accuracy than if 20 333 were used.

When the 20 300 pieces count is converted to weight by multiplying it by the scale's marked "minimum individual piece weight" of 0.03 g, the resulting weight value equals 609 g. If 20 333 is multiplied by this same factor, the resulting weight value equals 609.99 g. It would be considered acceptable to perform the test at 20 333 pieces using a test load of 609.99 g, providing test standards were available in small enough denominations for converting this count value to its exact equivalent in weight; however, it is easier and more practical to use test standards in denominations of whole grams.

10.1.4. Conversion of Count Values to Weight.

Convert the selected count values to weight by multiplying each count value by the minimum individual piece weight marked on the device.

Although the weight of an individual piece in any given prescription to be counted will often be greater than a scale's marked minimum individual piece weight, the sample used for the purpose of verifying count accuracy is established from minimum values (i.e., minimum individual piece weight and minimum sample piece count) marked on the device.

Given the same device for this example, convert selected count values of 100, 190, and 20 300 pieces to weight using the formula: piece count x minimum individual piece weight = amount of test weight to be applied.

$$\begin{aligned} 100 \times 0.03 \text{ g} &= 3 \text{ g} \\ 190 \times 0.03 \text{ g} &= 5.7 \text{ g} \\ 20\,300 \times 0.03 \text{ g} &= 609 \text{ g} \end{aligned}$$

11. Test Notes.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

11.1. Accuracy of the Test Standards.

In accordance with NIST Handbook 44, Appendix A Fundamental Considerations Section 3 Testing Apparatus paragraph 3.2. Tolerances for Standards, the combined error and uncertainty of any standard used for testing must be less than one-third the applicable device tolerance. Refer to the list of acceptable standards for use in testing precision scales in Section 3. Equipment List of this EPO. The use of the mass standards indicated for each of the scale accuracy classes listed below will ensure conformance with this fundamental consideration.

Code Reference: Appendix A Fundamental Considerations.

11.2. Handling and Care of Mass Standards.

Special care is required when handling mass standards to maintain the accuracy level needed to properly test most prescription and jeweler scales and scales marked Class I or Class II. At minimum when handling testing equipment:

- 1) Never touch standards with bare hands or otherwise contaminate standards by placing them on dirty surfaces.
- 2) Always wear suitable gloves or use tweezers when handling precision standards to prevent substances (oils, lint, moisture, etc.) from adhering to their metal surfaces.
- 3) Special filter papers are available and should be used to prevent contact with dirty surfaces.
- 4) Proper cleaning methods are to be used.
- 5) Exercise care in storing and transporting standards to avoid physical damage.

11.3. Recorded Representations.

If the scale is equipped with a printer, print a ticket or label at several test loads. Verify that recorded values agree with corresponding indicated values and that all values are appropriately and correctly identified on the ticket.

Code Reference: 1.10: G-S.5.1., G-S.5.2. (except G-S.5.2.1.), G-S.5.3., G-S.5.3.1., G-S.5.4., G-S.5.5., G-S.5.6.

12. Test.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

12.1. Test of the Counting Feature.

12.1.1. Determining the Minimum Sample Size in Weight.

Code Reference: 2.20: S.1.2.3.(b), S.2.5.3., N.1.10.

12.1.2. Minimum Individual Piece Weight of the Sample.

The counting feature test requires the scale meet all three test criteria listed in 12.1.1. through 12.1.3. below. It is first necessary to determine the “minimum sample size in weight” using the formula:

$$\begin{aligned} & \text{Minimum Sample Size in Weight} \\ & = \text{Minimum Individual Piece Weight} \times \text{Minimum Sample Piece Count} \end{aligned}$$

The values for “*minimum individual piece weight*” and “*minimum sample piece count*,” must be appropriately marked and identified on a prescription scale equipped with a legal for trade counting feature.

Verify that a scale's counting feature will not accept the entry of an individual piece weight that is less than the "minimum individual piece weight" by completing the following steps:

- a. Verify that the scale is in the counting mode of operation.
- b. With the scale operating in the counting mode, apply a sufficient load to the platter to cause the displayed indication to equal the "minimum sample size in weight."
- c. Attempt to input a sample piece count less than the "minimum sample piece count" marked on the device.
- d. The counting feature must reject the entry.

Code Reference: 2.20: S.1.2.3.(a), S.2.5.3., N.1.10.

12.1.3. Count Accuracy Verification.

Complete the following steps in order to verify the accuracy of a legal for trade counting feature:

- a. Place the scale in the counting mode of operation.
- b. Zero the scale with no load on the platter.
- c. Apply a load sufficient in amount to cause the displayed weight indication to equal the value of the "minimum sample size in weight" as marked on the device.
- d. Enter the value of the "minimum sample piece count" as marked on the device using the keyboard or other input means.
- e. Remove the sample load that was applied in step c.; scale must indicate zero pieces.
- f. Apply test standards equivalent in value to each of the test points selected, including the test point near highest possible count.
- g. Observe the displayed count indication after each test point load is applied and verify that no count errors exceed the applicable tolerances indicated in Table T.N.3.10.
- h. Remove the entire test load; scale must indicate zero pieces.
- i. Return the scale to the weigh mode, and verify a zero-balance indication.

Code Reference: 2.20: N.1.10., T.N.3.10.

12.1.4. Display of Total Quantity. A Class I or Class II prescription scale shall indicate to the operator when the piece weight computation is complete by a stable display of the quantity placed on the load-receiving element.

Code Reference: 2.20: S.2.5.3.

12.1.5. Minimum Count.

A prescription scale with an operational counting feature shall not be used to count a quantity of less than 30 pieces weighing a minimum of 90 e.

Code Reference: 2.20: UR.3.11.

12.1.6. Correct Stored Piece Weight.

The user is responsible for maintaining the correct stored piece weight. This is especially critical when a medicine has been reformulated or comes from different lots.

Code Reference: 2.20: UR.3.12.

13. Post-Test Tasks.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

13.1. 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.

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.

13.1.1. 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).

13.1.2. 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.

13.2. 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.

13.3. 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.**

Part II – Mechanical Equal Arm Prescription and Jeweler Scales**14. Scope.**

It is recommended this outline be followed as minimum criteria for examining scales and balances used in prescription and jeweler applications. EPO No. 5 is divided into two parts: Part I – Electronic Prescription and Jeweler Scales and Part II – Mechanical Equal Arm Prescription and Jeweler Scales. Part I applies to electronic prescription and jeweler scales and also includes procedures for verifying proper operation of a legal for trade counting feature on a Class I and Class II prescription scale. This portion of the EPO, Part II applies to mechanical equal arm scales and balances used in prescription and jeweler applications.

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.

15. Safety Notes. See EPO 5 Section 2. Safety Notes.

Prescription scales are often located and used in areas where controlled substances are stored. Access to these areas, except by qualified personnel, is generally prohibited. Do not enter any restricted areas unless authorized to do so by personnel having proper authority to grant such access.

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 a first aid kit is available and the kit is appropriate for the type of inspection activity.**

16. Equipment List. See EPO 5 Section 3. Equipment List.**17. Inspection.**

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

17.1. 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.

17.2. Zero-Load Balance and Level Condition.

Check the zero-load balance and level conditions as found. If the device is not indicating a zero-balance 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: 1.10: G-UR.3.1, 2.20: UR.4.1., UR.4.2.

17.2.1. Zero Indication.**17.2.1.1. Zero Indication - General.**

Indicate or record zero-balance condition. If indication is by other than a continuous digital zero, then an automatic means to inhibit weighing or to return to a continuous digital indication when in an out-of-balance condition.

Code Reference: 2.20: S.1.1.

17.2.2. Zero-Load Adjustment.**17.2.2.1. General Means.**

Code Reference: 2.20: S.2.1.1.

17.2.2.2. Manual and Semi-Automatic Zero-Setting, Direct Sales.

Code Reference: 2.20: S.2.1.2.

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

Code Reference: 2.20: S.2.1.3.1.(a).

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

Code Reference: 2.20: S.2.1.3.2.(b).

17.2.2.5. Initial Zero-Setting Mechanism (Class I, II, and III only).

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).

17.2.3. Combined Zero-Tare ("0/T") Key for Scales Not Used in Direct Sales.

Code Reference: 2.20: S.2.1.6.

17.2.4. Level-Indicating Means.

Code Reference: 2.20: S.2.4. (1/1/86).

17.2.4.1. Level Condition.

Code Reference: 2.20: UR.4.2.

17.3. Selection and Suitability.**17.3.1. Suitability, General.**

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

17.3.2. Special Designs.

Code Reference: 2.20: UR.3.6.

17.3.3. Adjustable Components.

Code Reference: 2.20: S.1.10.

17.3.4. Electronic Adjustable Components.

Code Reference: 1.10: G-S.8. (1/1/90).

17.3.5. Design of Weighing Devices, Accuracy Class.

Code Reference: 2.20: S.5.*

17.3.5.1. Designation of Accuracy Class.

Code Reference: 2.20: S.5.1.* (1/1/86), UR.1.1.

17.3.5.2. Parameters for Accuracy Class.

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

17.3.6. Typical Class for Weighing Applications.

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

17.3.7. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

17.3.8. Maximum Load.

Code Reference: 2.20: UR.3.2.

17.3.9. Environment.**17.3.9.1. Suitable for the environment in which it is used.**

Code Reference: 1.10: G-UR.1.1., G-UR.1.2., 2.20: UR.1., UR.3.1.

17.3.9.2. Protection from environmental factors.

Code Reference: 2.20: UR.2.3.

17.3.10. Permanence.

Code Reference: 1.10: G-S.3.

17.4. Installation.**17.4.1. In Accordance with Manufacturer's Instructions.**

Code Reference: 1.10: G-UR.2.1.

17.4.2. Indicating and Recording Elements.

Code Reference: 1.10: G-UR.2.2.

SAFETY REMINDER!!!

- **Check to ensure that scale supports provide a firm foundation adequate to support the scale under all loading conditions, including loading of the platform to device capacity!**

17.4.3. Foundation, Supports, and Clearance – Soundness of the scale’s support structure and clearance of its parts from any impedance.

Code Reference: 2.20: UR.2.1., UR.2.2., UR.2.4.

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

Code Reference: 1.10: G-UR.2.1.1.

17.4.5. Position of Equipment.

Not applicable to prescription scales.

Code Reference: 1.10: G-UR.3.3.

17.4.5.1. Customer Indications.

Code Reference: 2.20: S.1.8.4., S.1.8.4.1. (1/1/01).

17.5. Use.**17.5.1. Facilitation of Fraud.**

Code Reference: 1.10: G-S.2.

17.5.2. Method of Operation.

Code Reference: 1.10: G-UR.3.1.

17.5.3. 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.

17.5.4. Operation with Associated and Nonassociated Equipment.

Code Reference: 1.10: G-UR.3.2.

17.5.5. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

17.5.6. Maximum Load.

Code Reference: 2.20: UR.3.2.

17.6. Maintenance.

17.6.1. Maintenance of Equipment, General.

Code Reference: 1.10: G-UR.4., G-UR.4.1.

17.6.2. Abnormal Performance.

Code Reference: 1.10: G-UR.4.2.

17.6.3. Scale Modification.

Code Reference: 2.20: UR.4.3.

17.6.4. Use of Adjustments.

Code Reference: 1.10: G-UR.4.3.

17.6.5. Check for the presence of security seals on any component designed to be sealed.

Code Reference: 1.10: G-UR.4.5.

17.7. Design of Weighing Device.**17.7.1. Designation of Accuracy Class.**

Code Reference: 2.20: S.5.1.* (1/1/86), UR.1.1.

17.7.2. Parameters for Accuracy Class.

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

17.7.3. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.

17.8. Markings.

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.

17.8.1. Markings – Overview.**17.8.1.1. Identification.**

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

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

Code Reference: 1.10: G-S.5.2.3.

17.8.1.3. Values.

Code Reference: 1.10: G-S.5.2.4.

17.8.1.4. Permanence of Markings.

Code Reference: 1.10: G-S.5.2.5.

17.8.1.5. Accuracy Class.

Code Reference: 2.20: S.5.

17.8.1.6. Location.

Code Reference: 2.20: S.6.2.

17.8.1.7. Specific Scales' Code Markings.

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

17.8.1.8. Special Design.

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

Scales designed for special application appropriately marked to restrict its use (e.g., postal scale, prepack scale, weight classifier).

Code Reference: Table S.6.3.b. Note 13 (Nonretroactive 1/1/86).

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

Code Reference: Table S.6.3.b. Note 13 Retroactive.

17.8.2. Marking Requirements – All Devices.**17.8.2.1. General.**

Code Reference: 2.20: S.6.

17.8.2.2. Identification.

Code Reference: 1.10: G-S.1.

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

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

17.8.2.2.2. 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).

17.8.2.2.3. 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).

17.8.2.2.4. As of 2004 the current software version or revision identifier for not-built-for-purpose software-based devices and as of 2022 the current software version or revision identifier for all software-based devices.

Code Reference: 1.10: G-S.1.(d) (1/1/04), G-S.1.(d) (1/1/22).

Software Version or Identifier.

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

- (1) Preface identifying it as such.
Code Reference: 1.10: G-S.1.(d)(1)*i.* (1/1/07).
- (2) Continuously displayed or accessible via display.
Code Reference: 1.10: G-S.1.(d)(1)*ii.* (1/1/22).
- (3) Acceptable abbreviations for “version,” “number,” and “revision.”
Code Reference: 1.10: G-S.1.(d)(2) (1/1/07).

17.8.2.2.5. NTEP CC Number for Devices with NTEP CC.

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

Preface by the terms “NTEP CC,” “CC,” or “Approval” followed by either the word or an acceptable abbreviation of “number.”

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

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

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

17.8.2.4. Devices or main elements remanufactured as of January 1, 2002.

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).

17.8.2.5. Operational Controls, Indications, and Features.

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

17.8.2.6. Lettering.

Code Reference: 1.10: G-S.7.

17.8.2.7. Visibility of Identification – installation to ensure ready visibility of markings.

Code Reference: 1.10: G-UR.2.1.1.

17.8.2.8. Interchange or Reversal of Parts.

Code Reference: 1.10: G-S.4.

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

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

17.8.3.1. Accuracy Class.

Code Reference: Table S.6.3.b. Note 17 (Nonretroactive 1/1/86).

17.8.3.2. Nominal Capacity.

Code Reference: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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: 2.20: Table S.6.3.b. Note 3 (Nonretroactive 1/1/83).

For any scale that has no “d,” the nominal capacity shall be shown together with the verification scale interval “e.”

Code Reference: Table S.6.3.b. Note 4(a) (Nonretroactive 1/1/86).

For any scale 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: 2.20: Table S.6.3.b. Note 4(b) (Nonretroactive 1/1/86).

17.8.3.3. Temperature Limits.

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

17.8.4. Marking Requirements – Indicating 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.

17.8.4.1. Accuracy Class.

Code Reference: 2.20: Table S.6.3.b. Note 8 (Nonretroactive 1/1/88).

17.8.4.2. Nominal Capacity.

Code Reference: 2.20: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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: 2.20: Table S.6.3.b. Note 3 (Nonretroactive 1/1/83).

For any scale that has no “d,” the nominal capacity shall be shown together with the verification scale interval “e.”

Code Reference: 2.20: Table S.6.3.b. Note 4(a) (Nonretroactive 1/1/86).

For any scale 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: 2.20: Table S.6.3.b. Note 4(b) (Nonretroactive 1/1/86).

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

17.8.4.4. Maximum Number of Verification Scale Intervals ($n_{\max}$).

Code Reference: 2.20: Table S.6.3.b. Note 6 (Nonretroactive 1/1/88).

17.8.5. 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.

17.8.5.1. Accuracy Class.

Code Reference: 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).

17.8.5.2. Nominal Capacity.

Code Reference: 2.20: Table S.6.3.b. Note 3 Retroactive and Note 18 Retroactive.

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

Code Reference: 2.20: Table S.6.3.b. Note 5 (Nonretroactive 1/1/86).

17.8.5.4. Maximum Number of Verification Scale Intervals ($n_{\max}$).

Code Reference: 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).

17.8.5.5. Minimum Verification Scale Division for which device complies with the requirements ($e_{\min}$ or d).

Code Reference: 2.20: Table S.6.3.b. Note 19 (Nonretroactive 1/1/88).

17.9. Indicating and Recording Elements.**17.9.1. Appropriateness of Design.****17.9.1.1. Accuracy Class.**

Code Reference: 2.20: S.5.

17.9.1.2. Computing Capability (for price-computing scales).

Code Reference: 2.20: S.1.8.

17.9.1.3. Indicating and Recording Elements, General Design.

Code Reference: 1.10: G-S.5.1.

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

Code Reference: 2.20: S.1.7.

17.9.1.5. 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).

17.9.1.6. Recommended Minimum Load.

Code Reference: 2.20: UR.3.1.

17.9.1.7. Maximum Load.

Code Reference: 2.20: UR.3.2.

17.9.2. 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 ($\frac{3}{8}$ inch) in height.

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

17.9.3. Value of Scale Division and/or Interval.

17.9.3.1. Value – General.

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

17.9.3.2. Value of Scale Units.

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

17.9.3.3. Digital Indicating Scales, Units.

Code Reference: 2.20: S.1.2.1. (1/1/89).

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

Code Reference: 2.20: S.1.2.2.1.*

17.9.3.5. Extended Display Mode.

Code Reference: 2.20: S.1.2.2.3.

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

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

17.9.3.7. Multi-Interval and Multiple-Range Scales.

Code Reference: 2.20: S.5.3.

17.9.4. Graduations.

Code Reference: 2.20: S.1.3.

17.9.5. Indicators.

Code Reference: 2.20: S.1.4.

17.9.5.1. Recorded representations, Point-of-Sale Systems.

Code Reference: 2.20: S.1.8.5.

17.9.5.2. Customer Indications, Computing Scales.

Code Reference: 2.20: S.1.8.4., S.1.8.4.1. (1/1/01).

17.9.6. Prepackaging Scales Only.

Code Reference: 2.20: S.1.9.1.

17.9.7. Tare.

17.9.7.1. Value of Tare Division.

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

17.9.7.2. Tare Mechanism.

Code Reference: 2.20: S.2.3.

17.9.7.3. Combined Zero-Tare (“0/T”) Key.

Code Reference: 2.20: S.2.1.6.

17.9.8. Repeatability.

Code Reference: 1.10: G-S.5.4.

17.9.9. Recorded Representations.**17.9.9.1. Recorded Representations, General.**

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

17.9.9.2. Recorded Representations, Prepackaging Scales.

Code Reference: 2.20: S.1.9.2.

17.9.9.3. Indicated and Recorded Representation, 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).

17.9.10. Damping Means.

Code Reference: 2.20: S.2.5., S.2.5.2.

17.9.11. Adjustable Components.

Code Reference: 2.20: S.1.10.

17.9.12. Manual Weight Entries.

Code Reference: 2.20: S.1.12. (1/1/93 and 1/1/05), UR.3.10.

17.10. Weighing Elements.**17.10.1. Antifriction Means.**

Code Reference: 2.20: S.4.1.

17.10.2. Adjustable Components.

Code Reference: 2.20: S.1.10., S.4.2.

17.10.3. Multiple Load-Receiving Elements.

Code Reference: 2.20: S.4.3.

17.10.4. Scoop Counterbalance.

Code Reference: 2.20: S.3.3.

17.11. Provision for Sealing.

The Provision for Sealing requirements outlined below are provided in entirety to include the full scope of requirements applicable to sealable parameters for prescription and jeweler scale applications. The information is intended to provide the EPO user with additional details on the complete scope of the requirement across multiple device applications and types.

17.11.1. 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.

Note: 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).

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: 2.20: S.1.11.2.

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).

17.11.2. A metrologically-significant software change is a sealable event.

Code Reference: 1.10: G-S.9.

17.11.3. 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).

17.11.4. Physical Means of Security.

17.11.4.1. 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.

17.11.4.2. 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.

17.11.5. 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).

17.11.6. Audit Trails, General.

17.11.6.1. 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).

17.11.6.2. 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).

17.11.7. 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).

18. Pretest Determinations.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

18.1. Tolerances – General.

18.1.1. Acceptance/Maintenance Tolerances.

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

18.1.2. Application.

Code Reference: 1.10: G-T.3., 2.20: T.N.2.1., T.N.2.3.

18.1.3. Intermediate Values.

Code Reference: 1.10: G-T.4.

18.2. Tolerance Values

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

18.2.1.1. Using the following formula determine the number of verification scale intervals (n):

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

18.2.2. Tolerance Associated with the Standard.

18.2.2.1. Tolerance 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.

18.2.3. Unmarked Scales – Tolerance Values.

18.2.3.1. Scales that are not marked with an accuracy class designation.

- Tolerance Application.

Code Reference: 2.20: T.N.1., Table T.1.1.

- Unmarked Scales – All. Ratio Tests.
Code Reference: 2.20: T.N.2.5.
- Single indicating or recording elements.
Code Reference: 2.20: T.N.4.2.
- Repeatability of Indications.
Code Reference: 1.10: G-S.5.4., 2.20: T.N.5.

18.2.4. Marked Scales – Tolerance Values.

18.2.4.1. Scales marked with an accuracy class designation.

- Principles
Code Reference: 2.20: T.N.1.*
- General Tolerances.
Code Reference: 2.20: T.N.2.1.*, T.N.2.3.
- Ratio Tests (scales equipped with commercial weights).
Code Reference: 2.20: T.N.2.5.
- Maintenance tolerance values.
Code Reference: 2.20: T.N.3.1. [Table 6].
- Acceptance tolerance values.
Code Reference: 2.20: T.N.3.2.
- Single indicating or recording elements.
Code Reference: 2.20: T.N.4.2.
- Repeatability of Indications.
Code Reference: 1.10: G-S.5.4.
- Time Dependence.
Code Reference: T.N.4.5.*, T.N.4.5.1.*

18.3. Sensitivity Requirements.

18.3.1. Marked Scales.

18.3.1.1. Application.

Code Reference: 2.20: T.N.6.*

18.3.1.2. Test Load.

Code Reference: 2.20: T.N.6.*

18.3.1.3. Application.

Code Reference: 2.20: T.N.6.1.(b).*

18.3.1.4. Minimum Change.

Code Reference: 2.20: T.N.6.2.*

18.3.2. Unmarked Scales.

18.3.2.1. Application.

Code Reference: 2.20: T.2.1.

18.3.2.2. Test Load (Prescription Scales).

Code Reference: 2.20: T.2.4.

18.3.2.3. Test Load (Jewelers Scales).

Code Reference: 2.20: T.2.4.

18.3.2.4. Minimum Change.

Code Reference: 2.20: T.3.

18.4. Minimum Test Weights and Test Loads.

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

19. Test Notes.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

19.1. 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 HB 44 Appendix A – Fundamental Considerations.

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

19.1.1. Tolerance Testing. Tolerance testing determines whether or not a scale is performing to within applicable tolerances. This method of testing does not reveal the precise amount of error in a scale. To use the tolerance test method, standards equal to the value of tolerance are added at each test load to the pan of the lighter side and the balance indicator is observed. The addition of standards equal to the value of applicable tolerance must change the position of rest of the indicator back to the initial zero-load balance indication or beyond for a scale to perform within acceptable limits.

19.1.2. Error-Weight Testing. Error-weight testing determines the precise amount of error in a scale. To use the error-weight method, precision field standards (i.e., error weights) in minimum denominations equal to 0.1 d are added at each test load to the pan of the lighter side in the amount necessary to cause the position of rest of the indicator to return back to the initial zero-load balance indication. The weight values of the precision field standards (i.e., error weights) are then added together and summed, the total result being equal to the amount of error in the scale at that particular test load.

Note: In cases where precision field standards in denominations equal to 0.1 d are not readily available, the error-weight method of testing should not be performed.

19.2. Verify Scale Accuracy.

For scales not marked with an accuracy class designation two different methods may be used to verify compliance with accuracy requirements, i.e., the tolerance testing method or the error-weight testing method. Each test method procedure starts with the scale in a zero-load balance and level condition.

Scales marked with an accuracy class designation should always be tested using the error-weight method since compliance with T.N.4.4. (shift test agreement) can only be determined if the precise amount of error in each shift test result is known.

19.3. Return to Zero-Load Balance. Verify the scale returns to zero-load balance each time the entire test load is removed.

Code Reference: 1.10: G-UR.4.2., 2.20: N.1.9.

19.4. Repeatability. Check repeatability of indications throughout the test.

19.4.1. Repeatability of Indications.

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

20. Test.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

20.1. Commercial Weights.

20.1.1. Precision Field Standards Guidelines.

Commercial weights, (i.e., weights used in connection with commercial weighing devices) are not to be used in any of the performance tests described herein. Rather, performance testing of prescription and jewelers’ scales requires the sole use of suitable precision field standards. Guidelines for determining the necessary accuracy level of the precision field standards needed to properly test prescription and jewelers’ scales are included in the “Equipment List” in EPO 5 Section 3. Equipment List.

20.1.2. Testing Commercial Weights.

Commercial weights should be tested on a precision balance using adequate standard weights; the combined errors and uncertainties of the standard weights, when used without correction, shall not exceed one third of the smallest tolerance to be applied to the device under test. It may not be appropriate to apply the requirements in NIST HB 44 Section 2.23 to verify the accuracy of commercial weights used in connection with prescription and jewelers’ scales in every field environment. In some instances, accuracy can only be verified in a laboratory that is formally accredited or recognized (i.e., a laboratory having the necessary qualifications to perform the necessary calibrations given the accuracy level of the standards being tested, e.g., OIML E-2, ASTM 1, etc.). In addition, it is recommended that commercial weights be calibrated (i.e., their accuracy verified) at a frequency interval necessary to ensure continued compliance with applicable tolerances and that the calibration frequency interval be based upon the collection of actual performance data.

Code Reference: NIST HB 44 Weights Code (Section 2.23).

20.2. Zero-Load Balance.

Check for maintenance of the zero-load balance and level condition. Establish a correct zero-load balance and level condition prior to beginning the test.

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

20.3. Sensitivity Test at Zero Load and Maximum Test Load.

Code Reference: 2.20: N.1.4.

20.4. Ratio Test.

Ratio tolerances are to be applied whenever the multiple of the lever system is verified using suitable precision field standards of equal value applied to opposite pans.

Code Reference: 2.20: N.1.7.

20.5. Increasing-Load Test. Conduct an increasing-load test with the test loads approximately centered on the platter.

Code Reference: 2.20: N.1.1.

20.5.1. Scales Not Marked with an Accuracy Class.

For scales marked with an accuracy class, test at several points in each tolerance range including at or near the highest test load that can be applied to the scale without the tolerance increasing to the next tolerance range. For scales not marked with an accuracy class, test at several points to capacity, including test loads at or near one-quarter, one-half, and three-quarters scale capacity and at full capacity.

20.5.2. Scales Marked with an Accuracy Class.

Scales marked with an accuracy class designation should always be tested using the error-weight method since compliance with T.N.4.4. (shift test agreement) can only be determined if the precise amount of error in each shift test result is known.

20.5.3. Testing Weighbeams and Dials.

Verify the accuracy of each weighbeam or dial at a minimum of two points, (i.e., at or near half and full weighbeam or dial capacity). It is recommended that additional verifications be performed at test loads where these elements are regularly used.

Code Reference: 2.20: N.1.1.

20.6. Shift Test.

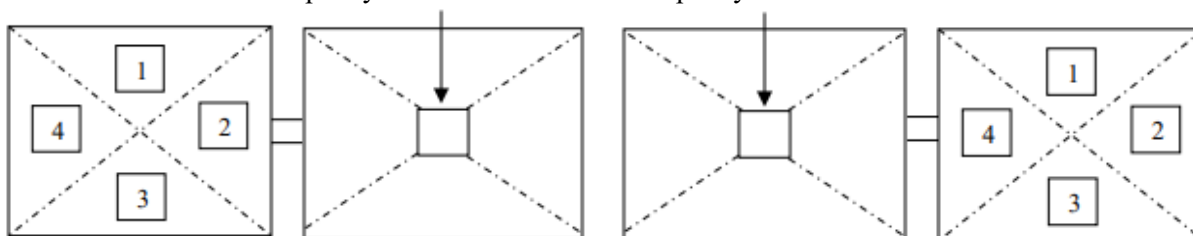
A shift test performed at one-half scale capacity is to be conducted separately on each pan of an equal arm balance as shown below in Figure 5 and Figure 6. The test is conducted with mass standards equal to one-half capacity centered on one pan and standards equal to one-half capacity centered successively at four points equidistant between the center and the front, left, back, and right edges of the opposite pan. Once the results of all four positions of the first pan have been determined, remove all test weight, and verify return to zero-load balance. Then conduct a shift test on the pan opposite the first pan, using these same loading procedures, except the test load is applied to the opposite pan.

Code Reference: 2.20: N.1.2.3.

Figure 5. Equal-Arm Scales: Shift Test Patterns – Rectangular Platter
(one-half capacity test load)

The numbered boxes identify the various positions for placing the shift test load.

$\frac{1}{2}$ capacity test load centered $\frac{1}{2}$ capacity test load centered



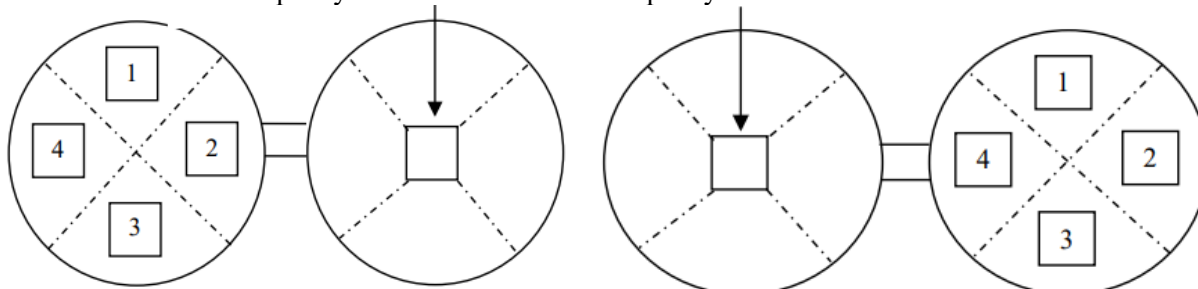
Example: Shift Test Positions - Left Pan

Example: Shift Test Positions - Right Pan

Figure 6. Equal-Arm Scales: Shift Test Patterns – Circular Platter
(one-half capacity test load)

The numbered boxes identify the various positions for placing the shift test load.

$\frac{1}{2}$ capacity test load centered $\frac{1}{2}$ capacity test load centered



Example: Shift Test Positions - Left Pan

Example: Shift Test Positions - Right Pan

20.7. Return to Zero-Load Balance.

Recheck the zero-load balance each time the test load is removed.

Code Reference: 2.20: N.1.9.

SAFETY REMINDER!!!

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

21. Post-Test Tasks.

NOTE: Code references used throughout the document are drawn from NIST Handbook (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.

21.1. 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.

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.

21.1.1. 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).

21.1.2. 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.

21.2. 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.

21.3. 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.

Appendix A. Conversion Tables for Units of Mass Measurement**Table A-1. Carats (SI*) to Grams****Conversion Factor:** 1 carat (c) = 0.2 gram (g) exactly

(All underlined figures are exact values.)

Selected Known Test Load (c)	Equivalent Load (g)
1.0	<u>0.2</u>
2.0	<u>0.4</u>
5.0	<u>1.0</u>
7.5	<u>1.5</u>
10.0	<u>2.0</u>
12.5	<u>2.5</u>
15.0	<u>3.0</u>
17.5	<u>3.5</u>
20.0	<u>4.0</u>
25.0	<u>5.0</u>
30.0	<u>6.0</u>
35.0	<u>7.0</u>
40.0	<u>8.0</u>
45.0	<u>9.0</u>
50.0	<u>10.0</u>
60.0	<u>12.0</u>
70.0	<u>14.0</u>
80.0	<u>16.0</u>
90.0	<u>18.0</u>
100.0	<u>20.0</u>
125.0	<u>25.0</u>
150.0	<u>30.0</u>
175.0	<u>35.0</u>
200.0	<u>40.0</u>
250.0	<u>50.0</u>
300.0	<u>60.0</u>
350.0	<u>70.0</u>
400.0	<u>80.0</u>
450.0	<u>90.0</u>
500.0	<u>100.0</u>
600.0	<u>120.0</u>
700.0	<u>140.0</u>
800.0	<u>160.0</u>
900.0	<u>180.0</u>
1 000.0	<u>200.0</u>
1 250.0	<u>250.0</u>
1 500.0	<u>300.0</u>
1 750.0	<u>350.0</u>
2 000.0	<u>400.0</u>
2 500.0	<u>500.0</u>
3 000.0	<u>600.0</u>

Selected Known Test Load (c)	Equivalent Load (g)
3 500.0	<u>700.0</u>
4 000.0	<u>800.0</u>
4 500.0	<u>900.0</u>
5 000.0	<u>1 000.0</u>

*International System of Units (SI) is commonly known as the metric system of measurement. To convert the carat to grams, multiply the carat value to be converted by a factor of 0.2. The result produced will equal the equivalent value in grams. In the Department of Commerce Circular of the Bureau of Standards No. 43) *The Metric Carat* the Bureau acknowledged as of July 1, 1913 the recognition of the international metric carat as 200 milligrams for diamonds and other precious stones and expressed as decimal fractions. The carat was further divided, where 1 carat equals 100 points. Note the National Bureau of Standards became NIST. The publication is available on the NIST website at: <https://nvlpubs.nist.gov/nistpubs/Legacy/circ/nbscircular43.pdf>.

Table A-2. Pennyweight (Troy) to Grams**Conversion Factor:** 1 pennyweight (dwt) = 1.555 173 84 grams (g) exactly

Selected Known Test Load (dwt)	Equivalent Load (g)*
0.20	0.311
0.50	0.778
0.75	1.166
1.00	1.555
2.00	3.110
5.00	7.776
10.00	15.552
20.00	31.103
35.00	54.431
50.00	77.759
75.00	116.638
100.00	155.517
150.00	233.276
200.00	311.035
250.00	388.793
300.00	466.552
350.00	544.311
400.00	622.070
450.00	699.828
500.00	777.587
550.00	855.346
600.00	933.104
650.00	1 010.863
700.00	1 088.622
750.00	1 166.380
800.00	1 244.139
875.00	1 360.777
925.00	1 438.536
1 000.00	1 555.174
1 100.00	1 710.691
1 200.00	1 866.209
1 300.00	2 021.726
1 400.00	2 177.243
1 500.00	2 332.761
1 600.00	2 488.278
1 700.00	2 643.796
1 800.00	2 799.313
1 900.00	2 954.830
2 000.00	3 110.348
2 250.00	3 499.141
2 500.00	3 887.935
2 750.00	4 276.728
3 000.00	4 665.522

Selected Known Test Load (dwt)	Equivalent Load (g)*
3 500.00	5 443.108
4 000.00	6 220.695
4 500.00	6 998.282
5 000.00	7 775.869
5 500.00	8 553.456
6 000.00	9 331.043
6 500.00	10 108.630
7 000.00	10 886.217
7 500.00	11 663.804
8 000.00	12 441.391
8 500.00	13 218.978
9 000.00	13 996.565
9 500.00	14 774.151
10 000.00	15 551.738

*All values in this column have been rounded to the nearest one milligram (0.001 g). Rounding of all computed values shall comply with the rules in NIST Handbook 44 Appendix A, Fundamental Considerations, Section 10. Rounding Off Numerical Values. A rounding error of no more than one-half milligram (0.000 5 g) may, therefore, exist for any single gram value shown. This amount of potential rounding error is insignificant and will not adversely affect the results of performance testing on Class I, Class II, or Class III prescription and jewelry scales provided that the scale being tested has a minimum resolution of 0.01 pennyweight or higher resolution and mass standards of proper accuracy level are used in the testing. Refer to EPO No. 5 Section 3. Equipment List for guidelines on determining the proper accuracy level of mass standards.

Do not sum any two or more gram values shown in this table when determining the appropriate equivalent load in grams. Instead, to calculate the gram equivalent of any troy pennyweight value not included in this table, multiply the troy pennyweight value by 1.555 173 84, then round to the nearest one milligram (0.001 g).

Note: Pennyweight is a unit of mass in the troy system where 20 pennyweight is equal to 1 troy ounce exactly.

Table A-3. Pounds (Avoirdupois) to Grams
Conversion Factor: 1 pound (lb) = 453.592 37 grams (g) exactly

Selected Known Test Load (lb)	Equivalent Load (g)*
0.01	4.536
0.05	22.680
0.10	45.359
0.15	68.039
0.20	90.718
0.25	113.398
0.30	136.078
0.40	181.437
0.50	226.796
0.75	340.194
0.95	430.913
1.00	453.592
1.25	566.990
1.50	680.389
1.75	793.787
2.00	907.185
2.50	1 133.981
3.00	1 360.777
3.50	1 587.573
4.00	1 814.369
4.50	2 041.166
5.00	2 267.962
5.50	2 494.758
6.00	2 721.554
7.00	3 175.147
8.00	3 628.739
9.00	4 082.331
10.00	4 535.924
11.00	4 989.516
12.00	5 443.108
14.00	6 350.293
16.00	7 257.478
18.00	8 164.663
20.00	9 071.847
22.00	9 979.032
24.00	10 886.217
26.00	11 793.402
28.00	12 700.586
30.00	13 607.771
32.00	14 514.956
34.00	15 422.141
36.00	16 329.325

*All values in this column have been rounded to the nearest one milligram (0.001 g). Rounding of all computed values shall comply with the rules in NIST Handbook 44 Appendix A, Fundamental Considerations, Section 10. Rounding Off Numerical

Values. A rounding error of no more than one-half milligram (0.0005 g) may, therefore, exist for any single gram value shown. This amount of potential rounding error is insignificant and will not adversely affect the results of performance testing on Class I, Class II, or Class III prescription and jewelry scales provided that the scale being tested has a minimum resolution of 0.0002 pound or higher resolution and mass standards of proper accuracy level are used in the testing. Refer to EPO No. 5 Section 3. Equipment List for guidelines on determining the proper accuracy level of mass standards.

To avoid mathematical errors do not sum any two or more gram values shown in this table when determining the appropriate equivalent load in grams. Instead, to calculate the gram equivalent of any avoirdupois pound value not included in this table, multiply the avoirdupois pound value by the conversion factor 453.592 37, then round to the nearest one milligram (0.001 g).

Table A-4. Ounces (Avoirdupois) to Grams**Conversion Factor:** 1 ounce (oz avdp) = 28.349 523 125 grams (g) exactly

Selected Known Test Load (oz avdp)	Equivalent Load (g)*
0.25	7.087
0.50	14.175
0.75	21.262
0.95	26.932
1.00	28.350
1.25	35.437
1.50	42.524
1.75	49.612
1.95	55.282
2.00	56.699
2.50	70.874
3.00	85.049
3.50	99.223
4.00	113.398
4.50	127.573
5.00	141.748
6.00	170.097
7.00	198.447
8.00	226.796
9.00	255.146
10.00	283.495
12.00	340.194
14.00	396.893
16.00	453.592
18.00	510.291
20.00	566.990
25.00	708.738
30.00	850.486
40.00	1 133.981
50.00	1 417.476
60.00	1 700.971
70.00	1 984.467
80.00	2 267.962
90.00	2 551.457
100.00	2 834.952
125.00	3 543.690
150.00	4 252.428
175.00	4 961.167
200.00	5 669.905
250.00	7 087.381
300.00	8 504.857
350.00	9 922.333
400.00	11 339.809
450.00	12 757.285

Selected Known Test Load (oz avdp)	Equivalent Load (g)*
500.00	14 174.762

*All values in this column have been rounded to the nearest one milligram (0.001 g). Rounding of all computed values shall comply with the rules in NIST Handbook 44 Appendix A, Fundamental Considerations, Section 10. Rounding Off Numerical Values. A rounding error of no more than one-half milligram (0.0005 g) may, therefore, exist for any single gram value shown. This amount of potential rounding error is insignificant and will not adversely affect the results of performance testing on Class I, Class II, or Class III prescription and jewelry scales provided that the scale being tested has a minimum resolution of 0.005 ounce or higher resolution and mass standards of proper accuracy level are used in the testing. Refer to EPO No. 5 Section 3. Equipment List for guidelines on determining the proper accuracy level of mass standards.

To avoid mathematical errors do not sum any two or more gram values shown in this table when determining the appropriate equivalent load in grams. Instead, to calculate the gram equivalent of any avoirdupois ounce value not included in this table, multiply the avoirdupois ounce value by the conversion factor 28.349 523 125, then round to the nearest one milligram (0.001 g).

Table A-5. Ounces (Troy) to Grams**Conversion Factor:** 1 ounce troy (oz t) = 31.103 476 8 grams (g) exactly

Selected Known Test Load (oz t)	Equivalent Load (g)*
0.01	0.311
0.05	1.555
0.10	3.110
0.25	7.776
0.45	13.997
0.50	15.552
0.75	23.328
0.95	29.548
1.00	31.103
1.50	46.655
2.00	62.207
2.50	77.759
3.00	93.310
4.00	124.414
5.00	155.517
6.00	186.621
7.00	217.724
8.00	248.828
9.00	279.931
10.00	311.035
11.00	342.138
12.00	373.242
13.00	404.345
14.00	435.449
15.00	466.552
16.00	497.656
17.00	528.759
18.00	559.863
19.00	590.966
20.00	622.070
21.00	653.173
22.00	684.276
23.00	715.380
24.00	746.483
25.00	777.587
30.00	933.104
35.00	1 088.622
40.00	1 244.139
45.00	1 399.656
50.00	1 555.174
55.00	1 710.691
60.00	1 866.209
65.00	2 021.726
70.00	2 177.243

Selected Known Test Load (oz t)	Equivalent Load (g)*
75.00	2 332.761
80.00	2 488.278
85.00	2 643.796
90.00	2 799.313
95.00	2 954.830
100.00	3 110.348
110.00	3 421.382
120.00	3 732.417
130.00	4 043.452
140.00	4 354.487
150.00	4 665.522
160.00	4 976.556
170.00	5 287.591
180.00	5 598.626
190.00	5 909.661
200.00	6 220.695

* All values in this column have been rounded to the nearest one milligram (0.001 g). Rounding of all computed values shall comply with the rules in NIST Handbook 44 Appendix A, Fundamental Considerations, Section 10. Rounding Off Numerical Values. A rounding error of no more than one-half milligram (0.0005 g) may, therefore, exist for any single-gram value shown in this table. This amount of potential rounding error is insignificant and will not adversely affect the results of performance testing on Class I, Class II, or Class III prescription and jewelry scales provided that the scale being tested has a minimum resolution of 0.0005 ounce troy or higher resolution and mass standards of proper accuracy level are used in the testing. Refer to EPO No. 5 Section 3. Equipment List for guidelines on determining the proper accuracy level of mass standards.

To avoid mathematical errors do not sum any two or more gram values shown in this table when determining the appropriate equivalent load in grams. Instead, to calculate the equivalent of any troy ounce value not included in this table, multiply the troy ounce value by the conversion factor 31.103 476 8, then round to the nearest one milligram (0.001 g).