NIST | OFFICE OF WEIGHTS AND MEASURES

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

EPO No. 25

Loading Rack Meters

EPO25.20250618 (content current as of 2025-06-18)

This publication is available free of charge:
https://www.nist.gov/pml/owm/owm-examination-procedure-outlines-epos

THIS PAGE INTENTIONALLY LEFT BLANK

Table of Contents

EPO No. 25
NIST Examination Procedure Outline (EPO) for
Loading-Rack Meters

1. Scope.

It is recommended that this outline be followed as minimum criteria for examining loading-rack meters used to measure petroleum products sold at wholesale. The outline may be applied to devices with or without Automatic Temperature Compensating Systems. Non-retroactive and retroactive requirements are followed by the applicable date in parentheses.

2. Safety Notes.

When excerpting this Examination Procedure Outline for duplication, the EPO Safety Annex (Safety Considerations and Glossary of Safety Key Phrases) should be duplicated and included with this 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 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 in 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 NIST EPO Safety Annex - "Safety Considerations and Glossary of Safety Key Phrases." The terms and key phrases in each safety reminder of this outline are found in the glossary of the EPO Safety Annex. The inspector is reminded of the importance of evaluating potential safety hazards prior to an inspection and taking adequate precautions to avoid personal injury or damage to the device. As a minimum, the following safety precautions should be noted and followed during the inspection.

- **Clothing**
- **Electrical Hazards**
- **Emergency Procedures**
- **Eye Protection**
- **Fire Extinguisher**
- **First Aid Kit**
- **Grounding/Bonding**
- **Ignition Sources**
- **Lifting**
- **Location**
- **Nature of Product**
- **Obstructions and Overhead Hazards**
- **Personal Protection Equipment**
  - e.g., Barrier Cream, Eye Protection, Gloves, Hard Hat, Safety Aprons, Safety Shoes, etc., if deemed necessary Static Discharge
- **Safety Cones/Warning Signs**
- **Safety Data Sheets (SDS)**

- **Static Discharge**
- **Support - for prover**
- **Switch Loading**
- **Traffic**
- **Transportation of Equipment**
- **Weather**

Also

- **Chemicals**
- **Hazardous Materials**
- **Petroleum Products**
- **Wet/Slick Conditions**

SAFETY REMINDER!!!

- **Check the inspection site carefully for safety hazards and take appropriate precautions.**
- **Check to be certain that the ground surface of the inspection site is sufficiently strong and rigid to support the prover when it is filled with product – don't forget to chock the wheels of the prover.**
- **Learn the nature of hazardous products used at or near the inspection site–, and obtain and read copies of the applicable SDS (Safety Data Sheet).**
- **Know emergency procedures and location and operation of fire extinguishers and emergency shutoffs.**
- **Post safety cones/warning signs and be aware of vehicular and pedestrian traffic patterns.**
- **Use caution moving around in wet, slippery areas and in climbing on prover, storage tanks, and vehicles.**
- **Use personal protection equipment and clothing appropriate for the inspection site.**
- **If leaks, spills, or exposed wiring cause hazardous testing conditions it is recommended that the testing be discontinued until the unsafe conditions are corrected.**
- **Be sure a first aid kit is available and that the kit is appropriate for the type of inspection activity.**

3. Inspection.

NOTE: Code references used throughout the document are drawn from NIST HB 44 General Code (Section 1.10) and Liquid-Measuring Devices Code (Section 3.30). 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.

3.1. Accessibility and assistance in inspecting, testing, and sealing.

3.1.1. The device must be readily accessible for purposes of testing.

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

3.1.2. Assistance shall be provided by the firm if needed.

Code Reference: 1.10: G-UR.4.4.

3.2. Selection and Suitability.

3.2.1. Selection and suitability, general.

The device must be suitable for the service in which it is used with respect to the elements of design, including flow rate, computing capability, the details of its indicating and recording elements, and the value of its smallest unit and unit prices.

Code Reference: 1.10: G-UR.1.1., G-UR.1.2., 3.30: UR.2.2.

3.2.2. Minimum delivery required.

Code Reference: 1.10: G-UR.1.3.

3.2.3. Environment.

The device must also be suitable for use in the environment in which it is installed.

Code Reference: 1.10: G-UR.1.2.

3.2.4. Permanence.

Code Reference: 1.10: G-S.3.

3.3. Installation.

3.3.1. Installation shall not facilitate fraud.

Examine the system and any associated equipment insure the assembly, installation, and construction do not facilitate fraud.

Code Reference: 1.10: G-S.2.

3.3.2. Diversion of measured product.

Examine the discharge lines and valves to ensure the system is installed such that measured liquid cannot be diverted.

Code Reference: 1.10: G-S.2., 3.30: S.3.1.

3.3.3. Installed in accordance with manufacturer's instructions.

A device shall be installed in accordance with manufacturer's instructions.

A device installed in a fixed location shall be installed so that neither its operation nor its performance will be adversely affected by any characteristic of the foundation, supports, or any other detail of the installation. The installation shall be sufficiently secure and rigid to maintain this condition.

Code Reference: 1.10: G-UR.2.1., 3.30: UR.2.1.

3.3.4. Discharge rate.

A device shall be installed such that the actual maximum discharge rate will not exceed the marked maximum discharge rate. Automatic means for regulating the flow shall be incorporated into the system, if necessary.

Code Reference: 3.30: UR.2.2.

3.3.5. No obstruction between indicating and recording elements.

The device shall be installed so that there is no obstruction between a primary indicating element or recording element and the measuring element. Otherwise, there shall be convenient and permanently installed means for direct oral or visual communication between an individual located at the primary element and an individual located at the measuring element.

Code Reference: 1.10: G-UR.2.2.

3.3.5.1. Visibility of Markings.

Code Reference: 1.10: G-UR.2.1.1.

3.3.5.2. Position of Equipment.

A device or system equipped with a primary indicating element and used in direct sales shall be positioned so that its indications may be accurately read and the measuring operation may be observed from some reasonable "customer" and "operator" position. The positioning shall be determined on a case-by-case basis, considering the individual circumstances, including the size and character of the indicating element.

Code Reference: 1.10: G-UR.3.3.

3.4. Use.

3.4.1. Facilitation of fraud.

Code Reference: 1.10: G-S.2.

3.4.2. Method of operation.

Device and any associated equipment are to be operated and maintained as intended by the manufacturer.

Code Reference: 1.10: G-UR.3.1., G-UR.4.1.

3.4.3. Operation of associated and nonassociated equipment.

Code Reference: 1.10: G-UR.3.2.

3.4.4. Return of Indicating and Recording Elements to Zero.

When primary indicating and/or recording elements are returnable to zero, these shall be returned to zero immediately before each delivery and after the pump has been activated and product to be measured has been supplied to the measuring system.

Code Reference: 3.30: UR.3.1.

3.4.5. Computing-Type Devices.

The total price, the total volume of the delivery, and the price per liter or gallon shall be shown, either recorded by the device or in clear hand script, on any recorded representation issued by a device and containing any one of these values. Nonretroactive as of January 2021, the recorded representation shall also include a corresponding dispenser/meter designation.

Code Reference: 3.30: UR.3.4. (a portion Nonretroactive).

3.4.6. Use of Automatic Temperature Compensation (ATC).

Code Reference: 3.30: UR.3.6.1.1.

3.4.7. Use of Adjustments, Multiple Linearization Factors.

Code Reference: 3.30: UR.4.1.

3.5. Maintenance.

3.5.1. Maintenance in proper operating condition.

The device and any associated equipment are to be maintained in proper operating conditions.

Code Reference: 1.10: G-UR.4.1.

3.5.2. Abnormal performance.

Code Reference: 1.10: G-UR.4.2.

3.5.3. Errors not in favor of the device owner.

Adjustments not used to compensate for worn or faulty parts and made to bring errors as close to zero value as practicable.

Code Reference: 1.10: G-UR.4.3.

3.6. Indicating and Recording Elements.

3.6.1. Design, General.

The device must be equipped with indicating elements and MAY be equipped with a recording element

Code Reference: 3.30: S.1.1.

3.6.2. Units.

3.6.2.1. Units of Measurement.

Units are to be in terms of liters, gallons, quarts, pints, fluid ounces, or binary-sub-multiples or decimal subdivisions of the liter or gallon.

Code Reference: 3.30: S.1.2., S.1.2.2.

3.6.2.2. Value of Smallest Unit.

Shall not exceed 5 L (1 gal) on devices with a maximum flow of more than 750 L/min (200 gal/min).

Code Reference: 3.30: S.1.2.3.(b).

3.6.3. Readability.

- Indicating and recording elements must be clear, definite, and easily read.

Code Reference: 1.10: G-S.5., 3.30: S.1.4., S.1.5.

- Required markings shall be distinct, easily readable, and of a permanent nature.

Code Reference: 1.10: G-S.6. (1/1/77), G-S.7.

3.6.4. Value of Intervals.

Values of the graduated intervals must be uniform throughout the series of indicating elements or, if equipped, recording elements.

Code Reference: 1.10: G-S.5.3.

For devices indicating or recording in more than one unit, the values must be appropriately identified.

Code Reference: 1.10: G-S.5.3.1.

3.6.5. Advancement and return to zero.

It shall not be possible to advance primary indicating and recording elements except by mechanical operation of the device.

Code Reference: 3.30: S.1.3.

Indicating and recording elements may only be advanced to zero by the mechanical operation of the device, UNLESS:

a. Advancement cannot be stopped until zero is reached, OR

b. The indicating elements are automatically obscured until the elements reach a correct zero position.

Code Reference: 3.30: S.1.3.

3.6.6. Return of Indicating and Recording Elements to Zero.

When primary indicating and/or recording elements are returnable to zero, these shall be returned to zero immediately before each delivery and after the pump has been activated and product to be measured has been supplied to the measuring system.

Code Reference: 3.30: UR.3.1.

3.6.7. Travel of Indicator.

Device shall be readily operable to deliver accurately any quantity from 200 L (50 gal) to the capacity of the device. If the most sensitive element utilizes an indicator and graduations, their relative movement corresponding to a delivery of 4 L (1 gal) shall be not less than 5 mm (0.20 in).

Code Reference: 3.30: S.1.7.1.

3.6.8. Recording Elements, General.

Code Reference: 1.10: G-S.5.6.

3.7. Provision for Sealing.

3.7.1. Sealing, general.

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

- any measuring or indicating element;
- any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and
- any metrological parameter that will affect the metrological integrity of the device or system.

Code Reference: 1.10: G-S.8. (1/1/90), 3.30: S.2.2., Table S.2.2. (1/1/95), S.2.7.3.

3.7.2. Adjustments Using Removable Digital Storage Devices.

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.

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.

A printed copy of the information must be available on demand through the device or through another on-site device.

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.8.2.

3.7.3. Multiple Elements that Share a Common Provision for Sealing.

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).

3.7.4. Metrologically Significant Software Updates.

A metrologically-significant software change is a sealable event.

Code Reference: 1.10: G-S.9.

3.7.5. Audit Trails.

3.7.5.1. 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), 3.30: S.2.2., Table S.2.2. (1/1/95).

3.7.5.2. Audit Trail Format.

For devices using an audit trail(s) as a means of security, the audit trail(s) shall use the format set forth in Table S.2.2. Categories of Devices and Methods of Sealing.

Code Reference: 3.30: Table S.2.2. (1/1/95).

3.7.6. Security Seals.

Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new ones as needed.

Code Reference: 1.10: G-UR.4.5.

3.7.6.1. Accessibility of the Adjusting Mechanism.

When applicable the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

Code Reference: 3.30: S.2.2.

3.7.6.2. Provisions for Sealing ATC (for systems equipped with ATC).

Code Reference: 3.30: S.2.7.3.

3.8. Marking Requirements.

3.8.1. General.

3.8.1.1. Clear and Permanent Marking.

Equipment shall be clearly and permanently marked for the purposes of identification.

Code Reference: 1.10: G-S.1.

3.8.1.2. Visibility of G-S.1. Marking Information.

Required information shall be located so that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

Code Reference: 1.10: G-S.1.

3.8.2. Identification.

Code Reference: 1.10: G-S.1.

3.8.2.1. Name, initials, or trademark of manufacturer or distributor.

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

3.8.2.2. Model designation.

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

(1) Model identifier prefix and acceptable abbreviation for “model” and “number.”

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

3.8.2.3. Nonrepetitive serial number.

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

(1) Serial number prefix.

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

(2) Acceptable abbreviation for “serial” and “number.”

Code Reference: 1.10: G-S.1.(c)(2) (1/1/01).

3.8.2.4. Software version or identifier.

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

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).

(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 the 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).

3.8.2.5. NTEP CC number for devices with NTEP CC.

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

(1) NTEP CC Number Identifier.
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) (1/1/03).

3.8.3. Location of G-S.1. Marking Information for Not-Built-for-Purpose, Software-Based Devices.

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

3.8.4. Devices or Main Elements Remanufactured as of January 1, 2002.

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

3.8.4.1. Name, initials, or trademark of last remanufacturer or distributor.

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

3.8.4.2. Model designation if different from original model designation.

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

3.8.5. Values Identified.

If graduations, indications, or recorded representations are intended to have specific values, these values shall be adequately defined and markings positioned as close as practicable to values being identified.

Code Reference: 1.10: G-S.5.2.4.

3.8.6. Permanence of Indications and Markings.

Graduations, indications, or recorded representations and their defining figures, words, and symbols shall be of such character that they will not tend easily to become obliterated or illegible.

Code Reference: 1.10: G-S.5.2.5.

3.8.7. Marking, Operational Controls.

All switches, lights, displays, pushbuttons, and other operational controls and features must be clearly and definitely identified.

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

3.8.8. Visibility of Required Markings After Installation.

Code Reference: 1.10: G-UR.2.1.1.

3.8.9. Money-Operated Devices, Responsibility.

Code Reference: 1.10: G-UR.3.4.

3.8.10. Limitation on Use.

The limitation on a device's use shall be clearly and permanently marked on any device intended to measure accurately:

- only products having particular properties,
- only under specific installation conditions, or
- only when used in conjunction with specific accessory equipment.

Code Reference: 3.30: S.4.1.

3.8.11. Discharge Rates.

- A meter shall be marked to show its designed minimum and maximum discharge rates.
- The minimum discharge rate shall not exceed 20 % of the maximum discharge rate.

Code Reference: 3.30: S.4.3.1.

3.8.12. For Devices Equipped with ATC Systems for Refined Petroleum Products, Markings.

Primary indicating elements, recording elements, and recorded representations shall be marked to show the volume has been adjusted to the volume at 15 °C or 60 °F.

Code Reference: 3.30: S.4.3.2.

3.9. Measuring Elements.

3.9.1. Air/Vapor Elimination.

Effective, automatic means to eliminate air/vapor shall be provided.

Code Reference: 3.30: S.2.1., S.2.1.1.(a).

Verify any operationally controlled means are effective in preventing air/vapor from entering the system.

Code Reference: 3.30: S.2.1.1.(a).

Verify air/vapor eliminator vent lines are made of appropriate, non-collapsible material.

Code Reference: 3.30: S.2.1.1.(b).

3.9.2. Security Seals.

3.9.2.1. Sealing, General.

Code Reference: 1.10: G-UR.4.5., 3.30: S.2.2., Table S.2.2. (1/1/95).

3.9.2.2. Security Seal on Adjusting Mechanism.

Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new ones as needed.

Code Reference: 1.10: G-UR.4.5.

3.9.3. Directional Flow Valves.

Valves intended to prevent reversal of flow shall be automatic in operation

Code Reference: 3.30: S.2.3.

3.9.4. Verify that means are provided for determination of product temperature.

3.9.4.1. For devices without automatic temperature compensating systems.

Means shall be provided either in the:

a. Liquid chamber of the meter; or

b. Meter inlet or discharge line immediately adjacent to the meter.

Code Reference: 3.30: S.2.6. (1/1/85).

3.9.4.2. For devices with automatic temperature compensating systems.

The thermometer well shall be located either in the:

a. Liquid chamber of the meter; or

b. Meter inlet or discharge line immediately adjacent to the meter.

Code Reference: 3.30: S.2.7.4.

3.10. Discharge Lines and Valves.

3.10.1. Directional flow valves (see 3.9. Measuring Elements above).

Code Reference: 3.30: S.2.3.

3.10.2. Diversion of Measured Liquid.

Code Reference: 3.30: S.3.1.

3.10.2.1. Verify the Discharge Line and Valve Installation.

Examine the discharge line and valves to ensure measured liquid cannot be diverted from the measuring chamber or discharge line.

3.10.2.2. Outlets Automatic Means for Product Flow.

Two or more outlets may be installed only if automatic means are provided to ensure:

a. Liquid can only flow from one outlet at a time; and

b. The direction of flow for which the mechanism may be set at any time is clearly and conspicuously indicated.

3.10.2.3. Permissible Use of Outlets for Purging, Draining, or Recirculating Product.

Outlets for purging or draining the measuring system or for recirculating (when recirculating is necessary to keep the product in a deliverable state) shall be permitted only for:

- Food products
- Agri-chemicals
- Biodiesel
- Biodiesel blends

Effective automatic means shall be provided to prevent the passage of liquid through such an outlet during normal device operation and shall inhibit meter indications/recorded representations while the outlet is in operation.

3.10.3. Leaks.

No leaks should exist in the system on the outlet side of the meter.

Note: If leaks are detected on the inlet side of the meter, a notation should be made on the inspection report and the firm should be made aware of the location of the leak for purposes of safety.

Code Reference: 1.10: G-UR.4.1., 3.30: S.3.1.

3.10.4. Gravity-Discharge Unit.

The discharge hose or equivalent pipe shall be of the dry-hose type with no shutoff valve at its outlet end, unless the hose or pipe drains to the same level under all conditions of use.

The dry hose shall be of such stiffness and only of such length as to facilitate its drainage.

The inlet end of the hose or of an equivalent outlet pipe shall be of such height as to provide for proper drainage of the hose or pipe.

There shall be incorporated an automatic vacuum breaker or equivalent means to prevent siphoning and to ensure rapid and complete drainage.

Code Reference: 3.30: S.3.4.

3.11. Automatic Temperature Compensation (ATC) for Refined Petroleum.

3.11.1. Automatic Temperature Compensation.

A device may be equipped with an automatic means for adjusting the indication and registration of the measured volume to the volume of product at 15 °C (60 °F).

Code Reference: 3.30: S.2.7.1.

3.11.2. Provisions for Deactivating ATC.

Provision shall be made to deactivate the automatic temperature compensating system so that the meter may indicate and record, if equipped to record, in terms of the uncompensated volume.

Code Reference: 3.30: S.2.7.2.

3.11.3. Provisions for Sealing ATC.

For devices and systems in which the ATC system can be disconnected and/or adjusted 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. (See this reference in the Inspection portion of this EPO.).

Code Reference: 1.10: G-S.8.2, 3.30: S.2.2.

For other devices, adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that an ATC system cannot be disconnected and no adjustment may be made to the system the system.

Code Reference: 3.30: S.2.2., S.2.7.3., Table S.2.2. (1/1/95).

3.11.4. Temperature Determination, Thermometer Well.

A thermometer well shall be provided for determination of the temperature of the liquid.

Code Reference: 3.30: S.2.7.4.

3.11.5. Use of Temperature Compensation, Wholesale-Automatic.

Code Reference: 3.30: UR.3.6.1.

3.11.5.1. When to be Used.

If a device is equipped with a mechanical automatic temperature compensator, it shall be connected, operable, and in use at all times; thermometer well shall be provided as a means for determination of the temperature of the liquid.

Code Reference: 3.30: UR.3.6.1.1.

3.11.5.2. Invoices.

Code Reference: 3.30: UR.3.6.1.2.

3.11.6. Use of Temperature Compensation, Wholesale – Nonautomatic.

Code Reference: 3.30: UR.3.6.1.1.

3.11.6.1. Temperature Determination.

Code Reference: 3.30: UR.3.6.2.1.

3.11.6.2. Invoices.

Code Reference: 3.30: UR.3.6.2.2.

3.11.7. Use of Temperature Compensation, Wholesale – Period of Use.

Fuel shall be bought or sold using the same method over at least a consecutive 12-month period, unless otherwise agreed to by both buyer and seller.

Code Reference: 3.30: UR.3.6.3.

3.12. Totalizers.

3.12.1. Totalizers, General.

Verify totalizers are operating properly.

Code Reference: 1.10: G-UR.4.1., G-UR.4.2.

4. Pretest Determinations.

NOTE: Code references used throughout the document are drawn from NIST HB 44 General Code (Section 1.10) and Liquid-Measuring Devices Code (Section 3.30). 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.

4.1. Test Methods.

This EPO was designed around the use of volumetric, neck-type test standards. However, this does not preclude the use of other test methods and apparatus that have been approved by the Director as described in NIST Handbook 44, Appendix A, Section 3. Testing Apparatus. If other test standards and apparatus are used, corresponding adjustments to the test procedures described in this EPO may be needed to reflect the use of that equipment.

Code Reference: 1.10: G-N.3., Appendix A. Fundamental Considerations Section 3. Testing Apparatus.

4.2. Test Draft Size.

Test drafts shall be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate and shall in no case be less than 200 L (50 gallons).

Code Reference: 3.30: N.3.5.

4.3. Prover Design and Condition.

Ensure prover is of appropriate capacity and has a valid calibration certificate and its security seals are intact.

Prover and system design must be compatible (top loading/bottom loading).

For top loading provers, the prover inlet must be lower than the outlet of the meter discharge line. This assures complete drainage of the downspout at the conclusion of the delivery.

Inspect prover's interior surface for dents, product clingage, rust, water, or other foreign material.

Prover sight glass must be clean and fittings must not leak.

4.4. Thermometers.

4.4.1. Thermometers may be of the partial immersion or digital type.

(See NIST HB 105-6 Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures, 6. Specifications and Tolerances for Thermometers, 1997, for additional information.)

4.4.2. Accuracy:

Thermometers shall be matched.

a. ± 0.5 °C, have a range of at least 0 °C to 50 °C, and be divided in increments of no greater than 0.5 °C for liquid-in-glass thermometers and 0.1 °C for digital thermometers; or

b. ± 1 °F, have a range of at least 0 °F to 120 °F, and be divided in increments of no greater than 1 °F for liquid-in-glass thermometers and 0.1 °F for digital thermometers.

4.5. Tolerances.

4.5.1. Acceptance/Maintenance Tolerances.

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

4.5.2. Application.

Code Reference: 1.10: G-T.3., 3.30: T.1.

4.5.3. Intermediate Values.

Code Reference: 1.10: G-T.4.

4.5.4. Tolerance Values.

Code Reference: 3.30: T.2., Table T.2.

4.5.5. Normal Tests Tolerances:

- Acceptance Tolerance – 0.3 Percent for Asphalt Meters greater than 50 °C
- Acceptance Tolerance – 0.2 Percent for Other Products
- Maintenance Tolerance – 0.3 Percent

4.5.6. Special Test Tolerance:

- Special Test Tolerance – 0.5 Percent

4.5.7. Repeatability.

Code Reference: 3.30: T.3.

4.5.8. Devices Equipped with ATC.

Code Reference: 3.30: T.4.

4.6. Test Liquid.

Determine the test liquid is the same as that to be commercially measured or is a liquid with the same general physical characteristics.

Code Reference: 3.30: N.1.1.

Note the product used during the test on the official report. Following completion of a successful examination, the official should attach a label or tag or otherwise mark the system indicating the product used during the test.

Code Reference: 3.30: N.1.2.

SAFETY REMINDER!!!

- **Wear appropriate personal protection equipment such as petroleum-resistant, nonskid safety shoes (to prevent possible injury from spills or slipping on slick surfaces), protective clothing, eye protection (to prevent injury from splashed product), and a hard hat (to prevent injury from overhangs and projections).**
- **Use proper grounding/bonding procedures. Be sure that prover is equipped with an explosion proof motor.**
- **Carefully inspect electrical supply lines to test equipment for wear and damage; correct potentially hazardous conditions before use.**
- **Device operator should be present at all times during test – the operator (not the inspector) should operate the device under test.**
- **Never leave equipment unattended while it is in operation.**

5. Test Notes.

NOTE: Code references used throughout the document are drawn from NIST HB 44 General Code (Section 1.10) and Liquid-Measuring Devices Code (Section 3.30). 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.

5.1. Totalizers.

To determine proper operation of totalizers, read and record the totalizer indications before and after all test drafts. Provide this information to the device owner to account for the product dispensed and returned to the device owner's tank during official tests.

Mark any delivery tickets or recorded representations as appropriate to indicate they were generated as part of an official test and to deter the potential for their misuse. Return all delivery tickets or recorded representations used during the test to the device owner at the end of the test.

5.2. Test Equipment Setup and Leveling.

5.2.1. Test Equipment Setup

- Ensure the ground surface on which the standard or trailer rests is firm and stable and is adequate to safely bear the weight of the test apparatus when the standard is full of product.

- Ensure the test equipment is properly grounded. Connect safety interlock and ground cable. If applicable, connect the vapor recovery hose.
- For top-loading provers, take precautions to minimize splashing and to maintain the spout fill in a consistent position.
- Verify that all valves in the proving system are closed and that the prover pumping mechanism is functional.

5.2.2. Leveling the Prover

- Check for the proper operation of the level indicators on the prover.
- Prior to dispensing product into the prover, level the prover by repositioning the prover by moving or adjusting it until the prover is level according to the level indicating means provided on the prover (and as verified by the calibration laboratory).
- After filling the prover with product and before reading the indications on the prover, re-check the level of the prover to ensure the weight of the liquid has not affected the level condition. Re-level the prover as necessary.

5.3. Dry Prover.

If the prover is dry, it must be prepared for use by first "wetting" it. To wet the test measure or prover, fill it to capacity and empty it following proper drain procedures.

Code Reference: NIST HB 105-3, *Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures, 3. Specifications and Tolerances for Graduated Neck Type Volumetric Field Standards,* 2010.

5.4. Evaporation and Volume Change.

Exercise care so the product temperature in the prover is the same as or as close as practical to that at the meter. Take care to minimize changes in volume of the test liquid due to temperature changes and evaporation losses.

Code Reference: 3.30: N.2.

5.5. Temperature Corrections.

Adjustments shall be made for any changes in volume resulting from changes in liquid temperatures between the time of passage through the meter and time of volumetric determination in the prover. When adjustments are necessary, appropriate petroleum measurement tables shall be used.

Temperature readings are to be taken to the nearest 0.25 °C or 0.5 °F or for digital thermometers, to the nearest increment. Take the temperature of the test liquid in the prover immediately following each accuracy test. For provers equipped with more than one thermometer, the temperature of the test liquid is the mathematical average of the individual readings.

A thermometer placed in the thermowell adjacent to the meter is to be used to determine meter temperature. Meter temperature is to be taken during each delivery when meter indications reach quantities equal to 1/3 and 2/3 of the capacity of the prover and the two values averaged.

Code Reference: 3.30: N.5.

5.6. Read and Record Results Immediately.

Read and record the indications on the test measure or prover immediately after delivery.

5.7. Eye Level and Reading the Meniscus.

When reading the indications on the test measure or prover, position yourself so that the bottom of the meniscus is at eye level and observe the reading on the gauge scale opposite the bottom of the meniscus.

- If the level of the liquid is not exactly at the zero line, the value shown on the scale will be recorded as "plus" if above the zero line and "minus" if below the zero line.
- If the reading is between graduations, "round off" the results to the nearest graduation.
- If the reading is exactly in the middle of two graduations, read and report the results to one-half the graduation or follow your jurisdiction's policy for reporting such a result.

5.8. Confirm Results.

If the result of any test is at, near, or exceeds the applicable tolerance limit, repeat that test to confirm the results and to help ensure you did not inadvertently introduce error into the test process. If necessary, conduct a "Repeatability Test" as described under the "Test" section of this EPO.

5.9. Drain Procedures.

Bottom drain provers require a 30-second drain (or as specified otherwise on the calibration report or marked on the prover) after the main flow ceases. See NIST Handbook 105-3 Section 7.

When monitoring drainage of the prover, one of the following methods should be followed depending on prover design. Precautions should be taken to ensure that drainage procedure is followed in a consistent manner for each test.

a. If the prover has a lower neck equipped with a drain sight glass, close the drain valve prior to the liquid level reaching the zero mark indicator. After 30 seconds drain time, open the small drain-off valve and lower the liquid level to the zero mark. (Do not adjust the liquid level again, even if continued drainage raises the liquid level above the zero mark before the test is started.)
b. If the prover is not equipped with a lower sight glass, leave the drain valve open until continuous flow ceases and dripping commences. Close drain valve after 30 seconds.

Code Reference: 3.30: N.4.4.2., NIST HB 105-3, *Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures, 3. Specifications and Tolerances for Graduated Neck Type Volumetric Field Standards*, 2010, Section 7 Test Methods and References.

5.10. Recorded Representations – Tickets and Invoices.

Verify that any options for obtaining a recorded representation are appropriate. The customer may be given the option of not receiving the recorded representation. If the system is equipped with the capability, the customer may also be given the option of receiving the recorded representation electronically in lieu of or in addition to a hard copy.

Code Reference: 1.10: G-S.5.6.

When primary indicating and/or recording elements are returnable to zero, these shall be returned to zero immediately before each delivery and after the pump has been activated and product to be measured has been supplied to the measuring system.

Code Reference: 3.30: UR.3.1.

5.11. Steps After Each Test Draft.

5.11.1. Recorded Representation. Print a ticket/receipt if the device is so equipped and verify required information is provided and correctly recorded.

Code Reference: 1.10: G-S.5.2.2., G-S.5.6.

5.11.2. Computing-Type Devices.

(1) Verify means is provided to display in a manner that is clear to the operator.

(2) In addition to tickets printed during inspection and testing, several examples of actual used tickets are to be examined. This serves to verify the format of and information on actual printed tickets.

(3) Check price computations on all indications (including auxiliary indications) and on recorded representations.

Code Reference: 3.30: S.1.7.2.

(4) Check for mathematical agreement, verifying any digital money-value indication and any recorded money-value are in mathematical agreement with its associated quantity indication to within 1 cent of money-value.

Code Reference: 1.10. G-S.5.5., 3.30: S.1.7.2.

(5) The total price, the total volume of the delivery, and the price per liter or gallon shall be shown, either recorded by the device or in clear hand script, on any recorded representation issued by a device and containing any one of these values. Nonretroactive as of January 2021, the recorded representation shall also include a corresponding dispenser/meter designation.

Code Reference: 3.30: UR.3.4. (a portion Nonretroactive).

5.11.3. Check for agreement of values among indications and recorded representations.

Code Reference: 1.10: G-S.5.2.2.

5.11.4. Check invoices for systems equipped with automatic temperature compensation.

Code Reference: 3.30: UR.3.6.1.

Determine if:

Deliveries which are adjusted to 15 °C or 60 °F show that the volume has been adjusted to 15 °C or 60 °F.

Code Reference: 3.30: S.4.3.2., UR.3.6.1.2.(a).

In the case of an electronic wholesale device equipped with an automatic temperature compensating system, the API gravity, specific gravity, or coefficient of expansion; product temperature; and gross reading are also indicated.

Code Reference: 3.30: UR.3.6.1.2.(b).

5.11.5. For nonautomatic temperature compensation:

Code Reference: 3.30: UR.3.6.2.

If the volume of the product delivered is adjusted to the volume at 15 °C or 60 °F, verify that the product temperature is taken during delivery in:

- the liquid chamber of the meter,
- the meter inlet or discharge line adjacent to the meter, or
- the compartment of the receiving vehicle at the time it is loaded.

Code Reference: 3.30: UR.3.6.2.1.

The accompanying invoice for these systems shall indicate that the product has been adjusted to a volume at 15 °C or 60 °F and shall state the product temperature used in making the adjustment.

Code Reference: 3.30: UR.3.6.2.2.

5.12. Period of Use for Temperature Compensation.

When a device is equipped with a mechanical automatic temperature compensator, it shall be connected, operable, and in use at all times. An electronic or mechanical automatic compensating system may not be removed, nor may a compensated device be replaced with an uncompensated device without the written approval of the responsible weights and measures authority.

Code Reference: 3.30: UR.3.6.1.1.

When fuel is bought or sold based on temperature-compensated volume, it shall be bought or sold on this basis over at least a 12-month consecutive period, unless otherwise agreed to in writing by both the buyer and seller.

Code Reference: 3.30: UR.3.6.3.

5.13. Use of Adjustments.

Verify that adjustments are used only to correct for conditions that these elements are designed to control and that adjustments are made to bring performance errors as close to zero value as possible. Verify that equipment is properly maintained and that errors are not predominantly in favor of the device user.

Code Reference: 1.10: G-UR.4.1., G-UR.4.2., G-UR.4.3.

5.14. Multiple Linearization Factors.

For a measuring system capable of being programmed with multiple linearization factors, it is necessary to verify all enabled linearization factors. When any device is adjusted, it is the user's/owner's responsibility to ensure errors are within tolerance and any adjustments which are made are made to bring performance errors as close as practicable to zero value. Verify all enabled linearization factors are appropriate. This can be done through physical testing at each of the points where a factor has been enabled or through a combination of physical testing and empirical analysis.

Code Reference: 1.10: G-UR.4.1., G-UR.4.2., G-UR.4.3., 3.30: N.4.5., UR.3.1.

6. Test.

NOTE: Code references used throughout the document are drawn from NIST HB 44 General Code (Section 1.10) and Liquid-Measuring Devices Code (Section 3.30). 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.

SAFETY REMINDER!!!

- **Avoid switch loading product! Test devices dispensing low-vapor pressure products (e.g., diesel fuel and kerosene) before testing devices dispensing high-vapor pressure products (e.g., gasoline and Ethanol blends up to E85) with the same test measure or prover. Additional precautions may be necessary with other high vapor-pressure products.**
- **Use proper lifting techniques to lift and move equipment!**
- **Be aware of and attempt to eliminate potential ignition sources in or near the inspection site.**
- **Be aware of vehicular and pedestrian traffic in the area.**

6.1. General, All Meters.

- Verify all valves are closed and prover is level.
- Start testing with a wet prover. Use proper draining procedures each time the prover is emptied, as described in the Test Notes.
- Prior to Each Test Run:
  - Insert a meter ticket and set preset stop mechanism for the rated capacity of the prover prior to each test.
  - Reset the meter to zero.
  - Start the pump, then open the prover delivery valve.
- If any test result is at, near, or outside of applicable tolerances, repeat the test to confirm the results. If necessary, conduct a repeatability test as outlined in "6.3.3. Repeatability Test."
- If two consecutive tests are found to exceed applicable tolerance values, discontinue accuracy testing and proceed to the next portion of the EPO.

6.2. For Repair Personnel.

- Three consecutive test runs should be performed to insure repeatability. The difference between the high and low readings of these three consecutive runs should not exceed 0.05 percent of the prover's certified volume.
- If test results exceed applicable tolerance values, the meter should be adjusted at this point. Repair personnel should follow company policy regarding adjustment of a meter; for meters equipped with a temperature compensator, it may be necessary to first deactivate the temperature compensator prior to making any adjustment.
- A check for the performance of the temperature sensor should be performed at the end of each accuracy test. Utilize the section at the end of each worksheet to analyze the performance of the sensor. Should a variation of 1 °C or 2 °F exist for two consecutive runs, the normal operating thermometer must be recalibrated against a National Institute of Standards and Technology traceable thermometer.

Accuracy Tests - Overview

Non-Temperature-Compensated Meters

1. Normal Test – full flow, normal tolerance.
   Code Reference: 3.30: N.4.1., T.2., Table T.2., T.3.
2. Special Test – slow flow, special tolerance.
   Code Reference: 3.30: N.4.2., T.2., Table T.2., T.3.
3. Proceed to "Test – All Meters."

Temperature-Compensated Meters

1. Normal Test - Temperature Compensator Activated - full flow, normal tolerance.
   Code Reference: 3.30: N.4.1., N.4.1.1., T.2., Table T.2., T.3., T.4. (1/1/88)
2. Normal Test – Temperature Compensator Deactivated – full flow, normal tolerance. Compare the compensated volume indicated or recorded to the actual delivered volume corrected to 15 °C (60 °F).
   Code Reference: 3.30: N.4.1., N.4.1.1., T.2., Table T.2., T.3., T.4. (1/1/88)
3. Special Test – Temperature Compensator Deactivated – slow flow, special tolerance.
   Code Reference: 3.30: N.4.2., T.2., Table T.2., T.3.
4. Proceed to "Test – All Meters."

6.3. Test Procedures.

6.3.1. Non-Temperature Compensated Meters (NTCM).

If the result of any test is at, near, or outside the applicable tolerance, repeat that test. If necessary, conduct a repeatability test. See "6.3.3. Repeatability Test."

6.3.1.1. Temperature Corrections.

Temperature corrections are to be made for accuracy tests to account for any changes in product volume due to differences in the temperature of the liquid passing through the meter and the liquid in the prover.

Code Reference: 3.30: N.5.

6.3.1.2. Normal Test.

Full flow, normal tolerance.

Code Reference: 3.30: N.4.1., N.4.6., T.2., Table T.2., T.3.

6.3.1.2.1. Step 1 – Normal Test (NTCM).

Fill prover in a manner simulating actual use and determine actual flow rate. Test should be run at the maximum discharge rate anticipated under the conditions of the installation. Actual rate of flow should be within manufacturer's ratings of minimum and maximum flow.

Code Reference: 1.10: G-UR.3.1., 3.30: UR.2.2.

6.3.1.2.2. Step 2 – Normal Test (NTCM).

Verify all valves are closed and the prover remains level. Examine prover piping to ensure there is no entrapment of air and that there are no leaks.

6.3.1.2.3. Step 3 – Normal Test (NTCM).

Disconnect the bottom loading coupler or remove the loading spout from the liquid.

6.3.1.2.4. Step 4 – Normal Test (NTCM).

Allow time for product settling and foam dissipation prior to taking prover reading.

6.3.1.2.5. Step 5 – Normal Test (NTCM).

Read the thermometers at the meter and in the prover as described in **Test Notes**, and record the reading to the nearest 0.25 °C or 0.5 °F.

6.3.1.2.6. Step 6 – Normal Test (NTCM).

For an analog device, record ending meter reading to the nearest 0.1 gallon. For a digital-indicating device, record the meter indication to the smallest quantity division available, e.g., test mode indication. Check totalizer against actual amount dispensed.

6.3.1.2.7. Step 7 – Normal Test (NTCM).

Disconnect vapor recovery hose and then drain prover.

Code Reference: 3.30: N.4.4., N.4.4.2.

6.3.1.2.8. Step 8 – Normal Test Results (NTCM).

Follow steps using the worksheet section for "***non-compensated meters***" to determine meter error.

a. Correct **prover** indications to account for changes in prover volume resulting from the expansion/contraction of the **prover metal** due to temperature.

b. Correct both **prover** indications and **meter** indications to the volume at 15 °C (60 °F) to account for changes in product volume due to changes in the **temperature of the liquid** between the meter and prover.

Code Reference: 3.30: N.5.

6.3.1.3. Special Test (NTCM).

Slow flow.

Code Reference: 3.30: N.4.2., N.4.2.4., T.2., Table T.2.

6.3.1.3.1. Step 1 – Special Test (NTCM).

Reconnect vapor recovery hose, if applicable.

6.3.1.3.2. Step 2 – Special Test (NTCM).

Fill prover at a flow rate that is at or slightly above the slower of:

a. The minimum discharge rate marked on the device; or

b. 20 % of the maximum discharge rate marked on the device.

In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

Code Reference: 3.30: N.4.2.4.

6.3.1.3.3. Step 3 through Step 9 – Special Test (NTCM).

Repeat steps 6.3.1.2.2. through 6.3.1.2.8. of the Normal Test procedures above.

6.3.1.4. Proceed to "Test – All Meters."

6.3.2. Temperature Compensated Meters (TCM).

Note: For systems that indicate or record in both "gross" (uncompensated) and "net" (compensated) quantities, it is not necessary to run multiple tests. "Compensated" and "Uncompensated" test results can be calculated from a single test draft using the "gross" and "net" indications along with observed temperature information.

If the result of any test is at, near, or outside the applicable tolerance, repeat that test.

If necessary, conduct a repeatability test. See "6.3.3. Repeatability Test."

6.3.2.1. Temperature Corrections.

Temperature corrections are to be made for accuracy tests to account for any changes in product volume due to differences in the temperature of the liquid passing through the meter and the liquid in the prover.

Code Reference: 3.30: N.5.

6.3.2.2. Normal Test -Temperature Compensator Activated.

Full flow, normal tolerance.

Code Reference: 3.30: N.4.1., N.4.1.1., T.2., Table T.2., T.3., T.4. (1/1/88).

6.3.2.2.1. Step 1 through Step 7 – Normal Test (TCM).

Fill prover as described in Normal Test Procedures for Non-Temperature-Compensated Meters steps 6.3.1.2.2. through 6.3.1.2.7. above, without taking the temperature at the meter.

6.3.2.2.2. Step 8 – Normal Test Results (TCM).

Follow steps using the worksheet section for "***compensated meters***" to determine meter error.

a. Correct **prover** indications to account for changes in prover volume resulting from the expansion/contraction of the **prover metal** due to temperature.
b. Correct **prover** indications to the volume at 15 °C (60 °F). Since this test is conducted in the net mode, the meter indication will already be corrected to 60 °F by the automatic temperature compensating system. Consequently, the meter indication is read directly without applying any additional corrections.

Code Reference: 3.30: N.5.

6.3.2.3. Normal Test -Temperature Compensator Deactivated.

Full flow, normal tolerance.

Code Reference: 3.30: N.4.1., N.4.1.1., T.2., Table T.2., T.3., T.4. (1/1/88).

6.3.2.3.1. Step 1 – Normal Test (TCM) Temperature Compensator Deactivated.

Reconnect vapor recovery hose, if applicable.

6.3.2.3.2. Step 2 through Step 7 – Normal Test (TCM) Temperature Compensator Deactivated.

Fill prover as described in Normal Test Procedures for Non-Temperature-Compensated Meters steps 6.3.1.2.2. through 6.3.1.2.7. above.

6.3.2.3.3. Step 8 – Normal Test Results (TCM) Temperature Compensator Deactivated.

Follow steps using the worksheet section for "non-compensated meters" to determine meter error.

Code Reference: 3.30: N.4.1., N.4.1.1., T.2., Table T.2., T.3., T.4. (1/1/88).

a. Correct prover indications to account for changes in prover volume resulting from the expansion/contraction of the prover metal due to temperature.
b. Correct both prover indications and meter indications to the volume at 15 °C (60 °F) to account for changes in product volume due to changes in the temperature of the liquid between the meter and prover.

Code Reference: 3.30: N.5.

6.3.2.3.4. Results of the Automatic Temperature Compensation System's Test.

Compare the results of the normal test with the temperature compensator activated to the results of the normal test with the temperature compensator deactivated.

Code Reference: 3.30: T.4. (1/1/88).

a. For automatic temperature compensating systems (ATCs). The difference between the meter error for tests performed with and without the automatic temperature compensating system activated shall not exceed 0.2 percent for mechanical ATCs and 0.1 percent for electronic ATCs of the test draft.
b. The results of each test shall be within applicable tolerances.

Reactivate the compensator and apply security seals as appropriate when all accuracy testing is complete.

6.3.2.4. Special Test -Temperature Compensator Deactivated.

Slow flow, special tolerance.

Code Reference: 3.30: N.4.2., T.2., Table T.2., T.3.

6.3.2.4.1. Step 1 – Special Test (TCM) Temperature Compensator Deactivated.

Reconnect vapor recovery hose, if applicable.

6.3.2.4.2. Step 2 – Special Test (TCM) Temperature Compensator Deactivated.

Fill prover at a flow rate that is at or slightly above the slower of:

a. The minimum discharge rate marked on the device; or
b. 20 % of the maximum discharge rate marked on the device.

In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

Code Reference: 3.30: N.4.2.4.

6.3.2.4.3. Step 3 through Step 8 – Special Test (TCM) Temperature Compensator Deactivated.

Repeat steps 6.3.1.2.2. through 6.3.1.2.7. of the Normal Test procedures for Non-Temperature-Compensated Meters above.

6.3.2.4.4. Step 9 – Special Test Results (TCM) Temperature Compensator Deactivated.

Follow steps using the worksheet section for "non-compensated meters" to determine meter error.

a. Correct prover indications to account for changes in prover volume resulting from the expansion/contraction of the prover metal due to temperature.

b. Correct both prover indications and meter indications to the volume at 15 °C (60 °F) to account for changes in product volume due to changes in the temperature of the liquid between the meter and prover.

6.3.2.5. Reactivate the Temperature Compensator.

Have the device owner reactivate the temperature compensator.

6.3.2.6. Proceed to "Test – All Meters."

6.3.3. Repeatability Test, All Meters.

If necessary, conduct a repeatability test. A repeatability test must include at least three consecutive test drafts. Test drafts must be conducted under approximately the same conditions (e.g., flow rate and temperature) and be of approximately the same draft size.

Code Reference: 3.30: N.2., N.4.6., N.5., T.3.

6.3.4. Anti-Drain Test, All Meters.

For a wet hose system, check the effectiveness of the anti-drain valve or other means provided to prevent the drainage of the discharge hose.

Code Reference: 3.30: S.3.7.

6.3.5. Dry Hose System.

For a dry-hose system, check for complete drainage of the hose.

Code Reference: 3.30: S.3.4.

6.3.6. RFI/EMI Test (Electronic Equipment Only).

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

This testing is typically done during the inspection of a new installation. It is conducted subsequently only if a problem is suspected.

Test using only equipment that is or expected to be on site and in the vicinity of the metering system.

Results of this test must indicate that use of such equipment does not adversely affect performance of the metering system.

Code Reference: 1.10: G-N.2., G-UR.1.2., G UR.3.2., G-UR.4.2.

6.3.7. Automatic Stop Mechanism.

Any automatic stop mechanism included in the system must operate properly. Handbook 44 does not include a limit for the accuracy of its operation; however, the device should stop flow within one-half the minimum interval indicated.

Code Reference: 1.10: G-UR.4.1.

7. Post-Test Tasks.

NOTE: Code references used throughout the document are drawn from NIST HB 44 General Code (Section 1.10) and Liquid-Measuring Devices Code (Section 3.30). 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.

7.1. Security Means.

7.1.1. Provisions for Security.

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), 3.30: S.2.2., Table S.2.2. (1/1/95), S.2.7.3.

7.1.2. Metrological Parameters Changeable by a Removable Digital Storage Device.

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., 3.30: S.2.2.

7.1.3. Multiple Measuring Elements with a Single Provision for Sealing.

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).

7.1.4. Changes to Metrologically Significant Software.

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

Code Reference: 1.10: G-S.9.

7.1.5. 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), 3.30: S.2.2., Table S.2.2. (1/1/95).

7.1.6. Security Seals.

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

Code Reference: 1.10: G-UR.4.5.

7.2. Record Total Quantity.

Note the final totalizer reading and record the number of gallons of product dispensed during the test on the official test report. Verify totalizers are working correctly.

Code Reference: 1.10: G-UR.4.1., G-UR.4.2.

7.3. Review Results.

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

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

7.4. Affix Tags and Seals.

Affix tags and seals as appropriate to designate the disposition of the device.

Following completion of a successful examination, attach a label or tag indicating the type of liquid used during the test.

Code Reference: 3.30: N.1.2.

7.5. Record Compliance Action and Explain Results.

Record the compliance action and disposition of the device on the report and explain the inspection and test results to the device owner.

SAFETY REMINDER!!!

- **Avoid switch loading product! Test devices dispensing low-vapor pressure products (e.g., diesel fuel and kerosene) before testing devices dispensing high-vapor pressure products (e.g., gasoline and Ethanol blends up to E85) with the same test measure or prover. Additional precautions may be necessary with other high vapor-pressure products.**
- **Take precautions to isolate equipment when transporting it to avoid exposure to hazardous fumes.**

THIS PAGE INTENTIONALLY LEFT BLANK